

Cracking the New

The Princeton Review

GMAT[®] 2013

REVISED
& UPDATED
FOR THE
NEW TEST

**Proven techniques
for a higher score.**

- Everything needed to master Math, Verbal, Analytical Writing & Integrated Reasoning
- Access to 2 full-length practice tests
- Expert hints, tips & advice
- Detailed coverage of the new Integrated Reasoning section



By Geoff Martz and Adam Robinson
Revised by John Fulmer

GMAT is a registered trademark of the Graduate Management Admission Council, which does not sponsor or endorse this product.



Editorial

Rob Franek, VP Test Prep Books, Publisher
Seamus Mullarkey, Editorial Director
Laura Braswell, Senior Editor
Calvin Cato, Editor
Selena Coppock, Editor
Meave Shelton, Editor

Random House Publishing Team

Tom Russell, Publisher
Nicole Benhabib, Publishing Manager
Ellen L. Reed, Production Manager
Alison Stoltzfus, Associate Managing Editor

The Princeton Review, Inc.
111 Speen Street, Suite 550
Framingham, MA 01701
E-mail: editorialsupport@review.com

Copyright © 2012 by The Princeton Review, Inc.

The Princeton Review is not affiliated with Princeton University.

All rights reserved. Published in the United States by Random House, Inc., New York, and in Canada by Random House of Canada Limited, Toronto.

Terms of Service: The Princeton Review Online Companion Tools (“Online Companion Tools”) for the *Cracking* book series and *11 Practice Tests for the SAT & PSAT* are available for the two most recent editions of each book title. Online Companion Tools may be activated only once per eligible book purchased. Activation of Online Companion Tools more than once per book is in direct violation of these Terms of Service and may result in discontinuation of access to Online Companion Tools services.

eISBN: 978-0-307-94462-7

Editor: Selena Coppock
Production Editor: Kristen Harding
Production Coordinator: Deborah A. Silvestrini

2013 Edition

v3.1

Contents

Acknowledgments

Foreword

...So Much More Online!

Part I: Orientation

1 Introduction

2 How to Think About the GMAT

3 Cracking the Adaptive Sections: Basic Principles

4 Cracking the Adaptive Sections: Intermediate Principles

5 Cracking the Adaptive Sections: Advanced Principles

6 Taking the New GMAT

Part II: How to Crack the Math GMAT

7 GMAT Math: Basic Principles

8 POE and GMAT Math

9 Data Sufficiency: Basic Principles

10 Arithmetic

11 Algebra

12 Applied Arithmetic

13 Geometry

14 Advanced Data Sufficiency

Part III: How to Crack the Verbal GMAT

15 Sentence Correction

16 Reading Comprehension

17 Critical Reasoning

Part IV: How to Crack the Integrated Reasoning GMAT

18 Integrated Reasoning: Basics

19 Integrated Reasoning: Strategies

20 Integrated Reasoning: Drills

Part V: How to Crack the Analytical Writing Assessment

21 Analytical Writing Assessment

Part VI: Answer Key to Drills

Part VII: The Princeton Review GMAT Math and Verbal Warm-Up Test and Explanations

22 GMAT Math and Verbal Warm-Up Test

23 GMAT Math and Verbal Warm-Up Test Scoring Guide

24 GMAT Math and Verbal Warm-Up Test: Answers and Explanations

Part VIII: The Princeton Review GMAT Math and Verbal Practice Bins and Explanations

25 GMAT Math and Verbal Practice Bins

26 GMAT Math and Verbal Practice Bins: Answers and Explanations

About the Author

Acknowledgments

Our GMAT course is much more than clever techniques and powerful computer score reports; the reason our results are great is that our teachers care so much about their students. Thanks to all the teachers who have made the GMAT course so successful, but in particular the core group of teachers and development people who helped get it off the ground: Alicia Ernst, Tom Meltzer, Paul Foglino, John Sheehan, Mark Sawula, Nell Goddin, Teresa Connelly, and Phillip Yee.

Special thanks to GMAT guru, John Fulmer, for his tireless work updating all of the books in the TPR GMAT suite for the new version of the GMAT.

Special thanks to Adam Robinson, who conceived of and perfected the Joe Bloggs approach to standardized tests and many of the other successful techniques used by The Princeton Review.

Foreword

I'm glad you bought this book.

Primarily I'm glad because you've probably heard good things about The Princeton Review. Our tutors and teachers are carefully chosen and supported, and our tutoring and classroom courses continue to produce unmatched gains in GMAT scores. And we attract people like Geoff Martz, who is one of the most insightful and articulate instructors I've met, to make sure this book reflects everything we've learned about the test and the best ways to prepare for it.

I'm also glad because it means you're going to raise your GMAT score, and you're going to do it without memorizing dozens of math theorems or the complete rules of English grammar. The information needed to do well on this test is surprisingly limited, and we'll concentrate on a small number of crucial concepts.

Students who feel that their standardized test scores do not reflect their college grades or business acumen probably suspect that there's more to mastering one of these tests than just honing rusty math and verbal skills. At their root, these tests are trying to measure your IQ. They do so with an array of tricks, many of which lead you to wrong answers (called, fittingly, distracters). Some of our techniques address those tricks; I think you'll find them fun and useful on every standardized test you take.

Despite Geoff's great skill, this book can't mold itself around your strengths and weaknesses as effectively as our instructors or online programs. For this reason, we've created supplementary online tools that you can access at PrincetonReview.com. Using the online exams, we can help you spend your time more wisely to achieve the best results possible.

So good luck on the New GMAT! And if you need more help, or just want to find the right business school or the best way to pay for it, please stop by PrincetonReview.com/mba or call us at 800-2REVIEW (international students should call 1-212-874-8282).

John Katzman
Founder

...So Much More Online!



princetonreview.com/cracking

Look For These Icons Throughout The Book



Go Online



More Great Books

More Practice...

Practice your GMAT test-taking skills.

Access two full length practice GMAT exams.

Take one as a diagnostic test before you work through Cracking the New GMAT.

Work through the chapters and practice questions found in this book, focusing on the sections where you need specific review.

Then take the second practice GMAT and see how much you improved.

Review all of the content to sharpen your skills one last time.

Then, prepare to tackle the new GMAT with skill and ease!

Register your book now!

Go to www.PrincetonReview.com/cracking

You'll see a welcome page where you should register your book using the ISBN. You can look at the ISBN on the copyright page of this book, labeled eISBN. Type in this ISBN and create a username and password so that next time you can log into www.PrincetonReview.com easily.

Now you're good to go!

Part I Orientation

1 Introduction

2 How to Think About the GMAT

3 Cracking the Adaptive Sections: Basic Principles

4 Cracking the Adaptive Sections: Intermediate Principles

5 Cracking the Adaptive Sections: Advanced Principles

6 Taking the New GMAT

Chapter 1 Introduction

Congratulations on your decision to attend business school! Preparing for the New GMAT is an important part of the process, so let's get started. This chapter will provide you with a strategic plan for acing the New GMAT, as well as an overview of the test itself, including question formats and information on how the test is scored.

HOW TO USE THIS BOOK: A STRATEGIC PLAN FOR ACING THE NEW GMAT

1. Learn the Famed Princeton Review Test-Taking Strategies

In the next few chapters, you'll find the strategies that have given our GMAT students the edge for the past 20 years.

2. Learn the Specific Math and Verbal Skills You'll Need

Our courses include an extremely thorough review of the math and verbal skills our students need to ace the GMAT, and this book will give you that same review.

Important Phone Numbers:

To register for the GMAT:
800-717-GMAT

To reach GMAC Customer Service: 866-505-6559 or
703-245-4222

3. Practice Each Type of Question—at the Difficulty Level You Need to Master

Two of the GMAT's sections, the Quantitative and Verbal sections, are computer adaptive. These sections quickly hone in on your ability level and then mostly give you questions at or just above that level. It makes sense for you to practice on the level of problem you will actually see during the test. *Cracking the New GMAT* is the only book out there with practice questions grouped by difficulty. Page after page of practice questions are arranged at the back of this book in difficulty "bins"—just like the questions on the real GMAT—so that you can concentrate on the question level you will have to answer on the actual test in order to get the score you need.

The new Integrated Reasoning section of the GMAT is not computer adaptive. We've provided two complete Integrated Reasoning sections at the back of this book to help you prepare for this section of the test.

4. Periodically Take Simulated GMATs to Measure Your Progress

As you work through the book, you'll want to take our online practice tests to see how you're doing. These tests closely mimic the GMAT so you can become familiar with the test's content and structure. Our tests include adaptive sections for the Quantitative and Verbal sections and a non-adaptive section for the Integrated Reasoning section. Our practice tests can be found at PrincetonReview.com/cracking. In addition, we actively encourage students to use *The Official Guide for GMAT Review*, which is published by the Graduate Management Admission Council (GMAC). It contains actual test questions from previous administrations of the GMAT. You should also take at least one of the real practice tests available through the GMAT website, www.mba.com.



Take GMATs online

at PrincetonReview.com/cracking

5. Hone Your Skills

Using the detailed score reports from your practice exams, you'll be able to zero in on problem areas and quickly achieve mastery through additional practice. And as your score rises on the adaptive sections, this book is ready with more difficult question bins to keep you on track for the score you need. You can use the two practice Integrated Reasoning sections in this book to help you prepare for your practice tests and your real GMAT.

6. Keep Track of the Application Process

Throughout the book, you will find informative sidebars explaining how and when to register for the test, how and when to apply to business school, the advantages and disadvantages of applying early, and much more. Plus, at PrincetonReview.com/cracking, you'll be able to take advantage of our powerful web-based tools to match yourself with schools that meet your needs and preferences.

Important Websites

To register for the GMAT:
www.mba.com

WHAT IS THE GRADUATE MANAGEMENT ADMISSION TEST?

The Graduate Management Admission Test (GMAT) is a standardized test used by business schools as a tool to decide whom they are going to let into their M.B.A. programs.



Learn About Different Business Schools

Check out our book:
Best 294 Business Schools.

What Does the Test Look Like?

The GMAT is only offered on computer. The 3.5 hour test is administered at a secure computer terminal at an approved testing center. You enter your multiple-choice answers on the screen with a mouse; you must compose your essay for the Writing Assessment section on the computer as well.

One 30 minute essay to be written on the computer using a generic word processing program.

One 30 minute, 12 question, multiple choice Integrated Reasoning section. Some integrated reasoning questions can have multiple parts.
(optional break)

A 75 minute, 37 question multiple choice Math section
(optional break)

A 75 minute, 41 question multiple choice Verbal section

On average, this would give you two minutes for each math question and a little less than two minutes for each verbal question—but you will find that our Princeton Review strategies will slightly revise these times. You must answer a question in order to get to the next question—which means that you can't skip a question and come back to it.

And while you are not required to finish any of the sections, your score will be adjusted downward to reflect questions you did not complete.

On each of the Math and Verbal sections, approximately one quarter of the questions you encounter will be experimental and will not count toward your score. These questions, which will be mixed in among the regular questions, are there so the test company can try out new questions for future tests. We'll have much more to say about the experimental questions later.

What Information Is Tested on the GMAT?

You will find several different types of multiple-choice questions on the GMAT.

Math (37 questions total)

Problem Solving—approximately 19 questions

Data Sufficiency (a strange type of problem that exists on no other test in the world)—approximately 18 questions

Verbal (41 questions total)

Reading Comprehension (tests your ability to answer questions about a passage)—approximately 13 questions

Sentence Correction (a grammar-related question type)—approximately 17 questions

Critical Reasoning (a logic-based question type recycled from the LSAT)—approximately 11 questions

Integrated Reasoning (12 questions total)

Table Analysis—data is presented in a sortable table (like an Excel spreadsheet); each question usually has four parts

Graphics Interpretation—a chart or graph is used to display data; each question usually has three parts; answers are selected from drop-down boxes.

Multi-Source Reasoning—information (a combination of charts, text, and tables) is presented on two or three tabs; each set of tabbed information is usually accompanied by three questions

Two-Part Analysis—each question usually has six options and you need to pick two

Where Does the GMAT Come From?

The GMAT is published and administered by the Graduate Management

Admission Council (GMAC). GMAC is a private company. We'll tell you more about them later on in this book.

How Is the GMAT Scored?

As soon as you've finished taking the GMAT, your computer will calculate and display your unofficial results, not including your Writing Assessment score. You can print out a copy of your unofficial results to take with you. Within 20 days, you will receive your score report online; a written report will be available only by request.

Most people think of the GMAT score as a single number, but in fact there are five separate numbers:

Math score (reported on a scale that runs from 0 to 60)

Verbal score (reported on a scale that runs from 0 to 60)

Total score (reported on a scale that runs from 200 to 800 and based only on the results of Math and Verbal sections)

Analytic Writing Assessment score (reported on a scale of 0 to 6, in half point increments; 6 is the highest score)

Integrated Reasoning score (reported on a scale that is yet to be determined by GMAC as of this writing; be sure to check www.mba.com for the latest information)

The report will look something like this:

Math	%	Verbal	%	Total	%	AWA	%	Integrated Reasoning	%
36	42	30	56	550	48	4.5	38	??	75

Many business schools tend to focus on the total score, which means that you may make up for weakness in one area by being strong in another. For example, if your quantitative skills are better than your verbal skills, they'll help pull up your total score—although some of the more selective schools say they prefer to see math and verbal sub-scores that are balanced. Total scores go up or down in ten-point increments. In other words, you might receive 490 or 500 on the GMAT, but never 494 or 495.

Since the Integrated Reasoning section is new, it's unclear how much importance schools will attach to your score on this section. Be sure to check with your schools to see

how they plan to use the Integrated Reasoning score. Your schools should also be able to tell you what they consider a competitive score for this section.

You will also see a percentile ranking next to each score. For example, if you see a percentile of 72 next to your verbal score, it means that 72 percent of the people who took this test scored lower than you did on the Verbal section.

WHAT IS THE PRINCETON REVIEW?

The Princeton Review is a test-preparation company founded in New York City. It has branches in more than 50 cities across the country, as well as abroad. The Princeton Review's techniques are unique and powerful, and they were developed after a study of thousands of real GMAT questions. They work because they are based on the same principles that are used in writing the actual test. The Princeton Review's techniques for beating the GMAT will help you improve your scores by teaching you to

- think like the test writers

- take full advantage of the computer-adaptive algorithms upon which the GMAT is based

- find the answers to questions you don't understand by using Process of Elimination

- avoid the traps that test writers have set for you (and use those traps to your advantage)

A Warning

Many of our techniques for beating the GMAT may be very different from the way that you would naturally approach problems. Some methods may even seem counterintuitive. Rest assured, however, that many test-takers have used our methods to get great GMAT scores. To get the full benefit of our techniques, you must trust them. The only way to develop this trust is to practice the techniques and persuade yourself that they work.

Practice with Real Questions

One reason coaching books do not use real GMAT questions is that GMAC won't let them. So far, the council has refused to let anyone (including us) license actual questions from old tests. As we mentioned above, the council has its own review book

called *The Official Guide for GMAT Review*, which we heartily recommend that you purchase. GMAC also puts out preparation software called *GMATPrep*, which can be downloaded for free from www.mba.com. This software includes two computer-adaptive tests plus additional practice sets, all of which feature real GMAT questions. By practicing our techniques on real GMAT items, you will be able to prove to yourself that the techniques work and increase your confidence when you actually take the test.

And, remember, by using The Princeton Review’s practice questions grouped by level of difficulty at the back of this book, you’ll be able to concentrate on types of questions you are actually likely to see.

There’s More to This Book Than This Book

When preparing for the GMAT, don’t forget to take advantage of the many resources that accompany this book. Register your book at PrincetonReview.com/cracking, and you’ll gain access to our computer-adaptive practice tests, graduate school ranking lists and information, and helpful links. All of these tools will help you reinforce what you’ve learned in this book and take it to the next level.

Summary

By using a combination of the Princeton Review’s Integrated Reasoning introduction, math and verbal reviews, the practice questions contained in this book, and periodic simulated tests, you will be able to improve your score on the GMAT.

The test itself is taken on computer. It consists of the following:

Analytical Writing Assessment			
• Analysis of an Argument	1 essay on business or a topic of general interest.	30 minutes	Scoring: 0–6 in half point increments

Quantitative Section			
<ul style="list-style-type: none"> • Problem Solving • Data Sufficiency 	<p>37 questions total. Roughly 50% problem solving.</p>	75 minutes	Scoring: 0–60

Verbal Section			
<ul style="list-style-type: none"> • Sentence Correction • Critical Reasoning • Reading Comprehension 	<p>41 questions total. Roughly 40% Sentence Correction and 30% each for Reading and Critical Reasoning.</p>	75 minutes	Scoring: 0–60
<p>Overall score: 200–800 (based only on the Quantitative and Verbal sections)</p>			

Integrated Reasoning Section			
<ul style="list-style-type: none"> • Table Analysis • Graphics Interpretation • Multi-Source Reasoning • Two-Part Analysis 	<p>12 questions total. Some questions can have multiple parts.</p>	<p>30 minutes</p>	<p>Scoring: To be determined—check out the latest information at www.mba.com</p>

Chapter 2

How to Think About the GMAT

If you think the GMAT tests your business knowledge or shows how smart you are, you're in for a surprise. This chapter will give you a new way to look at the GMAT to guide your studies in the right direction.

Are You a Genius Or an Idiot?

If you're like most people, you think that standardized tests measure how smart you are. If you score 800 on the GMAT, you may think of yourself as a genius (and the future manager of a corporate empire). If you score 200, you may think of yourself as an idiot (and the future manager of ... well ... nothing). You may think that the GMAT measures your verbal and math abilities. At the very least, you probably believe that the GMAT is an accurate predictor of how you'll do in business school.

What Does the GMAT Measure?

The GMAT is not a test of how smart you are. Nor is it a test of your business acumen or even a predictor of your grades in business school. It's simply a test of how good you are at taking the GMAT. In fact, you will learn that by studying the very specific knowledge outlined in this book, you can substantially improve your score.

The GMAT as a Job Interview

The first axiom of any how-to book on job interviewing is that you must always tell your interviewer what he or she wants to hear. No matter whether this is good job-hunting advice, it happens to be a very useful strategy on the GMAT. The test writers think in predictable ways. You can improve your score by learning to think the way they do and anticipating the kinds of answers that they think are correct.

How Closely Does The Princeton Review Monitor the GMAT?

Very closely. Each year, we publish a new edition of this book to reflect the subtle shifts that happen over time, or, in the case of the introduction of the new Integrated Reasoning section this year, the major changes to the GMAT. For the latest information on the GMAT, please visit our website at PrincetonReview.com.

Is This Book Just Like The Princeton Review Course?

No. You won't have the benefit of taking five computer-adaptive GMATs that are scored and analyzed by our computers. You won't get to sit in small classes with seven other highly motivated students who will spur you on. You won't get to work with our expert instructors who can assess your strengths and pinpoint your weaknesses. There is no way to put these things in a book.

What you will find in this book are some of the techniques and methods that have enabled our students to crack the system—plus a review of the essentials that you cannot afford not to know.

If at all possible, you should take our course. If that is not possible, then use this book.

How to Crack the System

In the following chapters we're going to teach you our method for cracking the GMAT. Read each chapter carefully. Some of our ideas may seem strange at first. For example, when we tell you that it is sometimes easier to answer GMAT questions without actually working out the entire problem, you may think, "This isn't the way I conduct business."

But the GMAT Isn't About Business

We're not going to teach you business skills. We're not going to teach you math and English. We're going to teach you the GMAT.

Chapter 3 Cracking the Adaptive Sections: Basic Principles

This chapter will show you how the computer-adaptive sections of the GMAT really work. You will learn to pace yourself and to take advantage of the test's limitations.

HOW THE COMPUTER-ADAPTIVE GMAT SECTIONS WORK

To understand how to beat the computer-adaptive sections (math and verbal) of the GMAT, you have to understand how they work.

Unlike paper-and-pencil standardized tests that begin with an easy question and then get progressively tougher, the computer-adaptive sections always begin by giving you a medium question. If you get it right, the computer gives you a slightly harder question. If you get it wrong, the computer gives you a slightly easier question, and so on. The idea is that the computer will zero in on your exact level of ability very quickly, which allows you to answer fewer questions overall and allows the computer to make a more finely honed assessment of your abilities.



To check out which
b-schools are the
"Toughest to Get Into,"
take a look at the rankings

on your online student tools. If you haven't registered yet, go to PrincetonReview.com/cracking

What You Will See on Your Screen

During the test itself, your screen will display the question you're currently working on, with little circles next to the five answer choices. To answer the question, you use your mouse to click on the circle next to the answer choice you think is correct. Then you press a button at the bottom of the screen to verify that this is the answer you want to pick.

What You Will Never See on Your Screen

What you will *never* see is the process by which the computer keeps track of your progress. When you start each adaptive section, the computer assumes that your score is average. So, your starting score for each section is around a 30. As you go through the test, the computer will keep revising its assessment of your score based on your responses.

Let's watch the process in action. In the left-hand column on the next page, you'll see what a hypothetical test taker—let's call her Jane—sees on her screen as she takes the test. In the right-hand column, we'll show you how GMAC keeps track of how she's doing. (We've simplified this example a bit in the interest of clarity.)

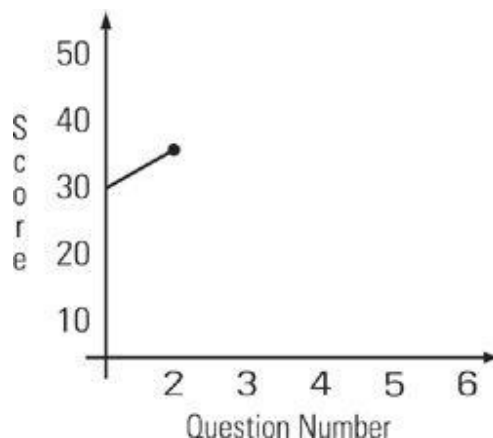
WHAT JANE SEES:

To regard the overwhelming beauty of the Mojave Desert is understanding the great forces of nature that shape our planet.

understanding the great forces of *to understand the great forces to* *to understand the great forces of* *understanding the greatest forces in*
 understanding the greater forces on **WHAT JANE DOESN'T SEE:**

When you start each adaptive section, the computer assumes that your score is average. So, your starting score for each section is around a 30. Jane gets the first

question right (the third answer down—what we'll call C), so her score goes up to a 35, and the computer selects a harder problem for her second question.



WHAT JANE SEES:

Hawks in a certain region depend heavily for their diet on a particular variety of field mouse. The killing of field mice by farmers will seriously endanger the survival of hawks in this region.

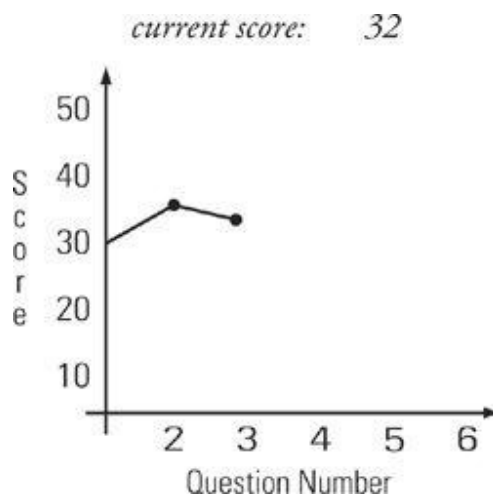
Which of the following, if true, casts the most doubt on the conclusion drawn above?

- The number of mice killed by farmers has increased in recent years.*
- Farmers kill many other types of pests besides field mice without any adverse effect on hawks.*
- Hawks have been found in other areas besides this region.*
- Killing field mice leaves more food for the remaining mice, who have larger broods the following season.*
- Hawks are also endangered because of pollution and deforestation.*

WHAT JANE DOESN'T SEE:

The computer happens to select a critical reasoning problem.

Oops. Jane gets the second question wrong (the correct answer is the fourth answer down—what we call choice D), so her score goes down to a 32, and the computer gives her a slightly easier problem.



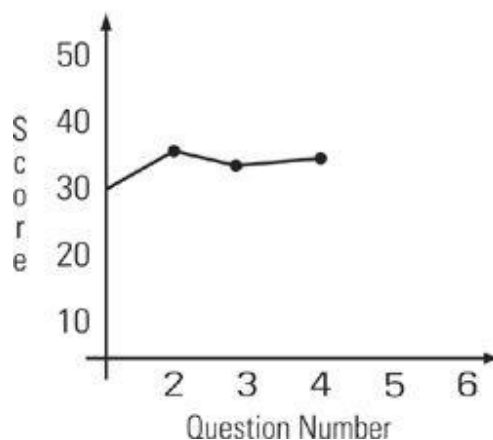
WHAT JANE SEES:

Nuclear weapons being invented, there was wide expectation in the scientific community that all war would end.

- Nuclear weapons being invented, there was wide expectation in the scientific community that
 When nuclear weapons were invented, expectation was that
 As nuclear weapons were invented, there was wide expectation that
 Insofar as nuclear weapons were invented, it was widely expected
 With the invention of nuclear weapons, there was wide expectation that

WHAT JANE DOESN'T SEE:

Jane has no idea what the correct answer is on this third question, but she guesses choice E and gets it correct. Her score goes up to a 33.



You get the idea. At the very beginning of the section, your score moves up or down in larger increments than it does at the end, when GMAC believes it is merely refining whether you deserve, say, a 42 or a 43. The questions you will see on your test come from a huge pool of questions held in the computer in what the test writers call “difficulty bins”—each bin with a different level of difficulty.

The Experimental Questions

Unfortunately, approximately one-fourth of the questions in each adaptive section (math and verbal) won’t actually count toward your score. The difficulty of an experimental question does not depend on your answer to the previous question. You could get a question right and then immediately see a fairly easy experimental question.

So, if you are answering mostly upper-medium questions and suddenly see a question that seems too easy, there are two possibilities: a) you are about to fall for a trap, or b) it’s an experimental question and really is easy. That means it can be very difficult for you to judge how you are doing on the section. So, don’t try! Your best strategy is to simply try your best on every question.

Remembering that experimental questions are included throughout the adaptive sections can also help you use your time wisely. When you get stuck on a question—even one of the first ten questions—remember that it might be experimental. Spending an inordinate amount of time on one question could cause you to rush and make silly mistakes later. Would you really want to do that if the question turned out to be experimental?

Eliminate what you can, guess, and move on in those situations.

What the Computer-Adaptive GMAT Uses to Calculate Your Score

The GMAT keeps a running tally of your score as it goes, based on the number of questions you get correct and their levels of difficulty—but there are two other important factors that can affect your score:

Early questions, which count more than later questions

Questions you leave unanswered, which will lower your score

How much can leaving questions at the end unanswered damage your score? GMAC says that somebody who was on track to score in the

91st percentile will drop
to the 77th percentile by
leaving just five questions
unanswered.
Answer every question!

Why Early Questions Count More Than Later Questions

At the beginning of the test, your score moves up or down in larger increments as the computer hones in on what will turn out to be your ultimate score. If you make a mistake early on, the computer will choose a much easier question, and it will take you a while to work back to where you started from. Similarly, if you get an early problem correct, the computer will then give you a much harder question.

However, later in the test, a mistake is less costly—because the computer has decided your general place in the scoring ranks and is merely refining your exact score.

While it is not impossible to come back from behind, you can see that it is particularly important that you do well at the beginning of the test. Answering just a few questions correctly at the beginning will propel your interim score quite high.

Pace Yourself

Make sure that you get these early questions correct by starting slowly, checking your work on early problems, and then gradually picking up the pace so that you finish all the problems in the section.

Still, if you are running out of time at the end, it makes sense to spend a few moments to guess intelligently on the remaining questions using POE rather than random guesses or (let's hope it never comes to this) not answering at all. You will be pleased to know that it is possible to guess on several questions at the end and still end up with a 700.

On the next page, you'll find our pacing advice for math and verbal. The charts will tell you how much time you should spend for each block of ten questions based on a practice test score.

MATH				
	Question numbers			
Score	1–10	11–20	21–30	31–37
Under 35	30 min.	25 min.	15 min.	5 min.
35–42	30 min.	20 min.	15 min.	10 min.
Above 42	25 min.	20 min.	20 min.	10 min.

VERBAL				
	Question numbers			
Score	1–10	11–20	21–30	31–41
Under 28	30 min.	25 min.	10 min.	10 min.
28–34	27 min.	20 min.	18 min.	10 min.
Above 34	25 min.	20 min.	15 min.	15 min.

The Princeton Review Approach to the GMAT

To help you ace the computer-adaptive sections of the GMAT, this book is going to provide you with

Test-taking techniques that have made The Princeton Review famous and that will enable you to turn the inherent weaknesses of the computer-adaptive sections of the GMAT to your advantage

A thorough review of all the major topics covered on the GMAT

A short practice test to help you predict your current scoring level

Practice questions to help you raise your scoring level

Know Your Bin

According to classic theory, the average test taker spends most of his or her time answering questions at his level of competency (which he gets right) and questions that are just above his level of competency (which he gets wrong). In other words, most testers will see questions from only a few difficulty “bins.”

This means that to raise your score, you must learn to answer questions from the bins immediately *above* your current scoring level. At the back of this book, you will find a short diagnostic test to determine your current scoring level and then bins filled with questions at various scoring levels. When combined with a thorough review of the topics covered on the GMAT, this should put you well on your way to the score you’re looking for.

But first, let’s learn with some test-taking strategies.

Summary

The computer-adaptive sections of the GMAT always start you off with a medium question. If you get it right, you get a harder question; if you get it wrong, you get an easier question. The test assigns you a score after each answer and quickly (in theory) hones in on your level of ability.

Mixed in with the questions that count toward your score will be experimental questions that do not count toward your score. The testing company is using you as an unpaid guinea pig to try out new questions. Approximately one-fourth of the questions in each of the adaptive sections are experimental.

Because the test is taken on a computer, you must answer each question to get to the next question—you can’t skip a question or come back to it later.

Because of the scoring algorithms, early questions count more than later questions—so check your work carefully at the beginning of the test.

The GMAT computer-adaptive sections select questions for you from “bins” of questions at different levels of ability. The Princeton Review method consists of finding your current bin level through diagnostic tests and then practicing questions from that bin, gradually moving to higher bins as you become more proficient.

Chapter 4 Cracking the Adaptive Sections: Intermediate Principles

This chapter provides an introduction to one of the key Princeton Review techniques: Process of Elimination.

Imagine for a moment that you are a contestant on *Deal or No Deal*. You're down to the final two briefcases. Howie Mandel asks you, "Do you want briefcase number two, or briefcase number three?"

As you carefully weigh your options, the members of the audience are shouting out *their* suggestions. But you can bet that there is *one* thing no one in the audience is going to shout at you: "Skip the question!"

It's just not an option. You have to make a choice—and you have to make it *now*. In one briefcase there is a million dollars with which you could buy a yacht; in the other, \$50 which won't even pay for the gas you used to drive to the studio. One of these choices is much better than the others, but on *Deal or No Deal*, you have no idea which is which.

B-School Lingo

If you want to be an MBA student, you'll have to learn to talk like one.

air hogs: students who monopolize classroom discussion and love to hear themselves speak.

B2B: "Business-to-Business": a company that sells not to retail consumers, but to other enterprises.

B2C: Business-to-Consumer: a company that sells primarily to individual retail consumers.

Source: *Best 294 Business Schools*

Let's Make a GMAT

Normally when you don't know the correct answer on a test, you skip the question and come back to it later. But on the computer-adaptive sections of the GMAT, as in *Deal or No Deal*, you can never skip the question.

To Get to the Next Question, You Have to Answer This One

Because of the way the computer-adaptive sections of the GMAT's scoring algorithm works, the question you see on your computer screen at any particular moment depends on your response to the question previous. This creates an odd situation for the test designers: If they allowed you to skip a question, they wouldn't know which question to give you next.

It's clear from articles that GMAT test designers have published that they know test takers are at a real disadvantage when they can't skip a problem and come back to it later. Still, the idea of using a computer to administer tests was too tempting to give up. In the end, GMAC decided that you should generously be willing to make the sacrifice in the name of progress.

So whether you know the answer to a problem or not, you have to answer it in order to move on.

This means that, like it or not, you may have to do some guessing on the GMAT. Ah, but there's guessing, and then there's *guessing*.

If You Don't Know the Right Answer, Don't You Dare Just Pick an Answer at Random

This may sound a little loony, but it turns out that you don't always have to know the correct answer to get a question right.

Try answering the following question:

What is the unit of currency in Sweden?

What? You don't know?

Unless you work for an international bank or have traveled in Scandinavia, there is no reason why you should know what the unit of currency in Sweden is. (By the way, the GMAT doesn't ask such factual questions. We're using this one to make a point.) As it stands now, because you don't know the answer, you would have to answer this question at random, right?

Not necessarily. GMAT questions are written in multiple-choice format. One of the five choices has to be the answer. You just have to find it.

Inappropriate Use of GMAT Scores

The following is a list of what GMAC considers "inappropriate uses" of GMAT scores:

1. As a requisite for awarding a degree

2. As a requirement for employment, for licensing or certification to perform a job, or for job-related rewards (raises, promotions, etc.)

3. As an achievement test

Source: *Graduate Management Admission Council*

Look for Wrong Answers Instead of Right Ones

Let's put this question into multiple-choice format—the only format you'll find

on the GMAT—and see if you still want to answer at random.

What is the unit of currency in Sweden?

- the dollar* *the franc* *the pound sterling* *the yen*
 the krona **PROCESS OF ELIMINATION**

Suddenly this question isn't difficult anymore. You may not have known the right answer, but you certainly knew enough to eliminate the wrong answers. Wrong answers are often easier to spot than right answers. Sometimes they just sound weird. At other times they're logically impossible. While it is rare to be able to eliminate all four of the incorrect answer choices on the GMAT, you will almost always be able to eliminate at least one of them—and frequently two or more—by using Process of Elimination. Process of Elimination (POE for short) will enable you to answer questions that you don't have the time to figure out exactly. We will refer to POE in every single chapter of this book. It is one of the most important and fundamental tools you will use to increase your score.

Try another example:

Which of the following countries uses the peso as its unit of currency?

Russia Canada Venezuela England Chile This time you can probably only get rid of three of the five answer choices using POE. The answer is clearly *not* Russia, Canada, or England, but most people probably don't know for sure whether the answer is Venezuela or Chile.

You've got the question down to two possibilities. What should you do?

Heads or Tails

A Chilean might flip a peso. You have a fifty-fifty chance of getting this question right, which is much better than if you had guessed at random. And because the GMAT forces you to guess anyway, it makes sense to guess intelligently.

In the chapters that follow, we'll show you specific ways to make use of POE to increase your score. You may feel uncomfortable about using these techniques at first, but the sooner you make them your own, the sooner you'll start to improve your score.

Is It Fair to Get a Question Right When You Don't Know the Answer?

If you took any math courses in college, you probably remember that the correct answer to a problem, while important, wasn't the only thing you were graded on. Your professor was probably more interested in how you got the answer, whether you wrote an elegant equation, or if you used the right formula.

If your equation was correct but you messed up your addition at the end, did you get the entire question wrong? Most college professors give partial credit for an answer like that. After all, what's most important is the mental process that goes into getting the answer, not the answer alone.

On the GMAT, if you don't click the correct circle with your mouse, you're wrong. It doesn't matter that you knew how to do the problem, or that you clicked the wrong answer by mistake. GMAC doesn't care: You're just wrong. And a wrong answer means that the running score that GMAC is keeping on you will go down by 10 or 20 points and you'll be forced to answer several easier questions correctly before you get back to the level at which you were.

This really isn't fair. It seems only fitting that you should also be able to benefit from the flip side of this situation: If you click on the correct circle, GMAC doesn't care how you got that answer either.

So, What Are the Appropriate Uses?

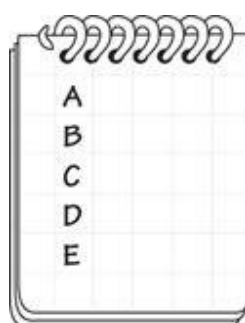
1. Selection of applicants for graduate study in management
2. Selection of applicants for financial aid on the basis of academic potential
3. Counseling and guidance

Source: *Graduate Management Admission Council*

Scratch Work

Process of Elimination is a powerful tool, but it's only powerful if you keep track of the answer choices you've eliminated. On a computer-adaptive test, you obviously can't cross off choices on the screen—but you can cross them off on your scratch paper.

The testing center provides each tester with a blank ten-page booklet and a fine-tipped black marker for scratch work. The pages are laminated and printed with a faint grid pattern useful for drawing math diagrams. In our course, we encourage our students to divide up each page into boxes and label each box with five answer choices as shown on the next page.



Each letter corresponds to an answer. Of course, the answers on the computer-adaptive sections of the GMAT are no longer labeled with letters, but to be able to track the answers you've crossed off, it helps to think of them as if they are. The first answer choice is equivalent to A, the second to B, and so on.

Throughout this book, you will see us using the scratch booklet to keep track of the answer choices that have already been eliminated. By making this part of the ritual of how you take the GMAT, you will be able to prevent careless errors and make your guesses count.

Summary

Because of the way the GMAT is designed, you will be forced to answer questions whether or not you know the correct answer.

However, not knowing the exact answer to a question does not mean that you have to get it wrong.

When you don't know the right answer to a question, look for wrong answers instead. This is called POE, or Process of Elimination.

The best way to keep track of the answer choices that you've eliminated is to use your scratch work to cross them off as you go.

Chapter 5

Cracking the Adaptive Sections: Advanced Principles

In this chapter, you will make a new friend named Joe Bloggs. You will also learn how to use the way the GMAT is constructed to radically increase your score.

The people who write the computer-adaptive section of the GMAT think that this part of the test is wonderful—and not just because they wrote it, or because it makes them a lot of money. They like it because it ensures that the only problems a test-taker gets to see are problems at, and slightly above and below, her level of ability. One of the things they always hated about the paper-and-pencil test was that a student scoring 300 could guess the correct answer to a 700-level question.

But They Have This Little Problem

The questions on the GMAT are still multiple-choice.

That may not seem like a problem to you, but consider the following situation. Suppose an average student takes the GMAT. He's answered 36 of the 37 problems on the Math section. There's one left, and as he looks at this last question, he realizes he has absolutely no idea of how to answer it. However, one of the answer choices just "seems" right. So he picks it.

And he gets it right.

The test writers get nightmares just thinking about this situation. That average student was supposed to get 500. He "deserved" 500. But by guessing the correct answer to one last problem, he may have gotten 510.

Ten points more than he "deserved."

GMAC's Solution

GMAC's tests wouldn't be worth much if students could routinely guess the correct answer to difficult questions by picking answers that seemed right.

So the test writers came up with a wonderful solution:

On difficult questions, answer choices that seem right to the average student are

almost always wrong.

Choosing Answers That Seem Right

Almost everybody gets stuck on at least a few questions when they take the computer-adaptive sections of the GMAT. After all, the questions keep getting harder as you get questions right. Sooner or later, you may run into a question that you just don't know how to do. If you're like most people, you'll get as far as you can, and then choose the answer that seems correct. In other words, you play a hunch. For some questions, you may pick an answer because it "just looks right" or something about it seems to go naturally with the question.

What Happens When the Average Person Takes the GMAT?

The average person picks the answer that seems right on every problem. Sometimes these hunches are correct; sometimes they are not.

On easy questions, the average person tends to pick the correct answer. The answers that seem right to the average person actually are right on the easy questions.

On medium questions, the average person's hunches are right only some of the time. Sometimes the answers that seem right to the average person really are right and sometimes they're wrong.

Finally, on difficult problems, the average person's hunches are almost always wrong. The answers that seem right to the average person on these questions are invariably wrong.

Question Difficulty

GMAT questions are rated based on how many people get them wrong not the question content.

Hard = 70 percent or more of people get it wrong

Medium = about half of people get it wrong

Easy = fewer than 30 percent of people get it wrong

MEET JOE BLOGGS

We're going to talk a lot about "the average test-taker" from now on. For the sake of convenience, let's call him Joe Bloggs. Joe Bloggs is just the average prospective business school student. Joe gets an average score—around 500—when he takes the GMAT because Joe always does what the test writers expect. Joe tends to answer questions quickly because he just picks answers that seem right.

There's a little bit of Joe in everybody. If you've ever wanted to pick an answer immediately after reading a question, you're in touch with your inner Joe. The problem only emerges later when you reread some of these questions and realize you missed something. The quick, obvious answer was wrong!

No matter what your score, Joe can help you do better on the GMAT. Any time you have the impulse to pick an answer within a few seconds of reading the question, you may be about to pick a "Joe Bloggs answer." Ask yourself, "Are they really going to let me go to a good business school for doing something that easy?" Probably not. Go reread the question!

How Does Joe Bloggs Approach the GMAT?

Joe Bloggs, the average test-taker, spends most of his time answering questions of medium difficulty. But whenever he gets several questions correct in a row, the computer gives him a more difficult question.

Joe approaches the GMAT just as the test writers expect. Whether the question is hard or easy, he always chooses the answer that *seems* to be correct.

Here's an example of what a more difficult problem might look like on a GMAT problem-solving section:

The output of a factory was increased by 10% to keep up with rising demand. To handle the holiday rush, this new output was increased by 20%. By approximately what percent would the output now have to be decreased in order to restore the original output?

20% 24% 30% 32% 79% This question is from an upper medium difficulty bin. Don't bother trying to work the problem out now. You will learn how to do this type of problem (percentage decrease) in the first math chapter.

How Did Joe Bloggs Do on This Question?

He got it wrong. Why? Because GMAC set a trap for him. In fact, this question was rated upper medium *because* the trap answer made it so easy to get the question wrong!

Which Answer Did Joe Bloggs Pick on This Question?

Joe didn't think this was a hard problem. The answer seemed perfectly obvious. Joe Bloggs picked the middle choice—what we call C. (Please note that the first answer choice is called A, the second B, etc.) Joe assumed that if you increase production first by 10% and then by 20%, you have to take away 30% to get back to where you started.

The test writers led Joe away from the correct answer by giving him an answer that seemed right. In fact, the correct answer is B. Here's the same problem with slightly different answer choices. We've changed the choices to make a point:

The output of a factory was increased by 10% to keep up with rising demand. To handle the holiday rush, this new output was raised by 20%. By approximately what percent would the output now have to be decreased in order to restore the original output?

21% 24% 34.2% 37% 71.5%

If Joe had seen this version, he actually would have been more likely to get the question right. He still would have thought, "That's easy—30 percent" two seconds after reading the question. However, when he looked at the answers and 30% wasn't there, he would have been forced to go back and think about how he should really work the question. But the test writers wanted him to get it wrong, so they supplied the trap answer.

B-School Lingo

back of the envelope: a quick analysis of numbers, as if scribbled on the back of an envelope

benchmarking: comparing a company to others in the industry

burn rate: the amount

of cash a money-losing
company consumes during
a period of time

Source: *Best 294 Business
Schools*

Could GMAC Have Made This an Easy Question Instead?

Sure, by writing different answer choices.

Here's the same question with choices we've substituted to make the correct answer choice obvious:

The output of a factory was increased by 10% to keep up with rising demand. To handle the holiday rush, this new output was raised by 20%. By approximately what percent would the output now have to be decreased in order to restore the original output?

a million % 24% a billion % a trillion % a zillion %

When the problem is written this way, Joe Bloggs can see that the answer has to be choice B. It seems right to Joe because all the other answers seem obviously wrong.

Profiting from Other People's Bankruptcy

Let's look at a textbook example of how *not* to run a company.

Suppose you started your own company, with three partners: Kenneth Lay (formerly of Enron), Bernie Madoff (former head of Madoff Investment Securities), and Martha Stewart (now back with Martha Stewart Omnimedia). You have an important business decision to make, and each of your partners gives you his or her advice. Lay says, "Take an established company with actual assets and turn it into an Internet company without assets. It always worked for me." Madoff says, "Just pretend you're actually making money--the investors will never know the difference." Stewart says, "What you need is inside information."

Are you going to make use of the advice of these people? Hell no! Now you know three things you're *not* going to do.

Joe Bloggs is our textbook example of how *not* to take a test.

YOUR PARTNER ON THE TEST: JOE BLOGGS

When you take the GMAT a few weeks or months from now, you'll have to take it on your own, of course. But suppose for a moment that GMAC allowed you to take it with Joe Bloggs as your partner. Would Joe be any help to you on the GMAT?

You Probably Don't Think So

After all, Joe is wrong as often as he's right. He knows the answers to the easy questions, but so do you. You'd like to do better than average on the GMAT, and Joe earns only an average score (he's the average test-taker, remember). All things considered, you'd probably prefer to have someone else for your partner.

But Joe might turn out to be a pretty helpful partner, after all. Because his hunches on difficult questions are always wrong, couldn't you improve your chances on those questions simply by finding out what Joe wanted to pick and then picking something else?

If you could use what you know about Joe Bloggs to eliminate one, two, or even three obviously incorrect choices on a hard problem, wouldn't you improve your score by guessing among the remaining choices?

Whatever Your Current Scoring Level, the Joe Bloggs Principle Can Help You

We're going to teach you how to use Joe Bloggs while taking the GMAT.

After you've taken the practice test at the back of this book, the free tests on our website, or the practice tests available in *GMATPrep*, you will have some idea of how you are scoring at any given moment on the GMAT. This means that you'll know approximately the level of difficulty of most of the problems you'll face.

Don't worry about how you are doing on the test. You really don't have time for that. Anytime that you get an answer with very little work, consider that you might be about to pick a Joe Bloggs answer. At the very least, reread the question stem before selecting your answer. If you know from your practice tests that you generally do well on the section, you probably want to eliminate that easy answer.

Harvard and the GMAT

For 12 years, Harvard University's
Business School
would not even look at

the GMAT scores of its applicants. The class of 1997 was the first in more than a decade that was required to submit GMAT scores.

Should You Always Just Eliminate Any Answer That Seems to Be Correct?

No! Remember what we said about Joe Bloggs:

His hunches are often correct on easy questions.

His hunches are sometimes correct and sometimes incorrect on medium questions.

His hunches are always wrong on difficult questions.

Putting Joe Bloggs to Work for You

In the following chapters, we'll teach you many specific problem-solving techniques based on the Joe Bloggs principle. The Joe Bloggs principle will help you:

Use POE to eliminate incorrect answer choices.

Avoid careless mistakes.

Bloggs and Your Bin

Knowing your bin is key to knowing how to use Joe Bloggs. Based on your scores on practice tests, you will have a good sense of what bins the test writers will be drawing from during the real test. If those bins are from the upper medium or difficult problems, then you can expect to see Joe Bloggs answers in some of these questions—and you will know that they are almost certainly wrong. On the other hand, if you know that you are drawing questions from the easy and early medium questions, then you will also know that the Joe Bloggs answer you spot could well be correct.

Summary

Almost everyone approaches the GMAT by choosing the answer that seems correct, all things considered.

Joe Bloggs is the average GMAT test-taker. He earns an average score on the GMAT. On easy GMAT questions, the answers that seem correct to him are usually correct. On medium questions, his answers are sometimes correct and sometimes not. On hard questions, the answers that seem correct to him are always wrong.

By taking a practice test from time to time, you can predict your current scoring level—which, in turn, will tell you what type of questions you will generally be answering: easy, medium, or difficult.

Whatever your current scoring level, the Joe Bloggs principle can help you to eliminate answer choices when you don't know the correct answer.

Chapter 6 Taking the New GMAT

How do you register and practice for the New GMAT? What is taking the actual test really like? What do you do if something goes wrong? This chapter will answer these and other practical questions.

REGISTERING TO TAKE THE NEW GMAT

The easiest way to register for the exam is by telephone or online. You will be given a list of dates, times, and testing centers that are located near you. One of the actual advantages of the GMAT is that you get to schedule the time of the exam. If you are not a morning person, ask for an afternoon time slot. If you can't think after midday, ask for a morning time slot.

Keep in mind that certain slots get filled quickly, so be sure to call ahead of time. The registration fee is \$250 (worldwide). Those who schedule an exam in certain countries will incur taxes. Tax rate information is available at www.mba.com in the GMAT registration section. Note that checks or money orders payable in U.S. dollars must be drawn from banks located in the United States or Canada.

To register for the GMAT,
call 1-800-717-GMAT
or visit the website at

www.mba.com

PRACTICING TO TAKE THE NEW GMAT

As you prepare for the GMAT, it's important to know—in advance—what the experience of taking the test is like, so that you can mimic those conditions during practice tests. When you are taking a practice test, turn off your telephone, and try to strictly observe the time limits of the test sections, and even the time limits of the breaks in between sections. To mimic the experience of working with a scratch booklet, buy a spiral notebook filled with grid paper. If you know when you will be taking the real GMAT, try to schedule your practice tests around the same time of day.

If you are the sort of person who likes to have a mental picture of what a new experience will be like, you might even consider visiting the test center ahead of time. This serves two purposes: first, you'll know how to get there on the day of the test, and second, you'll be familiar with the ambiance in advance.

On the Days Before the Test

Try to keep to your regular routine. Staying up late to study the last few nights before the test is counterproductive. It's important to get regular amounts of exercise and sleep. Continue the study plan you've been on from the beginning, but taper off toward the end. You'll want to take your last practice exam no later than several days before the real test, so you'll have time to go over the results carefully. The last day or so should be devoted to any topics that still give you trouble.

On the Night Before the Test

Get together the things you will need to bring with you for the test: directions to the test center (if you haven't already been there); a mental list of the schools you wish to receive your test scores (if you can't identify these when you take the test, you will have to pay \$28 extra per school to get scores sent out later); a snack, and some water. Snacks and water are not allowed in the testing room, but they can be placed in your locker and consumed during a break. Don't bother to bring a calculator—no calculators are permitted for the adaptive sections (Quantitative and Verbal) of the GMAT. An onscreen calculator is provided for the Integrated Reasoning section.

Once you have gathered everything you need, take the night off. Go to a movie. Relax. There is no point in last-minute cramming. You are as ready as you are going to

be.

What to Bring to the Test Center

A government-issued ID

A snack

A bottle of water

On the Day of the Test

If you are taking the test in the morning, get up early enough that you have time to eat breakfast, if that is your usual routine, and do a couple of GMAT questions you've already seen in order to get your mind working. If you are taking the test in the afternoon, make sure you get some lunch, and, again, do a few GMAT problems. You don't want to have to warm up on the test itself.

Bring a snack to the test center. Use your breaks to eat the food you've brought, or to run to the bathroom.

At the Testing Center

Unlike testing sessions you may have attended in the past, where hundreds of people were lined up to take the same test, you may well be the only person at your testing center taking the GMAT. You'll be asked to present your government-issued ID, and an employee will take your photograph and scan your palm using a palm vein scanner. Finally, you'll be led to the computer station where you will take the test. The station consists of a desk with a computer monitor, a keyboard, a mouse, a scratch booklet, and a black, fine-tipped marker. The marker they will give you to write in your scratch booklet has tendency to dry up when left uncapped—so during breaks, remember to cap it. If you need another marker or another scratch booklet during the test, simply raise your hand, and a proctor will bring it. However, the timer won't stop while the proctor brings you another scratch booklet or marker. Use your practice tests to learn to fit your scratch work into one scratch booklet. Before the test starts, make sure you're comfortable. Is there enough light? Is your desk sturdy? Don't be afraid to speak up; you're going to be spending four hours at that desk.

There will almost certainly be other people in the same room at other computer stations taking other computer-adaptive tests. You might be seated next to someone taking the licensing exam for architects or a test for school nurses, or even a test for golf pros.

None of the people in the room will have necessarily started at the same time. The testing center employee will show you how to begin the test, but the computer itself will

be your proctor from then on. It will tell you how much time you have left in a section, when your time is up, and when to go on to the next section.

The test center employees will be available if you have a question. They will also monitor the room for security purposes. Just in case their eagle eyes aren't enough, video and audio systems will record everything that happens in the room.

The process sounds less human than it really is. Our students have generally found the test center employees to be quite nice.

What Your Screen Will Look Like

During most of the test, your screen will look a lot like this:

Admissions Insight No. 1: Timeline

January–May:

Research schools; study for the GMAT

June–July:

Take the GMAT; request official undergraduate transcripts; ask mentors for recommendations

July–August:

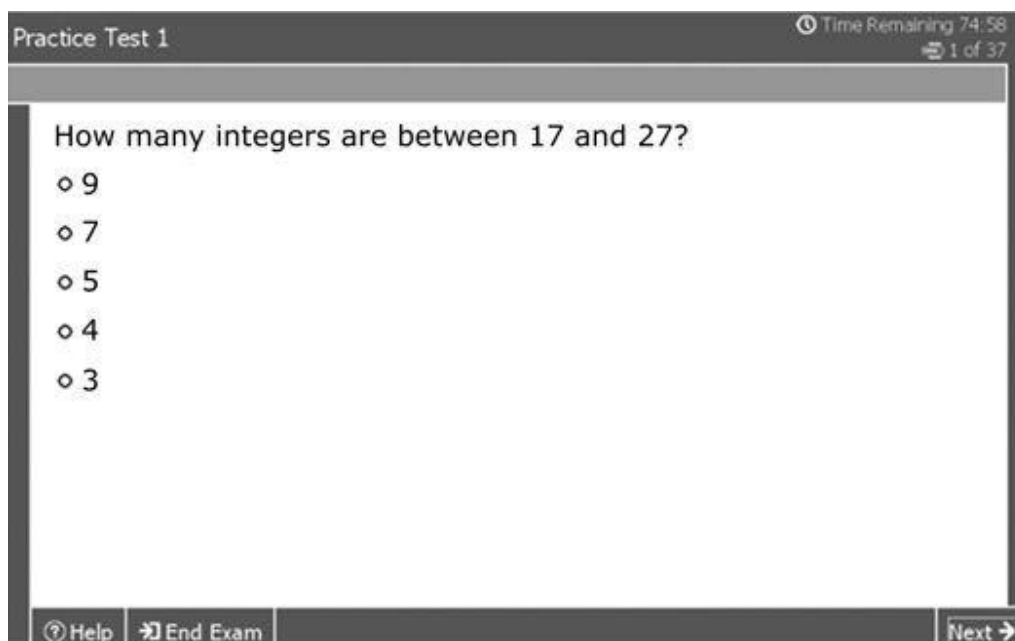
Start essays; follow up with recommenders; update resume

September:

Fine-tune essay; make sure recommenders meet deadlines

October:

Begin to submit applications; send thank-you notes to recommenders



The problem you're working on at any particular moment will be near the top of the screen (by the way, the answer to this one is the third choice—what we call choice C). At the top right will be a readout of the time remaining in the section, the number of the question you're working on, and how many total questions there are in the section. Here are the main interface items you will see on the screen:

End Exam—By clicking on this button, you can end the test at any moment. We don't recommend that you do this unless you actually become ill. Even if you decide not to have your test scored (an option they will give you at the end of the exam), you might as well finish—it's great practice, and besides, GMAC has no intention of giving you a refund.

Time—The time you have left to complete the section is displayed in the upper right of the screen. You can hide the time by clicking on it, and you can make it reappear by clicking on the icon in its place. During the last few minutes of the test, the time is automatically displayed and you cannot hide it.

Question Number—The question number that you are on is also displayed in the upper right, and it works just like the time display: You can hide it by clicking on it or make it reappear by clicking on the icon. During the last few minutes of the test, the question number is automatically displayed and cannot be hidden.

Help—During the test this button provides test and section directions and information about using the software.

Next—When you've answered a question by clicking on the small bubble in front of the answer you think is correct, you press this button.

Confirm—After you press “Next,” a pop-up window will open and ask you to confirm your answer. Select “yes” to continue to the next question.

What Happens If You Get Stuck on a Question?

Everyone knows that sinking feeling of not knowing how to do a test problem, but before you start panicking, there are a few things to bear in mind about the GMAT.

First of all, as any Princeton Review graduate will tell you, seeing hard questions on the adaptive (math and verbal) sections of the GMAT is a good sign. Because these sections are adaptive, you don’t get a hard question until you’ve answered a bunch of increasingly difficult medium questions correctly—which means you are probably already on track for a good score.

Second, if you have gone through this book and taken the practice tests, then chances are good that if you reread the question and think about it for a few seconds, you may get an idea of how to start it (and starting is half the battle).

Third, you should remember that approximately one-fourth of the questions on the adaptive sections of this test don’t even count. They are “experimental questions” being tried out for future versions of the GMAT, so there’s no point in getting too upset over a question that might not even get scored.

And fourth, if you are really stuck, then you can pull out The Princeton Review’s arsenal of POE (Process of Elimination) techniques to do some very shrewd guessing.

Admissions Insight No. 2: Research

All business schools are NOT alike. To begin your admissions research, go to **PrincetonReview.com**, and take advantage of our Advanced Business School Search tool. Our school profiles present detailed facts and figures on admissions, academics, student body, and career outlook.

What Happens If You Don’t Get to Every Question in a Section?

If you run out of time without having answered all the questions in one of the adaptive sections, the computer just moves you on to the next section. As we said earlier, for adaptive sections, the computer keeps an updated estimate of your score as you move through the section. If you don't get to answer some questions, the computer deducts points (based on an algorithm) and gives you a score based on the questions you *have* answered. So, you could get a score on the adaptive sections by answering only one math and one verbal question. Of course, that score would be pretty low!

For the Integrated Reasoning section, you also cannot skip a question and move onto the next question. For questions that have multiple parts, you also need to answer every part of the question before you move onto the next question. Like the adaptive sections, you can run out of time, however, and leave questions unanswered. Unfortunately, GMAC had not released the details of how the Integrated Reasoning section is scored when this book was written. For up to date information about how the Integrated Reasoning section is scored and your best strategy to maximize your score on this section, be sure to check out our advice on www.PrincetonReview.com.

It Is Actually in Your Interest to Answer *All* the Questions—Even If You Have to Guess

You might think it would be better to skip any questions you don't have time to answer at the end of an adaptive section—but in fact, the reverse is true: If time is running out, you will almost certainly get a higher score by clicking through and answering any remaining questions at random. This is because the penalty for getting a question wrong diminishes sharply toward the end of each adaptive section (when the computer has already largely decided your score). The penalty for each question skipped at the end of an adaptive section is actually greater than the penalty for getting one of those last questions wrong.

But You Can Do Much Better Than Guessing at Random

In the following chapters, we will give you all the specific mathematical and verbal skills you need to ace the Math, Verbal, and Integrated Reasoning sections. We will also raise the Process of Elimination to a fine art—in case you have to guess.

Zen and the Art of Test Taking

For each new question, put the previous question behind you. Don't get rattled if you think you got the previous question wrong. Even if your current question seems easier, it could be experimental. Just do your best to answer the current question

correctly.

At the End of the Test

When you finish, the computer will ask you if you want the test to count. If you say no, or you just walk away, the computer will not record your score, and no schools will ever see it. Of course, neither will you. GMAC will not let you look at your score and then decide whether you want to keep it. You should also know that if you do cancel your scores, your future score reports will show this.

If you tell the computer that you want the test to count, then it will give you your unofficial score right then and there on the screen. (Test center employees can print out the unofficial score report.) Within 20 days, you'll receive your official results online. If you choose to cancel at the test site, you will not be able to change your mind later. By the same token, once you've chosen to see your score, you can't cancel it.

If Something Weird Happens at the Test Center...

We have found that almost nothing ever goes wrong at the test centers. They are professionally run. But in the unlikely event that there is a technical glitch with your assigned computer, or if you want to complain about test center conditions or some other anomaly, it is best to start the process before you leave the test center by filing a complaint immediately after the test is over. If possible, get the test center staff to corroborate your complaint. Then, as soon as possible after the test is over, contact either Pearson VUE or GMAT Customer Service by one of the following methods:

E-mail: pvtestsecurity@pearson.com

Web: www.pearsonvue.com/contact/gmat/security

Phone: 800-717-GMAT or 952-681-3680

Fax: 952-681-3681

Mail:

Pearson VUE

5601 Green Valley Drive

Suite 220

Bloomington, MN 55437

**Admissions Insight
No. 3: When to Apply**

Although many schools have a filing range that stretches from six to eight months, early applications often have a better chance. This is because there are more spots available in the beginning of the process.

One Final Thought Before You Begin

No matter how high or low you score on the test and no matter how much you improve your performance with this book, you should *never* accept the score GMAC assigns you as an accurate assessment of your abilities. The temptation to see a high score as evidence that you're a genius, or a low score as evidence that you're an idiot, can be very powerful.

When you've read this book and practiced our techniques on real GMAT questions, you'll be able to judge for yourself whether the GMAT actually measures much besides how well you do on the GMAT.

Think of this as a kind of game—a game you can win.

Summary

Register for the GMAT either online or by telephone. Schedule the test for a time that is convenient for you, but that meets your schools' deadlines.

In the days leading up to the test, follow the study plan you set up in the beginning. Be sure to get plenty of rest, particularly the night before the test.

Get together all the things you'll need on the day of the test: directions to the test center, a list of schools to which you want to submit scores, a snack, water, and photo-ID.

At the testing center, make sure you are comfortable at the computer they assign to you. Tune out everyone else. Start working through the test. It should look exactly like the practice tests you have taken online. If you get stuck on a question, use POE and Joe Bloggs to make an educated guess and move on. Remember, some of the questions are experimental and may not even have an answer.

Because there is a penalty for unanswered questions at the end of the test, it makes sense to use POE to guess on any remaining questions rather than to leave them blank.

Part II

How to Crack the Math GMAT

7 GMAT Math: Basic Principles

8 POE and GMAT Math

9 Data Sufficiency: Basic Principles

10 Arithmetic

11 Algebra

12 Applied Arithmetic

13 Geometry

14 Advanced Data Sufficiency

Chapter 7

GMAT Math: Basic Principles

If *absolute value* sounds familiar, but you can't quite remember it, this chapter can help. It provides a comprehensive review of the math terms and rules you haven't had to think about since high school.

Math and the Integrated Reasoning Section

Before we get started talking about the Quantitative section of the GMAT, let's take a moment to talk about the Integrated Reasoning section. The Integrated Reasoning

section tests a blend of math and critical reasoning (verbal) skills. However, most questions test math skills. The good news is that those math skills are the same math skills that the GMAT has been testing for years. So, while we'll be mostly discussing the Quantitative section in this and the following chapters, you'll want to remember that you'll also use the math reviewed in these chapters to answer most of the Integrated Reasoning questions.

What's Covered in the Math Section

The 37 math questions on the GMAT come in two different formats. About half of the questions will be regular problem solving questions of the type you're familiar with from countless other standardized tests, such as the SAT. The other half of the questions, mixed in among the regular problem solving questions, will be of a type unique to the GMAT: They're called data sufficiency questions, and they will ask you to determine whether you can answer a math question based on two pieces of information. We've devoted two entire chapters to Data Sufficiency.

But whether the question falls into the category of problem solving or data sufficiency, the GMAT questions will test your general knowledge of three subjects:

Arithmetic

Basic algebra

Basic geometry

B-School Lingo

cold call: an unexpected, often dreaded request by the professor to open a case discussion

cycle time: how fast you can turn something around

Source: *Best 294 Business Schools*

What Isn't Covered in the Math Section

The good news is that you won't need to know calculus, trigonometry, or any complicated geometry. The bad news is that the specialized, business-type math you're probably good at isn't tested, either. There will be no questions on computing the profit on three ticks of a particular bond sale, no questions about amortizing a loan, no need to calculate the bottom line of a small business.

Ancient History

For the most part, what you'll find on the GMAT is a kind of math that you haven't had to think about in years: junior high school and high school math. Because most people who apply to business school have been out of college for several years, high school math may seem a bit like ancient history. In the next few chapters, we'll give you a fast review of the important concepts, and we'll show you some powerful techniques for cracking the system.

Order of Difficulty

The first problem on the computer-adaptive Math test will be of medium difficulty. Based on your response to that first question, you will next be presented with an easier or a more difficult problem.

The Princeton Review Approach

Because it's probably been a long time since you've needed to reduce fractions or figure out how many degrees there are in a quadrilateral, the first thing to do is review the information tested on the GMAT by going through our math review. Along the way, you'll learn some valuable test-taking skills that will allow you to take advantage of some of the inherent weaknesses of standardized testing.

When you've finished the math review, you should read our chapter on data sufficiency and then take our diagnostic math test. Based on your approximate score on our diagnostic, you can then practice working through the problems at, or just above, your scoring range. By becoming familiar with the general level of difficulty of these problems and the number of steps required to solve them, you can increase your score on the real GMAT.

Stay focused!

Always keep in mind that
if your purpose is to raise

your GMAT score, it's a waste of time to learn math that won't be tested. Don't get us wrong, we think the derivation of π is fascinating, but...

Extra Help

Although we can show you which mathematical principles are most important for the GMAT, this book cannot take the place of a basic foundation in math. We find that most people, even if they don't remember much of high school math, pick it up again quickly. Our drills and examples will refresh your memory if you've gotten rusty, but if you have serious difficulties with the following chapters, you should consider a more thorough review, like *Math Workout for the GMAT* or *Math Smart*, both from The Princeton Review. This book will enable you to see where you need the most work. Always keep in mind, though, that if your purpose is to raise your GMAT score, it's a waste of time to learn math that won't be tested.

No Calculators on Quant!

One form of extra help you won't be allowed during the Quantitative section of the GMAT is a calculator. (For the Integrated Reasoning section, there's an onscreen calculator.) All calculations for the Quant section must be done the old fashioned way—by hand. To get used to this, you should retire your calculator (especially during practice tests) until after you have finished with your real GMAT.

BASIC INFORMATION

Try the following problem:

How many even integers are between 17 and 27?

9 7 5 4 3

This is an easy GMAT question.

Even so, if you don't know what an integer is, the question will be impossible to answer. Before moving on to arithmetic, you should make sure you're familiar with some basic terms and concepts. This material isn't difficult, but you must know it cold. (The answer, by the way, is C.)

Integers

Integers are the numbers we think of when we think of numbers. Integers are sometimes called whole or natural numbers. They can be negative or positive. They do not include fractions. The positive integers are:

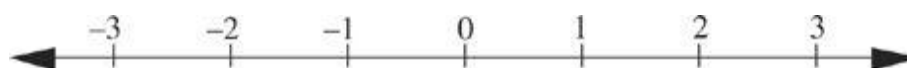
1, 2, 3, 4, 5, etc.

The negative integers are:

-1, -2, -3, -4, -5, etc.

Zero (0) is also an integer. It is neither positive nor negative.

Positive integers get bigger as they move away from 0; negative integers get smaller. Look at this number line:



2 is greater than 1, but -2 is less than -1.

Ancient History 101

The GMAT will test your (probably rusty) knowledge of high school math.

Positive and Negative

Positive numbers lie to the right of zero on the number line. Negative numbers lie to the left of zero on the number line.

There are three rules regarding the multiplication of positive and negative numbers:

positive \times positive = positive

positive \times negative = negative

negative \times negative = positive

If you add a positive number and a negative number, subtract the number with the negative sign in front of it from the positive number.

$$4 + (-3) = 1$$

If you add two negative numbers, you add them as if they were positive, then put a negative sign in front of the sum.

$$-3 + -5 = -8$$

Having Trouble Memorizing?

If you're having trouble memorizing GMAT math terminology, consider making flashcards to help you review.

Digits

There are ten digits:

$$0, 1, 2, 3, 4, 5, 6, 7, 8, 9$$

All integers are made up of digits. In the integer 246, there are three digits: 2, 4, and 6. Each of the digits has a different name:

6 is called the units (or ones) digit.

4 is called the tens digit.

2 is called the hundreds digit.

A number with decimal places is also composed of digits, although it is not an integer. In the decimal 27.63 there are four digits:

2 is the tens digit.

7 is the units digit.

6 is the tenths digit.

3 is the hundredths digit.

Remainders

If an integer cannot be divided evenly by another integer, the integer that is left over at the end of division is called the **remainder**. Thus, remainders *must* be integers.

$$\begin{array}{r} 3 \\ 2 \overline{) 7} \\ \underline{-6} \\ 1 \leftarrow \text{remainder} \end{array}$$

Odd or Even

Even numbers are integers that can be divided evenly by 2, leaving no remainder. Here are some examples:

$$-6, -4, -2, 0, 2, 4, 6, \text{ etc.}$$

Any integer, no matter how large, is even if its last digit is divisible by 2. Thus 777,772 is even.

Odd numbers are integers that cannot be divided evenly by 2. Here are some examples:

$$-5, -3, -1, 1, 3, 5, \text{ etc.}$$

Any integer, no matter how large, is odd if its last digit is not divisible by 2. Thus 222,227 is odd.

There are several rules that always hold true with even and odd numbers:

$$\text{even} \times \text{even} = \text{even}$$

$$\text{odd} \times \text{odd} = \text{odd}$$

$$\text{even} \times \text{odd} = \text{even}$$

$$\text{even} + \text{even} = \text{even}$$

$$\text{odd} + \text{odd} = \text{even}$$

$$\text{even} + \text{odd} = \text{odd}$$

It isn't necessary to memorize these, but you must know that the relationships always hold true. The individual rules can be derived in a second. If you need to know $\text{even} \times \text{even}$, just try 2×2 . The answer in this case is even, as $\text{even} \times \text{even}$ always will be.

Consecutive Integers

Consecutive integers are integers listed in order of increasing value without any integers missing in between. For example, $-3, -2, -1, 0, 1, 2, 3$ are consecutive integers. Only integers can be consecutive.

Some consecutive even integers: $-2, 0, 2, 4, 6, 8$, etc.

Some consecutive odd integers: $-3, -1, 1, 3, 5$, etc.

Distinct Numbers

If two numbers are **distinct**, they cannot be equal. For example, if x and y are distinct, then they must have different values.

Prime Numbers

A **prime number** is a positive integer that is divisible only by two numbers: itself and 1. Thus 2, 3, 5, 7, 11, 13 are all prime numbers. The number 2 is both the smallest and the only even prime number. Neither 0 nor 1 is a prime number. All prime numbers are positive.

Divisibility Rules

If there is no remainder when integer x is divided by integer y , then x is said to be

divisible by y . Put another way, divisible means you can evenly divide the bigger number by the smaller number. For example, 10 is divisible by 5.

Some Useful Divisibility Shortcuts:

An integer is divisible by 2 if its units digit is divisible by 2. Thus 772 is divisible by 2.

An integer is divisible by 3 if the sum of its digits is divisible by 3. We can instantly tell that 216 is divisible by 3, because the sum of the digits ($2 + 1 + 6$) is divisible by 3.

An integer is divisible by 4 if the number formed by its last two digits is divisible by 4. 3,028 is divisible by 4, because 28 is divisible by 4.

An integer is divisible by 5 if its final digit is either 0 or 5. Thus, 60, 85, and 15 are all divisible by 5.

An integer is divisible by 6 if it is divisible by both 2 and 3, the factors of 6. Thus 318 is divisible by 6 because it is even, and the sum of $3 + 1 + 8$ is divisible by 3.

Division by zero is undefined. The test writers won't ever put a zero in the denominator. If you're working out a problem and you find yourself with a zero in the denominator of a fraction, you've done something wrong. By the way, a 0 in the numerator is fine. Any fraction with a 0 on the top is 0.

$$\frac{0}{1} = 0$$

$$\frac{0}{4} = 0$$

$$\frac{4}{0} = \text{undefined}$$

Factors and Multiples

An integer, x , is a factor of another integer, y , if y is divisible by x . So, in other words, $y = nx$, where y , n and x are all integers. For example, 3 is a factor of 15 because $15 = (3)(5)$. All the factors of 15 are 1, 3, 5, and 15.

The **multiples** of an integer, y , are all numbers $0, \pm 1y, \pm 2y, \pm 3y, \dots$, etc. For example, 15 is a multiple of 3 (3×5); 12 is also a multiple of 3 (3×4). When you think about it, most numbers have only a few factors, but an infinite number of multiples. The memory device you may have learned in school is “factors are few; multiples are many.”

Every integer greater than 1 is both its own greatest factor and least positive multiple.

Least Common Multiples

If an integer, x , is divisible by two integers n and m , then x is a common multiple of n and m . For example, 30 is a common multiple of 5 and 6. The smallest common multiple of two integers is called the **least common multiple**. For our example, 30 is also the least common multiple of 5 and 6.

The most straightforward way to find a least common multiple is to simply start listing the positive multiples of both integers. When you find a number that is on both lists, that number is the least common multiple.

For example, here's how you find the least common multiple of 4 and 6.

Multiples of 4: 4, 8, 12, 16, 20,...

Multiples of 6: 6, 12,...

Since 12 is on both lists, 12 is the least common multiple of 4 and 6.

Greatest Common Factor

If two integers, n and m , are both divisible by an integer, x , then x is a common factor of n and m . For example, 6 is a common factor of both 12 and 18. The largest factor that two numbers have in common is referred to as the **greatest common factor**. For our example, 6 is also the greatest common factor of 12 and 18.

The most straightforward way to find a greatest common factor is to simply list the factors of both numbers. Then you just need to find the greatest number that is on both lists.

For example, here's how you find the greatest common factor of 12 and 18.

Factors of 12: 1, 2, 3, 4, 6, 12

Factors of 18: 1, 2, 3, 6, 9, 18

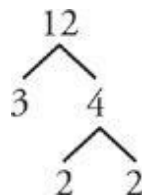
Since 6 is the greatest number on both lists, 6 is the greatest common factor of 12 and 18.

Prime Factors

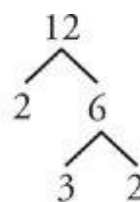
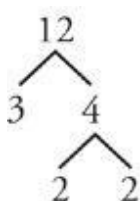
If an integer, x , that is a factor of an integer, y , is also prime, then x is called a

prime factor of y . For example, 3 and 5 are prime factors of 15.

To find the prime factors of an integer, use a factor tree:



All positive integers greater than 1 have unique prime factorizations, a fact that the GMAT frequently tests. So, it doesn't matter which pair of factors you start with when you use the factor tree.



The prime factorization of 12 is $2 \times 2 \times 3$.

Here are some symbols you should know for the GMAT:

Symbol Meaning

$=$ is equal to

\neq is not equal to

$<$ is less than

$>$ is greater than

\leq is less than or equal to

\geq is greater than

or equal to

Absolute Value

The **absolute value** of a number is the distance between that number and 0 on the number line. The absolute value of 6 is expressed as $|6|$.

$$|6| = 6$$

$$|-5| = 5$$

NOW LET'S LOOK AT THE INSTRUCTIONS

During the test, you'll be able to see test instructions by clicking on the "Help" button at the bottom of the screen. However, to avoid wasting time reading these during the test, read our version of the instructions for problem solving questions now:

Directions: For each problem solving question, solve the problem and choose the best of the answer choices provided.

Numbers: This test uses only real numbers; no imaginary numbers are used or implied.

Diagrams: All problem solving diagrams are drawn as accurately as possible UNLESS it is specifically noted that a diagram is "not drawn to scale." All diagrams are in a plane unless stated otherwise.

Summary

Without a review of the basic terms and rules of math tested on the GMAT, you won't be able to begin to do the problems.

Study the vocabulary and rules in the preceding chapter to get this stuff back into your head. If you find that you need an even more comprehensive review, consider getting *Math Workout for the New GMAT* or *Math Smart*, both published by The Princeton Review.

Chapter 8 POE and GMAT Math

This chapter shows you how to use one of the most powerful Princeton Review techniques—Process of Elimination—and apply it to GMAT math, with startling results!

In Chapter 4, we introduced you to the Process of Elimination—a way to find correct answers by eliminating wrong answers. Now, we’re going to show you how to turn POE into a science.

Here’s an example of a typical medium-level problem—the sort of problem that the computer might give you for your very first math question:

Twenty-two percent of the cars produced in America are manufactured in Michigan. If the total number of cars produced in America is 40 million, how many cars are produced outside of Michigan?

31.2 million **Zen and the Art of Test Writing**

Let’s put ourselves in the place of the GMAC test writer who has just written this medium-level math problem. He’s finished with his question, and he has his correct answer (31.2 million), but he isn’t done yet. He still has four empty slots to fill in. He needs to come up with incorrect numbers for answer choices A, B, C, and D.

He *could* simply choose numbers at random, or numbers that are closely clustered around the correct answer. However, if he did that, test takers who didn’t know how to do the problem wouldn’t see an obvious answer and might therefore guess at random. The test writer does *not* want test takers to guess at random. If they did, they might actually pick the right answer.

By the same token, if the test writer chooses numbers at random for his empty slots, test takers who actually understood the problem but made a careless error, wouldn’t see their result among the answer choices—and would know to go back and fix their mistake. The test writer doesn’t want that either.

So our test writer comes up with incorrect answer choices that whisper seductively, “Pick *me*.” He tries to figure out all the mistakes a careless test taker might make; then he includes those answers among the choices. Here’s that same question, now that the test writer has finished it:

Twenty-two percent of the cars produced in America are manufactured in Michigan. If the total number of cars produced in America is 40 million, how many cars

are produced outside of Michigan?

- 8.8 million
 18 million
 31.2 million
 48.8 million
 62 million
 Partial Answers

People often go wrong on GMAT math problems by thinking that they are finished before they really are. The first step in this problem is to find out how many actual cars are produced in Michigan; in other words, we need to know what 22 percent of 40 million equals. If you aren't sure how to do this, don't worry; we'll show you how to do percent problems in the arithmetic chapter. For the moment, take our word for it that 22 percent of 40 million equals 8.8 million.

If you were feeling smug about having figured this out, you might just look at the answer choices, notice that the first answer choice (what we call choice A) says 8.8 million and figure that you're done. Unfortunately, the problem didn't ask how many cars were produced in Michigan; it asked how many cars were *not* produced in Michigan.

GMAC provided answer choice A just in case you got halfway through the problem and decided you'd done enough work. It was a *partial* answer. To find the correct answer, you have to subtract 8.8 from 40 million. The correct answer is choice C, 31.2 million.

How Do You Avoid Picking Partial Answers?

You can avoid this mistake by doing three things:

When you finish a problem, always take two seconds to reread the problem to make sure you've actually answered the question.

Remember the practice problems that you have done and the practice tests that you have taken. For the most part, only fairly easy questions can be solved after only one or two steps. You no doubt remember some practice questions that you got wrong by essentially doing too little work. So, when you get an answer after doing very little work, stop and ask yourself "Is that really all they expected me to do?" You don't want to psyche yourself out but you do want to be careful.

Train yourself to look for complementary answers while you practice. A great number of questions that have partial answers are questions like the one we've been looking at. If the test writers are asking about the cars produced *outside* of Michigan, you just know they are going to include the number of cars produced *inside* Michigan as a partial answer. When you work practice questions, see if you can find complementary answers. As you do, you'll be training yourself to avoid a potential trap.

Crazy Answers

The GMAT test writers also know that people taking tests do crazy things under pressure. Thus, even though there is no good reason why a person would want to do this, some percentage of the test takers who see this question are going to correctly find 22 percent of 40, or 8.8, but then *add* it to the original 40. Thus, the test writer will want to include 48.8 among the answer choices. If it weren't there, test takers who'd gotten this answer might realize they had made a mistake and figure out the correct answer, but the test writer would prefer that they just get it wrong.

How else could a test taker go wrong on this problem?

Joe Bloggs and GMAT Math

In Chapter 5 we introduced you to Joe Bloggs—the average test taker. Joe just does the first thing that comes into his head. On easy problems, this often gets him the right answer. On difficult questions, his first response is *always* wrong. On medium problems Joe Bloggs's first response is wrong about half the time. On this particular medium problem, what might Joe want to do?

What about just adding the two numbers in the problem together? $22 + 40$ equals 62. Or subtracting 22 from 40, which gives you 18. If there's a chance that Joe might pick it, GMAC wants it to be there. So the test writers will probably include 62 and 40 among the answer choices. Again, there's no good mathematical reason why a test taker would want to do these things, but GMAC knows that you don't always need a good reason to go wrong.

It might strike you that this is pretty unfair. If GMAC just picked answers at random, Joe would be much less likely to fall into their traps. However, there is one positive side to GMAC's obsession with trap answers...

Common Sense: The Antidote to Trap Answers

GMAC is so caught up in trying to provide answer choices that anticipate all the mistakes a test taker might make on a problem that it often forgets to make certain that all of these answer choices make sense. Let's just think about that problem again.

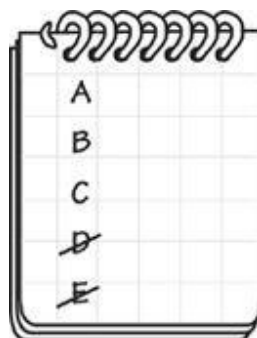
Twenty-two percent of the cars produced in America are manufactured in Michigan. If the total number of cars produced in America is 40 million, how many cars are produced outside of Michigan?

- 8.8 million 18 million 31.2 million 48.8 million 62

million We want the number of cars produced in places other than Michigan. Forget about math for a moment. Let's just look at the answer choices in the cold light of day. Even if you're rusty on percentages, is there any way that the number of cars produced in the other states could be greater than the total number of cars produced altogether? No way. The answer has to be less than 40 million. Thus, in their zeal to anticipate your potential wrong answers, the test writers have given you two answer choices (48.8 and 62) that are just plain crazy.

Scratch Work

If these two answers are crazy, then cross them off in your scratch booklet. It's psychologically very uplifting to see your possible answers narrowed down to only three. Here's what your scratch work should look like for this question:



Admissions Insight No. 4: How Criteria Are Weighted

Although requirements vary from school to school, most rely on some combination of the following criteria (although not necessarily in this order):

- 1) GMAT score
- 2) Undergraduate GPA
- 3) Work experience

4) Essays

5) Letters of recommendation

6) Interviews

7) Extracurricular activities

The advantage of this system is that it allows applicants to compensate for weaknesses in some areas with strengths in other areas. And the single easiest thing to change in your admissions “package” is your GMAT score.

How Do You Prevent Yourself from Picking Crazy Answers?

You can prevent yourself from selecting crazy answers by doing these simple things:

Before you even start doing any serious math, take a second to use common sense on the problem: Are there any answers that simply don’t make sense? If so, cross them off in your scratch work. This will prevent you from picking them later through carelessness or desperation.

If, based on your scores on practice tests, you expect to be seeing mainly medium and difficult problems on the Math section, take a second to see if there are any Joe Bloggs answers to cross off.

Always be suspicious of answers that you get too easily. Five second answers or answers that can be found by doing things like simply adding the numbers in the problem are not usually correct on the GMAT.

Psst! Hey, Joe...

To come up with answers that will appeal to Joe Bloggs, the GMAT test writer has to know how Joe thinks. Fortunately for the test writer, she can draw on more than 30 years of statistical information GMAC has compiled. From this, she knows that:

1. On difficult math problems, Joe Bloggs is always attracted to easy solutions that he can find in one step.

For example, Joe might just add together the numbers mentioned in the problem.

2. On difficult math problems, Joe Bloggs is attracted to numbers that he has already seen in the problem.

It's pretty silly, but frequently Joe picks a number simply because he remembers it from the problem itself.

Now, let's look at the upper-medium problem we showed you in Chapter 5, complete with answer choices:

The output of a factory was increased by 10% to keep up with rising demand. To handle the holiday rush, this new output was increased by 20%. By approximately what percent would the output now have to be decreased in order to restore the original output?

20% 24% 30% 32% 70% **Here's How to Crack It**

If the test writer has done her job properly, Joe Bloggs will never even consider the correct answer (24%). He's too smitten by the other answer choices. As we said in Chapter 5, Joe's favorite answer to this question is undoubtedly 30 percent (what we call choice C). Joe notices that the output seems to have increased by 30 percent and figures that to get rid of that increase, you would have to decrease it by 30 percent. Joe just added together the two numbers he saw in the problem.

On medium and difficult math problems, Joe Bloggs is attracted to easy solutions that he can find in one step.

Another answer Joe might be attracted to is choice A. Twenty (20%) is simply one of the numbers from the problem. There is no logical reason to think this is the correct answer, but Joe isn't always logical.

On medium and difficult math problems, Joe Bloggs is attracted to answer choices that simply repeat numbers from the problem.

Putting Everything Together

Here's one last example of an upper-medium problem to show how you can use both common sense and the Joe Bloggs principle to help eliminate answers:

A student took 6 courses last year and received an average grade of 100. The year before, the student took 5 courses and received an average grade of 90. To the nearest tenth of a point, what was the student's average grade for the entire two-year period?

- 79 89 95 95.5 97.2 **Here's How to Crack It**

Don't worry if you aren't sure how to solve this problem right now; we'll cover average problems in the next chapter. Let's assume for a moment that you've done our math review and will be facing mostly medium questions on the Math portion of the GMAT.

Always be suspicious of answers that you get too easily. Five second answers or answers that can be found by doing things like simply adding the numbers in the problem are not usually correct on the GMAT. Let's begin by thinking about what Joe Bloggs would like to pick on this question. Joe likes answer choice C a lot. He figures that to find the average of the entire two-year period, all he has to do is find that the average of 90 and 100 is 95. If this were an easy problem, he might be right, but we're assuming for the moment that you will be seeing mainly medium problems—so cross off choice C in your scratch booklet.

There are no other obvious Joe Bloggs answers, but it *is* possible to eliminate a couple of other choices by using common sense. The student's average for the first year was 90. The student's average for the second year was 100. Obviously the student's second-year grades are going to bring his average *up*. We may not be sure by exactly how much, but the average for the entire two-year period has to be higher than it was for the first year. Both choices A and B are less than the first year's average. We can therefore eliminate both of them.

We've eliminated three answer choices. If you know how to solve the problem, go to it. If not, you have a fifty-fifty shot at getting it right anyway. The correct answer is choice D, 95.5.

Summary

The Process of Elimination allows you to eliminate answer choices even when you don't know how to do a problem. There are three types of answers to look for: partial answers, crazy answers, and Joe Bloggs answers.

Partial answers: GMAC likes to include, among the answer choices, answers that are partial completions of the problem. If you get halfway through a problem and decide that you're done, the number you have arrived at will likely be there, waiting to trip you up. The way to avoid partial answers is to reread the problem before you pick an answer to make sure you're answering the question it has asked.

Crazy answers: The test writers also like to include, among the answer choices, numbers that a test taker may arrive at—even though they don't make much sense. Crazy answer choices can be spotted by taking a step back and looking at the problem and its answers in the cold light of day.

Joe Bloggs answers: GMAC also likes to plant, among the answer choices, numbers that would appeal to Joe Bloggs, the average test taker. Joe is attracted to easy solutions that he can arrive at in one step and answers that repeat numbers from the problem.

Chapter 9

Data Sufficiency: Basic Principles

Data sufficiency is a question type you've never seen before. This chapter will show you how to use basic POE techniques to make this format your new favorite kind of math.

Almost half of the thirty-seven math questions on the GMAT will be data-sufficiency questions. We're about to show you how to use POE to make this strange question type easy.

WHAT IS DATA SUFFICIENCY?

If you've never heard of data sufficiency, that's because these questions exist on no other test in the world and they definitely require some getting used to. If you have already taken a GMAT practice exam, or the actual GMAT, you may have spent several minutes just trying to understand the directions for data-sufficiency questions.

However, data-sufficiency questions really just test the same math concepts as problem-solving questions, but with a twist—a strange question format.

Here's what a data-sufficiency question will look like on the GMAT:

What is the value of y ?

(1) y is an even integer such that $-1.5 < y < 1.5$

(2) Integer y is not prime.

- Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.
 Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.
 BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient. EACH statement ALONE is sufficient. Statements (1) and (2) TOGETHER are NOT sufficient.
- Every data-sufficiency question consists of a question followed by two statements. There are also five possible answer choices, as shown. The answers are the same for every data-sufficiency question, so once you learn what each means, you won't need to spend time rereading the answers. You'll just be able to think about them as answers A, B, C, D, and E, which is how we'll refer to them.

Notice that there are two words that the answer choices keep repeating—alone and sufficient. So, it looks like we're supposed to evaluate the statements on their own—at least at first. Moreover, our task is evidently to determine whether we have sufficient information to answer the question.

That's how data sufficiency differs from problem solving. In problem-solving questions you are asked to give a numerical answer to the question. In fact, the inclusion of five numerical answer choices tells you that you can assume that the question can be solved. For data-sufficiency questions, however, you're not being asked to solve the question but to decide WHETHER the question can be solved. It may, in fact, turn out that the statements do not provide sufficient information to answer the question.

Here's How to Crack It

The first answer choice—which we'll call answer A—indicates that we should first look at Statement (1) by itself to see if it is sufficient to answer the question.

In fact, the best way to work data-sufficiency problems is to look at *one statement at a time*. So, ignore Statement (2). Here, we've replaced Statement (2) with question marks to indicate that we are looking only at the first statement—almost as though we had covered up the second statement.

What is the value of y ?

(1) y is an even integer such that $-1.5 < y < 1.5$

(2) ????

Now, we're ready to evaluate Statement (1) alone. There are three integers between -1.5 and 1.5 : -1 , 0 , and 1 . Of those, as you may recall from Chapter 7, only 0 is even. So, Statement (1) does provide sufficient information to answer the question.

We're not ready to choose the first answer—answer A—yet, however, because the second part of the answer choice states that Statement (2) alone is not sufficient. Now, forget that you have ever seen Statement (1).

What is the value of y ?

(1) ????

(2) Integer y is not prime.

The second statement only tells us that y is not prime. So, possible values for y include 1 , 4 , 6 , 8 , etc. Do we know the value of y ? No way. So, Statement (2) is not sufficient. Because (1) is sufficient and (2) is not, the answer to this question is

- Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.
Or, in other words, the correct answer is A.

DATA SUFFICIENCY: GETTING STARTED

Now that you've seen and worked a data-sufficiency question, it's time learn how to make this weird question type your own. The first step is to understand what each of the answer choices means.

By making small changes to the example you've just seen, we can provide examples of each of the answer choices. Next to each example, you'll find a graphic that provides a quick, down and dirty way to understand and remember each answer choice. Here's the example for choice A again:

- Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.

What is the value of y ?

(1) y is an even integer such that
 $-1.5 < y < 1.5$

(2) Integer y is not prime.

(A) ① ✗

Now, let's make some changes to the statements, to get an example of answer B.

Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.
 What is the value of y ?

(1) Integer y is not prime.

(2) y is an even integer such that
 $-1.5 < y < 1.5$

(B) ✗ ②

As you can see from this example, choice B is pretty much the flip side of choice A. In this case, the first statement provides no help in determining the value of y , but the second statement tells us that $y = 0$.

A few more changes produce an example of answer C.

BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient. What is the value of y ?

(1) y is an even integer.

(2) $-1.5 < y < 1.5$

(C) ✗ ✗

The first statement tells us that y is even, but there are a lot of even integers. The second statement gives us a range of values for y , but, by itself, we don't even know that y is an integer from the second statement. So, neither statement is sufficient on its own. But, when we put them together, we know that $y = 0$.

Now, let's get an example of answer D.

- EACH statement ALONE is sufficient. What is the value of y ?

(1) y is an even integer such that $-1.5 < y < 1.5$

(2) For any integer $a \neq 0$, $ay = 0$

(D) ①②

As pointed out in previous examples, the information in Statement (1) allows us to conclude that $y = 0$. The information in the second statement also tells us that y is 0 because the only way for the product of ay to equal 0 is if either a or y is 0. Since a can't be 0, y must be 0. Note how the statements independently allow us to arrive at the conclusion that $y = 0$ for answer choice D.

Finally, let's look at an example of choice E.

- Statements (1) and (2) TOGETHER are NOT sufficient. What is the value of y ?

(1) y is an even integer.

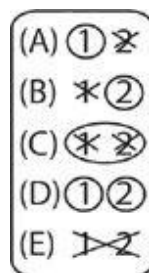
(2) Integer y is not prime.

(E) ✗

For this example, there's no way to determine the value of y . The first statement doesn't work because y could be any even integer. The second statement also doesn't help because y can be any integer that isn't prime. Even when we combine the statements, we don't know the value of y because any even integer except 2 fits the conditions. So, E is the no way, no how answer.

Below, you'll find the full graphic for all of the answers. You may find it helpful to keep the graphic handy until you are completely comfortable with what each answer

choice means.



DATA SUFFICIENCY: BASIC POE STRATEGY

One of the reasons the test writers decided to include data-sufficiency questions on the GMAT is that when this format was first dreamed up they thought these questions would be immune to Process of Elimination (POE). Were they ever wrong! If anything, it's even easier to apply POE to data-sufficiency questions. Let's see why.

First, however, let's restate one of the most important strategies for working any data-sufficiency question: *Evaluate the statements one at a time before you think about combining them.* Many people mistakenly pick C—you need both statements together—when it would have been possible to answer the question with only the information in the first statement or the second statement. Generally, people make this mistake when they read both statements right after reading the question stem. In fact, this mistake is the most common mistake that test takers make when working data-sufficiency questions.

To avoid this common mistake, *read the question stem and only the first statement.* Ignore the second statement. Pretend it isn't there. You may even go as far as covering Statement (2) with your finger if you find the temptation to read both statements too overpowering. Once you have evaluated Statement (1), forget it. Ignore it. It doesn't exist anymore. Cover it up if you need to and read and evaluate Statement (2).

What happens when you evaluate the statements one at a time? Something magical, that's what! POE comes roaring back. Consider the following partial example:

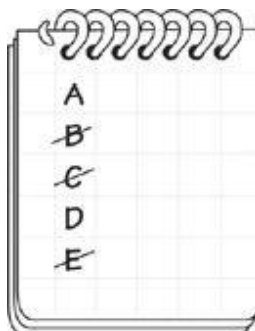
What is the value of x ?

(1) $x + 7 = 12$

We don't even have Statement (2), but we can still do a lot with this partial question. (Don't worry. There won't be any partial questions on the real test!) First, you want to see if the statement is sufficient to answer the question. In this case, you could subtract 7 from both sides of the equation to discover that $x = 5$. We'll take this as an

opportunity to remind you, however, that you don't really need to solve the equation—you just need to know that you *can* solve the equation. After all, to pick an answer to the problem, you just need to know if you have sufficient information.

Since Statement (1) is sufficient in this case, which answer choices can be eliminated? From the chart, you can see that there are only two answer choices—A and D—that have Statement (1) circled to indicate that, for that answer choice, Statement (1) is sufficient. So, if the first statement is sufficient, the answer to the problem must be A or D!

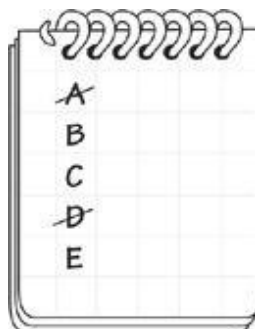


Now, check out this example:

What is the value of x ?

(1) x is an integer.

Now, what are the possible answers? If you said B, C, or E, you are well on your way to getting this data-sufficiency stuff under control. If you said something else, take a look at the steps back on [this page](#). In this case, the first statement is insufficient to determine the value of x . So, you want the answer choices that have 1 crossed off, and that is B, C, or E.



DRILL 1: (AD/BCE)

In the following drill, each question is followed by only one statement. Based on the first statement, decide if you are down to AD or BCE. The answers can be found in Part VI.

1. What is the value of x ? (1) $y = 4$

(2) ????

2. Is y an integer? (1) $2y$ is an integer.

(2) ????

3. A certain room contains 12 children. How many more boys than girls are there?
(1) There are three girls in the room.

(2) ????

4. What number is x percent of 20? (1) 10 percent of x is 5.

(2) ????

From AD or BCE to the Answer

Every time you start a data-sufficiency question, you should read the question and only the first statement. If the first statement is sufficient, your possible answers are A or D. If the first statement is insufficient, your possible answers are B, C, or E. So, you can always get rid of either two or three answer choices just by evaluating the first statement. The AD/BCE split is so important that you'll want to write down AD or BCE on your notebook.

But what happens next? How do you get to the answer? Let's take a look.



If $x + y = 3$, what is the value of xy ?

(1) x and y are integers

(2) x and y are positive

- Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.
 Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.
 BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient. EACH statement ALONE is sufficient. Statements (1) and (2) TOGETHER are NOT sufficient. **Here's How to Crack It**

As always, ignore Statement (2) and look only at Statement (1). If x and y are integers and $x + y = 3$, do we know what they are? Not really— x could be 1 and y could be 2 (in which case, xy would be 2). But x could also be 0 (yes, 0 is an integer) and y could be 3 (in which case, xy would be 0). Because Statement (1) alone does not answer the question definitively, we are down to BCE, a one in three shot. Write it down in your scratch booklet.

Now, ignore Statement (1) and look at Statement (2). By itself, this statement doesn't begin to give us values for x and y — x could be 1 and y could be 2, but x could just as easily be 1.4 and y could be 1.6. Because there is still more than one possible value for xy , cross off answer choice B.

We're down to C or E. Now it's finally time to look at both statements at the same time. See how late in the process we combine the statements? Get into the habit of physically crossing off B before you think about combining the statements. That's how you can avoid making the most common GMAT data-sufficiency mistake of putting the statements together too early.

Because we know from the first statement that x and y are integers, and from the second statement that they must be positive, do we now know specific values for x and y ?

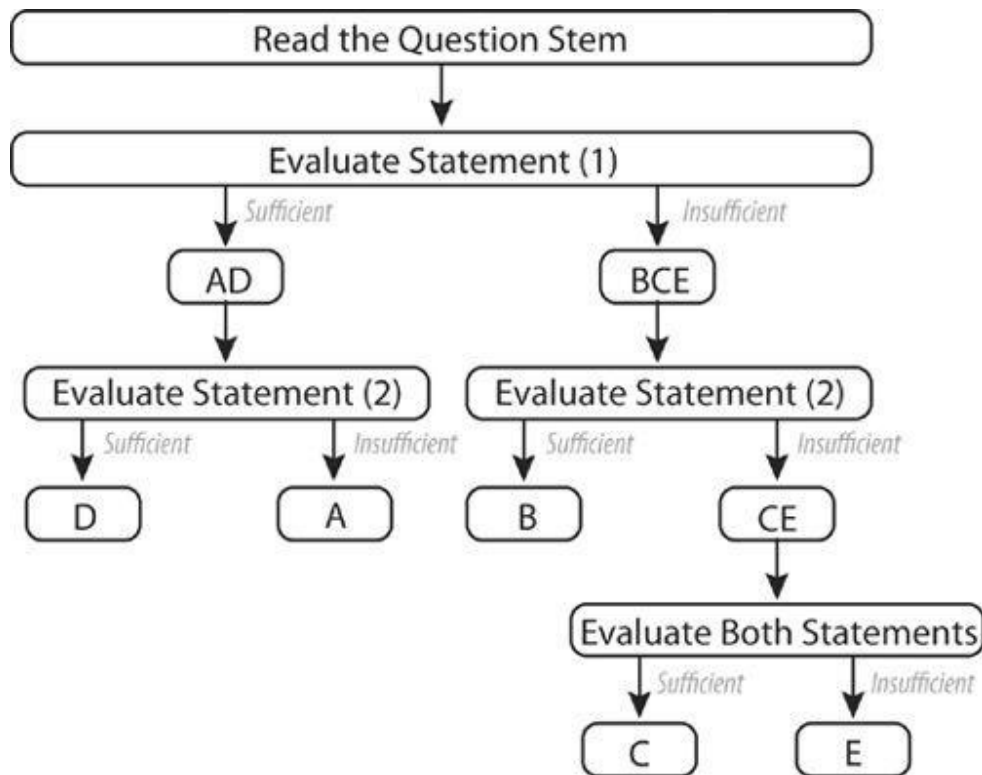
Well, we do know that there are only two positive integers in the world that add up to 3: 2 and 1. (Remember, zero is an integer but it is neither positive nor negative.)

Do we know if $x = 1$ and $y = 2$, or vice versa? Not really, but frankly, it doesn't matter in this case. The question is asking us the value of xy .

Because neither statement by itself is sufficient, but both statements together are sufficient, the answer is choice C.

Here's a handy flowchart that shows you what to do for any data-sufficiency problem. You should keep the flowchart next to you and consult it as you first start

practicing data-sufficiency questions. After you have done ten or twenty questions, you'll probably find that you have learned the basic POE process well enough that you don't need the chart anymore. However, if you ever find yourself having trouble with data sufficiency, pull out the chart again and do some more problems using it as a guide.



Combining the Statements

Notice how late in the process you combine the statements. Remember that one of the most common mistakes on data sufficiency is combining the statements before you have properly evaluated each statement on its own.

YES/NO DATA SUFFICIENCY: THE BASICS

If you were going to provide the answer to most data-sufficiency questions, your response would be a number. However, as many as half of all the data-sufficiency questions that you will see on your test will ask a yes-or-no question instead.

Leave it to GMAC to come up with a way to give you five different answer choices on a yes-or-no question. Let's look at an example.



Did candidate x receive more than half of the 30,000 votes cast in the general election?

- (1) Candidate y received 12,000 of the votes cast.
- (2) Candidate x received 18,000 of the votes cast.

Here's How to Crack It

When all is said and done, the answer to this question is either yes or no. Start by ignoring Statement (2) and evaluating Statement (1). Does Statement (1) alone answer the question? If you were in a hurry, you might think so. Many people assume that there are only two candidates in the election. They reason that if candidate y got 12,000 votes, then candidate x must have received 18,000 votes. However, there's no reason to assume that there are only two candidates. So, Statement (1) is insufficient. Write down BCE. Does Statement (2) alone answer the question? Yes, it's pretty clear that candidate x received more than half of the votes. So, the correct answer is B.



That didn't seem so bad, did it? Yet, you may have heard that yes/no data-sufficiency questions have a reputation for being hard. Let's change our example to see why.



Did candidate x receive more than half of the 30,000 votes cast in the general election?

- (1) Candidate y received 12,000 of the votes cast.

(2) Candidate x received 13,000 of the votes cast.

Here's How to Crack It

As always, start by ignoring Statement (2) so that you can properly evaluate Statement (1) alone. As in our previous example, Statement (1) is insufficient, so be sure to write down BCE. Statement (2) seems pretty straightforward. Candidate x received fewer than half of the votes cast. At this point many people say, “Since the guy clearly got fewer than half the votes, this statement doesn’t answer the question, either.” But those people are wrong!

Just Say No

Broken down to its basics, the question we were asked was, “Did he get more than half of the vote—yes or no?”

Statement (2) *does* answer the question. The answer is, “No, he didn’t.” So, the answer is the same as that of the first example. The answer is B.

On a yes/no data-sufficiency problem, if the statement answers the question in either the affirmative or the negative, it is sufficient.

Yes/No/Maybe

Yes/no questions really should be called yes/no/maybe questions. Even if that’s not their “official” name, it’s still worthwhile to think about them in that fashion.

Let’s look at one last example to see why.

Did candidate x receive more than half of the 30,000 votes cast in the general election?

(1) Candidate y received 12,000 of the votes cast.

(2) Candidate x received at least 13,000 of the votes cast.

Here's How to Crack It

Since the first statement of this question is the same as that of the previous two examples, we know that it is insufficient. So, write down BCE. Now, let's tackle Statement (2). Based on Statement (2), candidate x could have received exactly 13,000 votes, which would make the answer to the question "No, he did not receive more than half the votes cast." However, he could have also received 16,000 votes, and that would make the answer to the question, "Yes, he did receive more than half the votes cast." So, based on Statement (2), the best we can really say is that candidate x may have received more than half the votes. "Maybe" isn't good enough—we need a definitive yes or no answer. So, Statement (2) is insufficient. Cross off B. What if we combine the statements? We still have the same problem. We've accounted for at least 25,000 of the votes between the two candidates, but we don't know about the other 5,000. All of those votes could have gone to candidate x , making the answer to the question "yes." However, there could have been a third candidate who received those 5,000 votes. In that case, x would have received only 13,000 votes and the answer to the question is "no." Combining the statements didn't get us to a definitive answer. Cross off C. The correct answer is E.

MORE ON DATA SUFFICIENCY

Although data sufficiency problems test the same material covered by regular problem-solving questions, some readers find it distracting to learn the more complicated subtleties of this new question type at the same time that they are learning (or relearning) math concepts. That's why we've put our main chapter on data sufficiency at the end of our math review.

However, you will find data-sufficiency problems sprinkled throughout the math drills—and you should feel free at any time to dip into [Chapter 14](#), where you'll find everything in one place, including more advanced strategy, several more drills, and some great techniques to handle the most complicated yes/no questions.

Summary

"Data sufficiency" means just that, sufficiency. These questions are asking you if

the data presented is enough to solve the problem. It does not mean traditional problem solving.

Every data-sufficiency problem consists of a question followed by two statements. You must decide whether the question can be answered based on the information in the two statements.

The best strategy for data-sufficiency problems is to look at one statement at a time. Cover up the other statement with your hand, so that you can completely focus on one statement at a time.

AD or BCE: These are always your options when you first start eliminating. Memorize them.

Chapter 10

Arithmetic

Do you remember all the rules for exponents? This chapter will review rules for those and other important mathematical concepts and teach you how to solve problems involving fractions, proportions, decimals, ratios, percentages, averages, medians, modes, standard deviation, exponents, and radicals.

Although arithmetic is only one of the three types of math tested on the GMAT, arithmetic problems comprise about half of the total number of math questions.

Here are the specific arithmetic topics tested on the GMAT:

Axioms and Fundamentals (properties of integers, positive and negative numbers, even and odd). These were covered in [Chapter 7](#).

Arithmetic Operations

Fractions

Decimals

Ratios

Percentages

Averages

Exponents and Radicals

In this chapter, we will first discuss the fundamentals of each topic and then show how the test writers construct questions based on that topic.

ARITHMETIC OPERATIONS

There are six arithmetic operations you will need for the GMAT:

1. Addition ($2 + 2$)

The result of addition is a sum or total.

2. Subtraction ($6 - 2$)

The result of subtraction is a difference.

3. Multiplication (2×2)

The result of multiplication is a product.

4. Division ($8 \div 2$)

The result of division is a quotient.

5. Raising to a power (x^2)

In the expression x^2 the little 2 is called an exponent.

6. Finding a square root ($\sqrt{4}$)

$$\sqrt{4} = \sqrt{2 \times 2} = 2$$

Which One Do I Do First?

In a problem that involves several different operations, the operations must be performed in a particular order, and occasionally GMAC likes to see whether you know what that order is. Here's an easy way to remember the order of operations:

Please Excuse My Dear Aunt Sally
or
PEMDAS

The first letters stand for Parentheses, Exponents, Multiplication, Division, Addition, and Subtraction. Do operations that are enclosed in parentheses first; then take care of exponents; then multiply and divide; then add and subtract, going from left to right.

DRILL 2

Just to get you started, solve each of the following problems by performing the indicated operations in the proper order. The answers can be found in Part VI.

1. $74 + (27 - 24) =$

2. $(8 \times 9) + 7 =$

3. $2[9 - (8 \div 2)] =$

4. $2(7 - 3) + (-4)(5 - 7) =$

Here's how the GMAT might test PEMDAS on an easy question.

5. $4[-3(3 - 5) + 10 - 17] =$ -27 -4 -1 32 84

The Drill on Drills

You can't use a calculator on the math section of the GMAT, so please don't use one as you work through the math drills in this book.

To mimic the actual conditions of the test, get used to using scratch paper rather than writing in the book directly.

It is not uncommon to see a data sufficiency problem like this on the GMAT:

6. What is x ?

(1) $x^3 = 8$

(2) $x^2 = 4$

There are two operations that can be done in any order, provided they are the only operations involved: *When you are adding or multiplying a series of numbers, you can group or regroup the numbers any way you like.*

$2 + 3 + 4$ is the same as $4 + 2 + 3$

and

$4 \times 5 \times 6$ is the same as $6 \times 5 \times 4$

This is called the **associative law**, but the name will not be tested on the GMAT.

Another law that GMAC likes to test states that

$a(b + c) = ab + ac$ and $a(b - c) = ab - ac$.

This is called the **distributive law** but, again, you don't need to know that for the

test. Sometimes the distributive law can provide you with a shortcut to the solution of a problem. If a problem gives you information in “factored form”— $a(b + c)$ —you should distribute it immediately. If the information is given in distributed form— $ab + ac$ —you should factor it.

DRILL 3

If the following problems are in distributed form, factor them; if they are in factored form, distribute them. Then do the indicated operations. Answers are in Part VI.

1.

$$8(10 + 5)$$

2.

$$(55 \times 12) + (55 \times 88)$$

3.

$$a(b + c - d)$$

4.

$$abc + xyc$$

A GMAT problem might look like this:

5. If $x = 6$ what is the value of $\frac{2xy - xy}{y}$? -30 6 8
 30 It cannot be determined. It is not uncommon to see a data sufficiency problem like this on the GMAT:

6. If $ax + ay + az = 15$, what is $x + y + z$? (1) $x = 2$

(2) $a = 5$

FRACTIONS

Fractions can be thought of in two ways:

A **fraction** is just another way of expressing division. The expression $\frac{1}{2}$ is exactly the same thing as 1 divided by 2. $\frac{x}{y}$ is nothing more than x divided by y . In the fraction $\frac{x}{y}$, x is known as the **numerator** and y is known as the **denominator**.

The other important way to think of a fraction is as $\frac{\text{part}}{\text{whole}}$. The fraction $\frac{7}{10}$ can be thought of as 7 parts out of a total of 10 parts.

Adding and Subtracting Fractions with the Same Denominator

To add two or more fractions that have the same denominator, simply add up the numerators and put the sum over the common denominator. For example:

$$\frac{1}{7} + \frac{5}{7} = \frac{(1+5)}{7} = \frac{6}{7}$$

Subtraction works exactly the same way:

$$\frac{6}{7} - \frac{2}{7} = \frac{6-2}{7} = \frac{4}{7}$$

Adding and Subtracting Fractions with Different Denominators

Before you can add or subtract two or more fractions with different denominators, you must give all of them the same denominator. To do this, multiply the numerator and denominator of each fraction by a number that will give it a denominator in common with the others. If you multiplied each fraction by any old number, the fractions wouldn't have their original values, so the number you multiply by has to be equal to 1. For example, if

you wanted to change $\frac{1}{2}$ into sixths, you could do the following:

$$\frac{1}{2} \times \frac{3}{3} = \frac{3}{6}$$

We haven't actually changed the value of the fraction, because $\frac{3}{3}$ equals 1.

If we wanted to add:

$$\frac{1}{2} + \frac{2}{3}$$

$$\frac{1}{2} \times \frac{3}{3} + \frac{2}{3} \times \frac{2}{2}$$

$$\frac{3}{6} + \frac{4}{6} = \frac{7}{6}$$

The Bowtie

The Bowtie method has been a staple of The Princeton Review's materials since the company began in a living room in New York City in 1981. It's been around so long because it works so simply.

$$\frac{3}{5} + \frac{4}{7}$$

To add $\frac{3}{5}$ and $\frac{4}{7}$, for example, follow these three steps:

Step One: Multiply the denominators together to form the new denominator.

$$\frac{3}{5} + \frac{4}{7} = \frac{\quad}{5 \times 7} = \frac{\quad}{35}$$

Step Two: Multiply the first denominator by the second numerator ($5 \times 4 = 20$) and the second denominator by the first numerator ($7 \times 3 = 21$) and place these numbers above the fractions, as shown below.

$$\begin{array}{r} 21 \quad + \quad 20 \\ \frac{3}{5} + \frac{4}{7} \end{array}$$

See? A bowtie!

Step Three: Add the products to form the new numerator.

$$\frac{3}{5} + \frac{4}{7} = \frac{21 + 20}{5 \times 7} = \frac{41}{35}$$

Subtraction works the same way.

$$\begin{array}{r} 21 \quad - \quad 20 \\ \frac{3}{5} - \frac{4}{7} \end{array}$$

Note that with subtraction, the order of the numerators is important. The new

numerator is $21 - 20$, or 1. If you somehow get your numbers reversed and use $20 - 21$, your answer will be $-\frac{1}{35}$, which is incorrect. One way to keep your subtraction straight is to always multiply **up** from denominator to numerator when you use the Bowtie.

Multiplying Fractions

To multiply fractions, just multiply the numerators and put the product over the product of the denominators. For example:

$$\frac{2}{3} \times \frac{6}{5} = \frac{12}{15}$$

Reducing Fractions

When you add or multiply fractions, you often end up with a big fraction that is hard to work with. You can usually reduce such a fraction. To reduce a fraction, find a factor of the numerator that is also a factor of the denominator. It saves time to find the biggest factor they have in common, but this isn't critical. You may just have to repeat the process a few times. When you find a common factor, cancel it. For example, let's take the product we just found when we multiplied the fractions above:

$$\frac{12}{15} = \frac{4 \times \cancel{3}}{5 \times \cancel{3}} = \frac{4}{5}$$

Get used to reducing all fractions (if they can be reduced) *before* you do any work with them. It saves a lot of time and prevents errors in computation.

For example, in that last problem, we had to multiply two fractions together:

$$\frac{2}{3} \times \frac{6}{5}$$

Before you multiplied 2×6 and 3×5 , you could have reduced $\frac{6}{3}$ to $\frac{2}{1}$ and gotten the same answer even faster.

Dividing Fractions

To divide one fraction by another, just invert the second fraction and multiply:

$$\frac{2}{3} \div \frac{3}{4}$$

which is the same thing as...

$$\frac{2}{3} \times \frac{4}{3} = \frac{8}{9}$$

You may see this same operation written like this:

$$\frac{\frac{2}{3}}{\frac{3}{4}}$$

Again, just invert and multiply. This next example is handled the same way:

$$\frac{\frac{6}{2}}{\frac{3}{1}} = \frac{6}{1} \times \frac{1}{2} = \frac{18}{2} = 9$$

When you invert a fraction, the new fraction is called a **reciprocal**. $\frac{2}{3}$ is the reciprocal of $\frac{3}{2}$. The product of two reciprocals is always 1.

Converting to Fractions

An integer can be expressed as a fraction by making the integer the numerator and 1 the denominator: $16 = \frac{16}{1}$.

The GMAT sometimes gives you numbers that are mixtures of integers and fractions, for example, $3\frac{1}{2}$. It's easier to work with these numbers if you convert them into fractions. Simply multiply the denominator by the integer, then add the numerator, and place the resulting number over the original denominator. Because the fractional part of this number was expressed in halves, let's convert the integer part of the number into halves as well:

$$3 = \frac{6}{2}$$

Now just add $\frac{1}{2} + \frac{6}{2}$.

$$\text{So, } 3\frac{1}{2} = \frac{7}{2}$$

Comparing Fractions

In the course of a problem, you may have to compare two or more fractions and determine which is larger. This is easy to do as long as you remember that you can compare fractions directly only if they have the same denominator. Suppose you had to decide which of these three fractions is largest:

$$\frac{1}{2}, \frac{5}{9}, \text{ or } \frac{7}{15}$$

To compare these fractions directly you need a common denominator, but finding a common denominator that works for all three fractions would be complicated and time consuming. It makes more sense to compare these fractions two at a time. We showed you the classical way to find common denominators when we talked about adding fractions earlier.

Let's start with $\frac{1}{2}$ and $\frac{1}{2}$ and $\frac{5}{9}$. An easy common denominator for these two fractions is 18 (9×2).

$$\frac{1}{2} \quad \frac{5}{9}$$

$$\frac{1}{2} \times \frac{9}{9} \quad \frac{5}{9} \times \frac{2}{2}$$

$$= \frac{9}{18} \quad = \frac{10}{18}$$

$$\frac{5}{9} \quad \frac{7}{15}$$

Because $\frac{5}{9}$ is bigger, let's compare it with $\frac{7}{15}$. Here the easiest common denominator is 45. But before we do that...

Two Shortcuts

One good shortcut when comparing fractions is what we call the Bowtie. The idea

is that if all you need to know is which fraction is bigger, you just have to compare the new numerators. To use the Bowtie, simply multiply the denominator of the first fraction by the numerator of the second and the denominator of the second by the numerator of the first, as shown below.

$$9 \times 1 = 9 \quad \frac{1}{2} \begin{array}{c} \swarrow \searrow \\ \searrow \swarrow \end{array} \frac{5}{9} \quad 2 \times 5 = 10$$

$$10 > 9, \text{ therefore } \frac{5}{9} > \frac{1}{2}$$

You could also have saved yourself some time on the last problem by a little fast

estimation. Again, which is larger? $\frac{1}{2}$, $\frac{5}{9}$, or $\frac{7}{15}$?

Let's think about $\frac{5}{9}$ in terms of $\frac{1}{2}$. How many ninths equal a half? To put it another way, what is half of 9? 4.5. So $\frac{4.5}{9} = \frac{1}{2}$. That means $\frac{5}{9}$ is *bigger* than $\frac{1}{2}$.

Now let's think about $\frac{7}{15}$. Half of 15 is 7.5. $\frac{7.5}{15} = \frac{1}{2}$, which means that $\frac{7}{15}$ is less than $\frac{1}{2}$.

PROPORTIONS

A fraction can be expressed in many ways. $\frac{1}{2}$ also equals $\frac{2}{4}$ or $\frac{4}{8}$, etc. A **proportion** is just a different way of expressing a fraction. Here's an example:

If 2 boxes hold a total of 14 shirts, how many shirts are contained in 3 boxes?

Here's How to Crack It

The number of shirts per box can be expressed as a fraction. What you're asked to do is express the fraction $\frac{2}{14}$ in a different way.

$$\frac{2 \text{ (boxes)}}{14 \text{ (shirts)}} = \frac{3 \text{ (boxes)}}{x \text{ (shirts)}}$$

To find the answer, all you need to do is find a value for x such that $\frac{2}{14} = \frac{3}{x}$.
The easiest way to do this is to cross-multiply.

$2x = 42$, which means that $x = 21$. There are 21 shirts in 3 boxes.

DRILL 4

The answers to these questions can be found in Part VI.

1.

$$5\frac{2}{3} + \frac{3}{8} =$$

2.

Reduce $\frac{12}{60}$

3.

Convert $9\frac{2}{3}$ to a fraction

4.

$$\frac{9}{2} = \frac{x}{4}$$

A relatively easy GMAT fraction problem might look like this:

$$\frac{\left(\frac{4}{5} \frac{1}{8}\right) \left(\frac{3}{5} \frac{2}{3}\right)}{\frac{3}{4}} = \bigcirc$$

5. $\frac{3}{100}$

$\frac{3}{16}$

$\frac{1}{3}$

1

$\frac{7}{16}$

Proportions and Ratios

Proportions are really ratios. Where a proportion question asks about the number of shirts *per* box, a ratio question might ask about the number of red shirts to blue shirts in a box.

Fractions: Advanced Principles

Now that you've been reacquainted with the basics of fractions, let's go a little further. More complicated fraction problems usually involve all of the rules we've just mentioned, with the addition of two concepts: $\frac{\text{part}}{\text{whole}}$, and the rest. Here's a typical medium fraction problem:

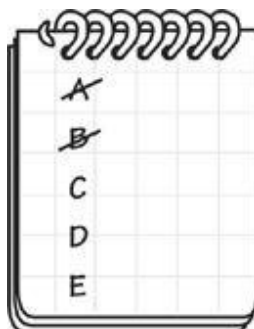


A cement mixture is composed of 3 elements. By weight, $\frac{1}{3}$ of the mixture is sand, $\frac{3}{5}$ of the mixture is water, and the remaining 12 pounds of the mixture is gravel. What is the weight of the entire mixture in pounds?

- 4 8 36 60 180

Easy Eliminations

Before we even start doing serious math, let's use some common sense. The weight of the gravel alone is 12 pounds. Because we know that sand and water make up the bulk of the mixture—sand $\frac{1}{3}$, water $\frac{3}{5}$ (which is a bit more than half)—the entire mixture must weigh a great deal more than 12 pounds. Answer choices A and B are out of the question. Eliminate them.



Here's How to Crack It

The difficulty in solving this problem is that sand and water are expressed as fractions, while gravel is expressed in pounds. At first there seems to be no way of knowing what fractional part of the mixture the 12 pounds of gravel represent; nor do we know how many pounds of sand and water there are.

The first step is to add up the fractional parts that we do have:

$$\frac{1}{3} + \frac{3}{5} = \frac{1}{3} \left(\frac{5}{5} \right) + \frac{3}{5} \left(\frac{3}{3} \right) = \frac{14}{15}$$

Sand and water make up 14 parts out of the whole of 15. This means that gravel makes up what is left over—the rest: 1 part out of the whole of 15. Now the problem is simple. Set up a proportion between parts and weights.

$$\frac{1}{15} = \frac{12}{x}$$

Cross-multiply: $x = 180$. The answer is choice E.

DECIMALS ARE REALLY FRACTIONS

A decimal can be expressed as a fraction, and a fraction can be expressed as a

decimal.

$$0.6 = \frac{6}{10}, \text{ which can be reduced to } \frac{3}{5}$$

$$\frac{3}{5} \text{ is the same thing as } 3 \div 5$$

Which would you rather figure out—the square of $\frac{1}{4}$ or the square of 0.25? There may be a few of you out there who've had so much practice with decimals in your work that you prefer decimals to fractions, but for the rest of us, fractions are infinitely easier to deal with.

Occasionally, you will have to work with decimals. Whenever possible, however, convert decimals to fractions. It will save time and eliminate careless mistakes. In fact, it makes sense to memorize the fractional equivalent of some commonly used decimals:

$0.2 = \frac{1}{5}$	$0.6 = \frac{3}{5}$
$0.25 = \frac{1}{4}$	$0.\overline{66} = \frac{2}{3}$
$0.\overline{33} = \frac{1}{3}$	$0.75 = \frac{3}{4}$
$0.4 = \frac{2}{5}$	$0.8 = \frac{4}{5}$
$0.5 = \frac{1}{2}$	

Adding and Subtracting Decimals

To add or subtract decimals, just line up the decimal points and proceed as usual. Adding 6, 2.5, and 0.3 looks like this:

$$\begin{array}{r} 6.0 \\ 2.5 \\ + 0.3 \\ \hline 8.8 \end{array}$$

Multiplying Decimals

To multiply decimals, simply ignore the decimal points and multiply the two numbers. When you've finished, count all the digits that were to the right of the decimal points in the original numbers you multiplied. Now place the decimal point in your answer so that there are the same number of digits to the right of it. Here are two examples:

$$0.3 \times 0.7 = 0.21$$

There were a total of two digits to the right of the decimal point in the original numbers, so we place the decimal so that there are two digits to the right in the answer.

$$14.3 \times .232 = 3.3176$$

There were a total of four digits to the right of the decimal point in the original numbers, so we place the decimal such that there are four digits to the right in the answer.

Dividing Decimals

The best way to divide one decimal by another is to convert the number you are dividing by (in mathematical terminology, the **divisor**) into a whole number. You do this simply by moving the decimal point as many places as necessary. This works as long as you remember to move the decimal point in the number that you are *dividing* (in mathematical terminology, the **dividend**) the same number of spaces.

For example, to divide 12 by 0.6, set it up the way you would an ordinary division problem: $0.6 \overline{)12}$

To make 0.6 (the divisor) a whole number, you simply move the decimal point over one place to the right. You must also move the decimal one place to the right in the dividend. Now the operation looks like this:

$$\begin{array}{r} 0.6 \overline{)12.} \\ 6 \overline{)120} \\ \underline{20} \\ 6 \overline{)120} \end{array}$$

Rounding Decimals

9.4 rounded to the nearest whole number is 9.

9.5 rounded to the nearest whole number is 10.

When GMAC asks you to give an approximate answer on an easy question, it is safe to round numbers. But you should be leery about rounding numbers on a difficult question. If you're scoring in a high percentile, rounding off numbers will be useful to eliminate answer choices that are out of the ballpark, but not to decide between two close answer choices.

To round a decimal, look at the digit to the right of the digits place you are rounding to. If that number is 0–4, there is no change. If that number is 5–9, round up.

DRILL 5

The answers to these questions can be found in Part VI.

1.

$$\begin{array}{r} 34.26 \\ - 0.96 \\ \hline \end{array}$$

2.

$$\begin{array}{r} 27.3 \\ \times 9.75 \\ \hline \end{array}$$

3.

$$\frac{19.6}{3.22} \text{ (rounded to the nearest hundredth) =}$$

4.

$$\frac{\frac{4}{0.25}}{\frac{1}{50}} =$$

Decimals or Fractions

Whether you prefer decimals or fractions, you must be able to work with both. The ability to work comfortably and confidently with decimals and fractions is vital to GMAT success.

On the GMAT, there might be questions that mix decimals and fractions:

5. $\frac{3}{10} \times 4 \times 0.8$ 0.32 0.96 0.333 3.0 30.0
- 96.0 6. If x and y are reciprocals, what is the value of $x + y$ rounded to the nearest hundredth? (1) $x = 0.2$

(2) $y = 5$

RATIOS

Ratios are close relatives of fractions. A ratio can be expressed as a fraction and vice versa. The ratio 3 to 4 can be written as $\frac{3}{4}$ as well as in standard ratio format: 3 : 4.

First Things First

On *all* questions, before you do any serious calculations, take a moment to see whether the answer choices make sense. Eliminate crazy answer choices.

Do this first because those “crazy” choices usually reflect the result of a common (but incorrect) approach to the problem. Eliminate first and you

won't think (falsely), "Aha, I've got it." Instead, you'll know you took a misstep somewhere.

There Is Only One Difference Between a Ratio and a Fraction

A fraction compares a part to whole relationship. A ratio compares a part to part relationship. It's that simple. Check out the box below for a handy visual representation.

<p>Fraction:</p> <p>part: 3 women</p> <hr style="width: 100%;"/> <p>whole: 7 people</p>	<p>Ratio:</p> <p>part: 3 women</p> <hr style="width: 100%;"/> <p>part: 4 men</p>
--	---

(The whole is 7.)

Aside from That, All the Rules of Fractions Apply to Ratios

A ratio can be converted to a percentage or a decimal. It can be cross-multiplied, reduced, or expanded—just like a fraction. The ratio of 1 to 3 can be expressed as:

$$\frac{1}{3}$$

$$1 : 3$$

$$\frac{2}{6}$$

$$\frac{3}{9}$$

An Easy Ratio Problem

The ratio of men to women in a room is 3 to 4. If there are 20 women, what is the number of men in the room?

Here's How to Crack It

No matter how many people are actually in the room, the ratio of men to women will always stay the same: 3 to 4. What you're asked to do is find the numerator of a fraction whose denominator is 20, and which can be reduced to $\frac{3}{4}$. Just set one fraction equal to another and cross-multiply:

$$\frac{3}{4} = \frac{x}{20} \quad 60 = 4x \quad x = 15$$

The answer to the question is 15 men. Note that $\frac{15}{20}$ reduces to $\frac{3}{4}$.

A More Difficult Ratio Problem

The ratio of women to men in a room is 3 to 4. If there are a total of 28 people in the room, how many are women?

This problem is more difficult because, while we are given the ratio of women to men, we are not given a specific value for either the women or the men. If we tried to set up this problem as we did the previous one, it would look like this:

$$\frac{3}{4} = \frac{x}{y}$$

Of course, you can't solve an equation that has two variables.

Here's How to Crack It

You need a way to see how the total number of people in the room, which you know is 28, can be broken down into groups of 3 women and 4 men.

A good way to solve the problem is to use a ratio box. Here's what that looks like for the information provided by the problem:

	Women	Men	Total
Ratio	3	4	
Multiplier			
Actual Number			28

To use a ratio box, you need a ratio and an actual number. Now, remember that ratios compare parts to parts. So, if you add up the parts, you get a group (or total) of 7 people.

Next, the key idea of a ratio is the multiplier, which allows you to make the group bigger or smaller while keeping everything in the same ratio. For this problem, you don't want a group of 7 people. You want a group of 28. So, you multiply $7 \times 4 = 28$.

To keep everything in the same ratio, you just need to remember that whatever you do to one part, you need to do to every part. So, multiply the ratio numbers for both the women and men by 4.

Here's what the box looks like when it is completed:

	Women	Men	Total
Ratio	3	4	7
Multiplier	4	4	4
Actual Number	$12 = (3 \times 4)$	$16 = (4 \times 4)$	$28 = (7 \times 4)$

There are 12 women in the room.

PERCENTAGES

A **percentage** is just a fraction in which the denominator is always equal to 100. Fifty percent means 50 parts out of a whole of 100. Like any fraction, a percentage can be reduced, expanded, cross-multiplied, converted to a decimal, or converted to another

fraction. $50\% = \frac{1}{2} = 0.5$

An Easy Percent Problem

5 is what percent of 20?

Here's How to Crack It

Whenever you see a percent problem, you should be thinking $\frac{\text{part}}{\text{whole}}$. In this case, the question asks you to expand $\frac{5}{20}$ into another fraction in which the denominator is 100.

$$\frac{\text{part}}{\text{whole}} = \frac{5}{20} = \frac{x}{100}$$

$$500 = 20x$$

$$x = 25$$

$$\frac{x}{100} = 25\%$$

Percent Shortcuts

In the last problem, reducing $\frac{5}{20}$ to $\frac{1}{4}$ would have saved you time if you knew that $\frac{1}{4} = 25\%$. Here are some fractions and decimals whose percent equivalents you should know:

$$\frac{1}{4} = 0.25 \text{ (a repeating decimal)} = 25\%$$

$$\frac{1}{2} = 0.5 \text{ (a repeating decimal)} = 50\%$$

$$\frac{1}{3} = 0.333\ldots \text{ (a repeating decimal)} = 33\frac{1}{3}\%$$

$$\frac{1}{5} = .20 = 20\%$$

Some percentages simply involve moving a decimal point: To get 10 percent of any number, you simply move the decimal point of that number over one place to the left:

$$10\% \text{ of } 6 = 0.6$$

$$10\% \text{ of } 60 = 6$$

$$10\% \text{ of } 600 = 60$$

• To get 1 percent of any number, you just move the decimal point of that number over two places to the left:

$$1\% \text{ of } 600 = 6$$

$$1\% \text{ of } 60 = 0.6$$

$$1\% \text{ of } 6 = 0.06$$

• To find a more complicated percentage, it's easy to break the percentage down into easy-to-find chunks:

20% of 60:

10% of 60 = 6; 20% of 60 is double 10%, so the answer is 2×6 , or 12.

30% of 60:

10% of 60 = 6; 30% of 60 is three times 10%, so the answer is 3×6 , or 18.

3% of 200:

1% of 200 = 2; 3% of 200 is just three times 1%, so the answer is 3×2 , or 6.

23% of 400:

10% of 400 = 40. Therefore 20% equals 2×40 , or 80. 1% of 400 = 4. Therefore 3% equals 3×4 , or 12. Putting it all together, 23% of 400 equals $80 + 12$, or 92.

A Medium Percent Problem

Like medium and difficult fraction problems, medium and difficult percent problems often involve remembering the principles of part and the rest.

A motor pool has 300 vehicles of which 30 percent are trucks. 20 percent of all the vehicles in the motor pool are diesel, including 15 trucks. What percent of the motor pool is composed of vehicles that are neither trucks nor diesel?

- 165%
 90%
 65%
 55%
 10%
 Here's How to Crack It

Do this problem one sentence at a time.

A motor pool has 300 vehicles, of which 30% are trucks. Thirty percent of 300 = 90 trucks, which means that 210 (the rest) are *not* trucks.

Twenty percent of all the vehicles are diesel, including 15 trucks. Twenty percent of 300 = 60 diesel vehicles, 15 of which are trucks, which means there are 45 diesel vehicles that are *not* trucks.

What percent of the motor pool is composed of vehicles that are neither truck nor diesel? We know from sentence number 1 that there are 210 nontrucks. We know from sentence number 2 that of these 210 nontrucks, 45 are diesel. Therefore 210 – 45, or 165, are neither diesel nor truck.

The question asks what percent of the entire motor pool these 165 nondiesel nontrucks are.

$$\frac{165}{300} = \frac{x}{100} \quad 300x = 16,500$$

$x = 55$ and the answer is choice D.

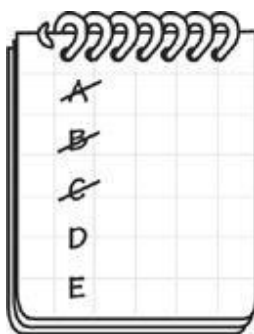
There's a handy formula for calculating mixed groups. It isn't a priority for you to memorize (you just saw the problem calculated without it), but the formula can be helpful on some questions. Here it is: Group 1 + Group 2 – both + neither = total. Here's what that looks like using the numbers from the vehicle problem. 90 trucks + 60 diesel – 15 diesel trucks + $x = 300$. $135 + x = 300$. $x = 165$, or 55% of 300.

Easy Eliminations

Because the problem asks us to find a portion of the entire motor pool, it's impossible for that portion to be larger than the motor pool itself. Therefore answer choice A, 165%, is crazy.

If the problem simply asked what percent of the motor pool was not made up of trucks, the answer would be 70%. But because there is a further condition (the vehicles must be both nontruck and nondiesel), the answer must be even less than 70%. This makes answer choice B impossible, too.

Answer choice C is probably a Joe Bloggs answer. You can get it simply by adding $30 + 20 + 15$.



Percent Increase or Decrease

Another type of percent problem you may see on the GMAT has to do with *percent increase* or *percent decrease*. In these problems the trick is always to put the increase or decrease in terms of the *original* amount. See the following example:

The cost of a one-family home was \$120,000 in 1980. In 1988, the price had increased to \$180,000. What was the percent increase in the cost of the home?

- 60%
 50%
 55%
 40%
 33.3%
 Here's How to Crack It

The actual increase was \$60,000. To find the percent increase, set up the following equation:

What's the Original Amount?

GMAT test writers like to see if they can trick you into mistaking which number

was the original amount. On percent decrease problems (sometimes called “percent less” problems), the original is the larger number; on percent increase problems (sometimes called “percent greater” problems), the original is the smaller number.

$$\frac{\text{amount of increase}}{\text{original amount}} = \frac{x}{100}$$

$$\frac{\$60,000}{\$120,000} = \frac{x}{100}$$

In this case, $\frac{\$60,000}{\$120,000} = \frac{x}{100}$. So, $x = 50$ and the answer is choice B.

To solve a percent *decrease* problem, simply put the amount of the decrease over the original amount.

Compound Interest

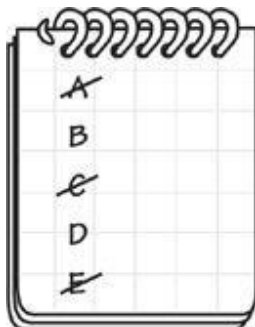
Another type of percent problem involves **compound interest**. If you kept \$1,000 in the bank for a year at 6% simple interest, you would get \$60 in interest at the end of the year. Compound interest would pay you slightly more. Let’s look at a compound-interest problem:

Ms. Lopez deposits \$100 in an account that pays 20% interest, compounded semiannually. How much money will there be in the account at the end of one year?

- \$118.00 \$120.00 \$121.00 \$122.00 \$140.00

Easy Eliminations

Joe Bloggs doesn’t know how to find compound interest, so he finds simple interest instead. In a compound-interest problem, always calculate simple interest first. \$100 at 20% simple interest for one year would turn into \$120, which is answer choice B. Because compound interest is always a *little bit* more than simple interest, we can eliminate answer choices A and B. Answer choice E is a great deal more than simple interest, so we can eliminate it, too. Only answer choices C and D are a *little bit* more than simple interest. We’re down to a fifty-fifty guess.



Here's How to Crack It

To find compound interest, divide the interest into as many parts as are being compounded. For example, if you're compounding interest semiannually, you divide the interest into two equal parts. If you're compounding quarterly, you divide the interest into four equal parts.

When Ms. Lopez deposited \$100 into her account at a rate of 20% compounded semiannually, the bank divided the interest into two equal parts. Halfway through the year, the bank put the first half of the interest into her account. In this case, because the full rate was 20% compounded semiannually, the bank deposited 10% of \$100 (10% of \$100 = \$10). Halfway through the year, Ms. Lopez had \$110.

For the second half of the year, the bank paid 10% interest on the \$110 (10% of \$110 = \$11). At the end of the year, Ms. Lopez had \$121.00 in her account. She earned \$1 more than she would have earned if the account had paid only simple interest. The answer is choice C.

AVERAGES

To find the **average** of a set of n numbers, you simply add the numbers and divide by n . For example:

$$\text{The average of 10, 3, and 5 is } \frac{10 + 3 + 5}{3} = 6$$

A good way to handle average problems is to set them up in the same way every time. Whenever you see the word *average*, you should think:

$$\frac{\text{total sum of the items}}{\text{total number of the items}} = \text{average}$$

Reminder!

Averaging problems often have easy eliminations, so be sure to look for them—*before* you solve.

A One-Step Average Problem

In a simple problem, GMAC will give you two parts of this equation, and it will be up to you to figure out the third. Let's warm up those old average skills.

What is the average of the numbers 3, 4, 5, and 8?

Here's How to Crack It

In this case they've given us the actual numbers, which means we know the total sum ($3 + 4 + 5 + 8 = 20$) and the total number of items (there are four numbers). What we're missing is the average.

$$\frac{\text{total sum of the items}}{\text{total number of the items}} = \text{average} \qquad \frac{20}{4} = x \qquad x = 5$$

Here's another one:

If the average of 7 numbers is 5, what is the sum of the numbers?

Here's How to Crack It

In this case we know the total number of items and the average, but not the total sum of the numbers.

$$\frac{\text{total sum of the items}}{\text{total number of the items}} = \text{average} \qquad \frac{x}{7} = 5 \qquad x = 35$$

The Average Trap For Joe Bloggs

Joe thinks you can take the average of two averages.

If Joe's average score on his first two tests was 70 and his average score on his next three tests was 80, what was his average score on all the tests?

Joe wants to say 75 (the average of 70 and 80) because he forgot that his first average was based on two tests, while his second average was based on three tests. To find the real answer, you have to find the total number of points he got on all the tests (70×2 plus 80×3) and divide by the total number of tests (5). His real average: 76.

A Two-Step Average Problem

This is the same problem you just did, made a little more difficult:

The average of 7 numbers is 5. If two of the numbers are 11 and 14, what is the average of the remaining numbers?

Here's How to Crack It

Always set up an average problem the way we showed you above. With more complicated average problems, take things one sentence at a time. The first sentence yields:

$$\frac{\text{total sum of the items}}{\text{total number of the items}} = \text{average} \quad \frac{x}{7} = 5 \quad x = 35$$

The sum of *all* the numbers is 35. If two of those numbers are 11 and 14, then the sum of the remaining numbers is $35 - (11 + 14)$, or 10. The question asks, "What is the average of the remaining numbers?" Again, let's set this up properly:

$$\frac{\text{total sum of the remaining numbers}}{\text{total number of the remaining numbers}} = \text{average} \quad \frac{10}{5} = y \quad y = 2$$

Why did we divide the total sum of the remaining numbers by 5? There were only 5 remaining numbers!

Medians and Modes

Calculating the average of a list of numbers is one way to find the "middle" of these numbers, but there are two other ways that yield slightly different results. To find the **median** of a list of n numbers, just reorder the numbers from least to greatest, and

pick the middle number.

If n is odd, this is a piece of cake:

The median of 4, 7, 12, 14, 20 = 12.

If n is even, it's still easy—just add the two middle numbers together and divide by 2:

The median of 4, 12, 14, 20 = $\frac{12+14}{2} = 13$.

To find the **mode** of a list of n numbers, just pick the number that occurs most frequently...

The mode of 5, 6, 3, 9, 3, 28, 3, 5 = 3.

...but remember that a list of numbers *can* have more than one mode:

The modes of 3, 3, 3, 4, 5, 5, 5 = both 3 and 5.

Here's a relatively easy problem:

$$\frac{\quad}{\{4, 6, 3, y\}}$$

If the mode of the list of numbers above is 3, then what is the average (arithmetic mean) of the list?

7 3 4 9 12 **Means**

When a question refers to an average, the words “arithmetic mean” will often follow in parentheses. This is not just to make the problem sound scarier. Arithmetic mean is the precise term for the process of finding an average that we've illustrated in the problems above.

Here's How to Crack It

The mode of the list of numbers is 3, which means that y must also equal 3

(because the mode is the number that occurs most frequently in the list). So now all we have to do is find the average of 4, 6, 3, and 3. The correct answer is choice C.

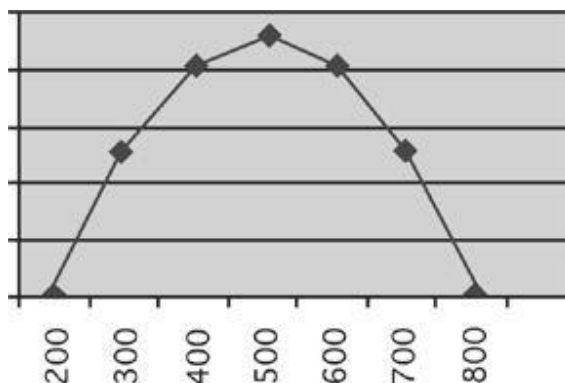
RANGE AND STANDARD DEVIATION

To find the **range** of a list of n numbers, take the smallest number and subtract it from the largest number. This measures how widely the numbers are dispersed.

The range of 4, 3, 8, 12, 23, 37 = $37 - 3 = 34$

Another way to measure the dispersion of a list of numbers is **standard deviation**, which measures the distance between the arithmetic mean and each of the numbers in that list. Even if you think you've never heard of this concept before, you've actually seen one example of standard deviation in the form of a graph that is near and dear to the test writers' hearts: the bell-shaped curve.

In the graph of approximate score frequencies below, you'll notice that many people's GMAT scores are clustered around the mean (500), with some people's scores below and other's above. The standard deviation is a number that expresses the degree to which the list of numbers vary from the mean, either above it or below it. The greater the standard deviation, the greater the degree of variation.



To calculate the standard deviation of a list of n numbers (not that the GMAT is likely to ask you to), first find the average (arithmetic mean) of the numbers. Then find the difference between that average and each number in the set and square each of the differences. And finally, find the average of the squared differences and take the square root of this average. The rather intimidating formula looks like this:

$$\sqrt{\frac{\sum (x - \bar{x})^2}{n - 1}}$$

But you won't need it.

Standard deviation usually comes down to a single number such as 2.4 or 3.0. Most GMAT questions about standard deviation concern the difference between standard

deviation and the mean. Here's a typical problem:

If the arithmetic mean of a list of numbers is 12 and the standard deviation of that list of numbers is 1.3, then which of the following numbers would be more than two standard deviations from the mean?

- I. 14.7 II. 12.3 III. 9.3 I only I and II only II only
 III only I and III only **Here's How to Crack It**

One standard deviation above the mean of 12 would be 13.3, and two standard deviations would be 14.6. So 14.7 (Statement I) is definitely more than two standard deviations. Is the correct answer choice A? We don't know yet—but we can definitely cross off choices C and D because they don't include statement I. Let's look at Statement II. 12.3 is definitely less than two standard deviations, so we can cross off choice B. Now, you may have wanted to cross off choice E as well, because 9.3 (Statement III) is much less than 14.6—but remember, standard deviation means a deviation either above *or below* the mean. Two standard deviations below 12 would be 9.4, so 9.3 is actually more than two standard deviations from the mean. The correct answer is choice E.

EXPONENTS

An **exponent** is a short way of writing the value of a number multiplied several times by itself. $4 \times 4 \times 4 \times 4 \times 4$ can also be written as 4^5 . This is expressed as “four to the fifth power.” The large number (4) is called the base, and the little number (5) is called the exponent.

There are several rules to remember about exponents:

• **Multiplying numbers with the same base:** When you multiply numbers that have the same base, you simply add their exponents.

$$6^2 \times 6^3 = 6^{(2+3)} = 6^5 \quad (y^4)(y^6) = y^{(4+6)} = y^{10}$$

• **Dividing numbers with the same base:** When you divide numbers that have the same base, you simply subtract the bottom exponents from the top exponents.

$$\frac{3^6}{3^2} = 3^{(6-2)} = 3^4 \quad \frac{x^7}{x^4} = x^{(7-4)} = x^3$$

• **Raising a power to a power:** When you raise a number with an exponent to another power, you can simply multiply the exponents.

$$(4^3)^2 = 4^{(3 \times 2)} = 4^6 \quad (z^2)^4 = z^{(2 \times 4)} = z^8$$

There are several operations that *seem* like they ought to work with exponents, but don't.

• Does $x^2 + x^3 = x^5$?

NO!

• Does $x^6 - x^2 = x^4$?

NO!

• Does $\frac{(x^2 + y^2 + z^2)}{(x^2 + y^2)} = z^2$?

NO!

But note that in the first example, $x^2 + x^3$ can be written in another form, using the distributive property: $x^2 + x^3 = x^2(1+x)$.

The Strange Powers of Powers

If you raise a positive integer to a power, the number gets larger. For example, $6^2 = 36$. However, raising a number to a power can sometimes have unexpected results:

Strange Powers Revealed!

Why is any number to the 0 power equal to 1 when any other time we multiply by 0 the result is 0? The answer is that we aren't multiplying by 0 at all.

Watch closely now: 3^0 should equal $3^{-1} \times 3^1$, because when you add

the exponents you get
 3^0 . Now, $3^{-1} \times 3^1$ can be
 rewritten $\frac{1}{3} \times 3 = \frac{3}{3} = 1$.

- If you raise a positive fraction that is less than 1 to a power, the fraction gets *smaller*.

$$\left(\frac{1}{3}\right)^2 = \frac{1}{3} \times \frac{1}{3} = \frac{1}{9}$$

- If you raise a negative number to an odd power, the number gets *smaller*.

$$(-3)^3 = (-3)(-3)(-3) = -27$$

(Remember, -27 is smaller than -3 .)

- If you raise a negative number to an even power, the number becomes positive.

$$(-3)^2 = (-3)(-3) = 9$$

(Remember, negative times negative = positive.)

- Any number to the first power = itself.
- Any number to the 0 power = 1.

RADICALS

The **square root** of a positive number x is the number that, when squared, equals x . By definition, you can only take the square root of a nonnegative number and the square root function returns only nonnegative values. The symbol for a square root is $\sqrt{\quad}$. A number inside the $\sqrt{\quad}$ is called a **radical**. Thus, in $\sqrt{4} = 2$, 4 is the radical and 2 is its square root.

The **cube root** of a positive number x is the number that, when cubed, equals x . For example, the cube root of 8 is 2, because $2 \times 2 \times 2 = 8$. The symbol for a cube root is $\sqrt[3]{\quad}$. Thus, the cube root of 27 would be represented as $\sqrt[3]{27} = 3$, because $3 \times 3 \times 3 =$

27. The cube root of -27 would be represented as $\sqrt[3]{-27} = -3$ because $-3 \times -3 \times -3 = -27$.

Even More Strange Powers

A radical can be rewritten as a fractional exponent, and vice versa.

That is: $\sqrt[3]{5} = 5^{\frac{1}{3}}$.

There are several rules to remember about radicals:

1. $\sqrt{x}\sqrt{y} = \sqrt{xy}$. For example, $\sqrt{12}\sqrt{3} = \sqrt{36} = 6$.

2. $\sqrt{\frac{x}{y}} = \frac{\sqrt{x}}{\sqrt{y}}$. For example, $\sqrt{\frac{3}{16}} = \frac{\sqrt{3}}{\sqrt{16}} = \frac{\sqrt{3}}{4}$.

3. To simplify a radical, try factoring. For example, $\sqrt{32} = \sqrt{16}\sqrt{2} = 4\sqrt{2}$.

4. The square root of a positive fraction less than 1 is actually larger than the original fraction. For example, $\sqrt{\frac{1}{4}} = \frac{1}{2}$.

Summary

The six arithmetic operations are addition, subtraction, multiplication, division, raising to a power, and finding a square root.

These operations must be performed in the proper order (**Please Excuse My Dear Aunt Sally**).

If you are adding or multiplying a group of numbers, you can regroup them in any order. This is called the **associative law**.

If you are adding or subtracting numbers with common factors, you can regroup them in the following way: $ab + ac = a(b + c)$

$$ab - ac = a(b - c)$$

This is called the **distributive law**.

A fraction can be thought of in two ways: another way of expressing division as $\frac{\text{part}}{\text{a whole}}$

You must know how to add, subtract, multiply, and divide fractions. You must also know how to raise them to a power and find their roots.

Always reduce fractions (when you can) before doing a complicated operation. This will reduce your chances of making a careless error.

In tough fraction problems always think and *the rest*.

A decimal is just another way of expressing a fraction.

You must know how to add, subtract, multiply, and divide decimals.

In general it is easier to work with fractions than with decimals, so convert decimals to fractions.

A ratio is a fraction in all ways but one: A fraction is a $\frac{\text{part}}{\text{whole}}$. A ratio is a $\frac{\text{part}}{\text{part}}$. In a ratio, the whole is the sum of all its parts.

A percentage is just a fraction whose denominator is always 100.

You must know the percentage shortcuts outlined in this chapter.

In tough percent problems, like tough fraction problems, think $\frac{\text{part}}{\text{whole}}$ and *the rest*.

In a percentage increase or decrease problem, you must put the amount of the increase or decrease over the *original* amount.

In compound interest problems, the answer will always be *a little bit more* than it would be in a similar simple interest problem.

To find the average of several values, add the values and divide the total by the number of values.

Always set up average problems in the same way:

$$\frac{\text{total sum of the items}}{\text{total number of the items}} = \text{average}$$

To find the median of a list of n numbers, reorder the numbers from least to greatest, and pick the middle number if n is odd. Take the average of the two middle numbers if n is even.

To find the mode of a list of n numbers, pick the number that occurs most frequently.

To find the range of a list of n numbers, subtract the smallest number from the greatest number.

Standard deviation measures the distance between a set of numbers and its arithmetic mean. Most GMAT problems about this concept hinge on the difference between the standard deviation and the arithmetic mean.

An exponent is a shorter way of expressing the result of multiplying a number several times by itself.

When you multiply numbers with the same base, you simply add the exponents.

When you divide numbers with the same base, you simply subtract the exponents.

When you raise a power to a power, you multiply the exponents.

You *cannot* add or subtract numbers with the same or different bases by adding their exponents.

The three radical rules you need to know:

$$\sqrt{x}\sqrt{y} = \sqrt{xy} \quad \sqrt{\frac{x}{y}} = \frac{\sqrt{x}}{\sqrt{y}}$$

$$\sqrt{x^2 y} = x\sqrt{y}$$

There are some unusual features of exponents and radicals: The square root of a positive fraction that's less than 1 is larger than the original fraction. When you raise a positive fraction that's less than 1 to an exponent, the resulting fraction is smaller. When you raise a negative number to an even exponent, the resulting number is positive. When you raise a negative number to an odd exponent, the resulting number is still a negative number.

Chapter 11

Algebra

Algebra is usually all about writing equations. In this chapter, we'll show you a fool-proof way to write the equations you *need* to write, give you a review of the quadratic formula, and teach you how to do simultaneous equations. Plus, you'll learn two fantastic techniques that will allow you to avoid writing equations on most GMAT questions: *Plugging In* and *Plugging In The Answers* (PITA).

Approximately one-fourth of the problems on the computer-adaptive GMAT Math section involve traditional algebra. Your algebra skills can also be tested by some questions in the Integrated Reasoning section.

In this chapter, we'll show you some powerful techniques that will enable you to solve these problems without using traditional algebra. The first half of this chapter discusses these new techniques. The second half shows you how to do the few algebra problems that must be tackled algebraically.

NOT EXACTLY ALGEBRA: BASIC PRINCIPLES

Algebra is used to come up with general solutions to problems. For example, you might know (for whatever reason) that the price of a new pair of shoes in relation to the cost of a pair of jeans is $3j + 20$, where j is the cost of the jeans. Based on this formula, if you know that the jeans cost \$50, then you know that the shoes cost \$170. But, you also know the cost of the shoes if the jeans cost \$75.

In most algebra problems, you need to find an algebraic expression that matches the description of the relationship given in the problem. For the situation above, the problem might say

At a certain store, the price of a pair of shoes is twenty dollars more than three times the price of a pair of jeans. If the price of a pair of jeans is j dollars at this store, then what is the price, in dollars, of a pair of shoes, in terms of j ?

$20 - 3j$ $3j + 20$ $3j - 20$ $3j + 60$ $20j + 3$ You might consider this question a fairly easy algebra question. To solve it, you might just start translating the phrase “the cost of a pair of shoes is twenty dollars more than three times the cost of a pair of jeans.” But, you need to be careful while doing that. If you get confused about whether you should add 20 or subtract 20, you'll pick the wrong answer. The test-writers have put a lot of thought into the ways that the key statement in the question can be misinterpreted.

So, if it's so easy to make a mistake while doing the algebra, is there a more foolproof way to do this question? Of course! Instead of trying to come up with a general solution—the algebraic approach—let's pick a number and come up with a specific solution. Then, we'll just pick the answer that matches.

We call this approach **Plugging In**. It is perhaps our most powerful math technique and will allow you to solve complicated problems more quickly than you might have ever thought possible. Plugging In is easy. There are three steps involved.

Plugging In

1. Pick numbers for the variables in the problem.
2. Using your numbers, find an answer to the problem. At The Princeton Review, we call this the target answer.
3. Plug your numbers into the answer choices to see which choice equals the answer you found in step 2.

Let's look at the same problem again:

At a certain store, the price of a pair of shoes is twenty dollars more than three times the price of a pair of jeans. If the price of a pair of jeans is j dollars at this store, then what is the price, in dollars, of a pair of shoes, in terms of j ?

$20 - 3j$ $3j + 20$ $3j - 20$ $3j + 60$ $20j + 3$ **Here's How to Crack It**

Let's pick a number for j . Let's say that the jeans cost \$10. (We don't need to worry about being realistic!) In your scratch booklet, write down " $j = 10$ ". We've now transformed the problem from an algebra problem into an arithmetic problem.

Here's what the problem now asks:

At a certain store, the price of a pair of shoes is twenty dollars more than three times the price of a pair of jeans. If the price of a pair of jeans is **10** dollars at this store, then what is the price, in dollars, of a pair of shoes, ~~in terms of j ?~~

You'll notice that we've substituted 10 for the variable j in the original problem. You'll also notice that we've crossed out the phrase "in terms of j ". Once we put a number into the problem, the phrase "in terms of" has no meaning so we can ignore it.

Using \$10 for the price of the jeans, the price of the pair of shoes is \$50. All we did was translate the phrase "the price of a pair of shoes is twenty dollars more than three times the price of a pair of jeans." Three times the price of the pair of jeans is $3 \times \$10 = \30 . Twenty dollars more is just $\$30 + \$20 = \$50$. The numerical answer to our problem is \$50. Write that number down on your noteboard and circle it to indicate that it is your target answers.

Now, you just need to find the answer that matches \$50 when you substitute 10 for j . You should write down A, B, C, D, E on your noteboard and work out each answer choice. Here's what that looks like:

A) $20 - 3j = 20 - 3(10) = -10$

B) $3j + 20 = 3(10) + 20 = 50$

C) $3j - 20 = 3(10) - 20 = 10$

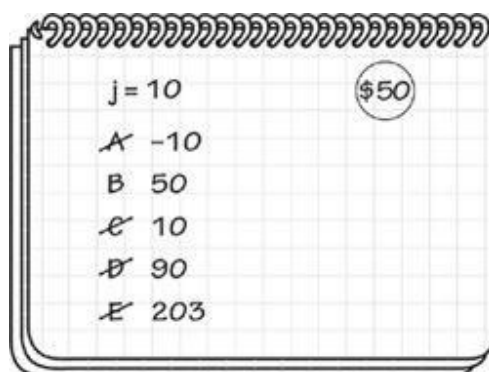
D) $3j + 60 = 3(10) + 60 = 90$

E) $20j + 3 = 20(10) + 3 = 203$

Answer B is the only answer that matches the target answer so it is the answer to this problem. You'll note that we checked all five answer choices. We did that to be sure that we were picking the correct answer.

Scratch Work

The students in our GMAT course learn to automatically do scratch work. When plugging in, always write down the numbers you are plugging in for each variable. Be sure to clearly label the number for each variable by writing down something like $j = 10$. Next, do the work for each step in the problem. When you find the numerical answer to the problem, write that down and circle it. Then, try each of the answer choices, crossing them off as you eliminate them. Here's what your scratch work should have looked like for the last problem:



Why Plug In? Because It Makes Difficult Problems Easy!

You might be thinking, “Wait a minute! It was just as easy to solve this problem algebraically. Why should I plug in?” To see why, let's take a look at another version of the problem.

At a certain store, the price of a pair of shoes is twenty dollars more than three times the price of a pair of jeans and the price of a sweater is fifty percent more than the price of a pair of shoes. If the price of a pair of jeans is j dollars at this store, then what is the price, in dollars, of a pair of shoes, a sweater and a pair of jeans, in terms of j ?

- $1.5j + 10$
 $3j + 20$
 $4.5j + 30$
 $5.5j + 30$
 $8.5j + 50$

Another Reason to Plug In

Plugging numbers into a problem is a much more natural way to think for most folks than algebra. Has anyone ever asked a bartender, “Say, could I get $6x$ of whiskey, where $6x$ equals a standard shot?” The bartender might comply, but you can be sure he’d ask for your car keys first. Complicate the question with y , the ounces of alcohol in a standard shot, and z , the number of ice cubes in the glass, and you’ve got a real headache. Essentially, Plugging In is a matter of putting numbers back into a form that you are used to working with.

Here’s How to Crack It

This version of the problem is wordier and that helps to make it more confusing. Let’s try plugging in. As before, we’ll start by making $j = 10$. So, the jeans cost \$10. Next, we know the relationship between the price of the jeans and the cost of the shoes. The price of the shoes is “twenty dollars more than three times the price of the jeans.” So, the price of the shoes is \$50. Finally, the sweater costs “fifty percent more than the price of the shoes.” So, the sweater is $\$50 + \25 or \$75. So, the cost of all three items is $\$10 + \$50 + \$75 = \135 . Be sure to circle \$135.

Now, it’s time to find the answer that equals 135 when $j = 10$. Choice A is 25, so cross it off. Choice B is 50, so it’s wrong. Choice C is 75, so it’s also wrong. Choice D is 85, so it can be eliminated. Finally, choice E is 135. Choice E matches the target and is the correct answer.

By the way, choice D is what you get if you misread how to calculate the cost of

the sweater. If you were doing the algebra, the cost of the shoes is $3j + 20$. It would be pretty easy to think that the price of the sweater is then $1.5j + 10$, which is fifty percent of the cost of the shoes rather than fifty percent *more*. Of course, you could make this mistake while working with the numbers, too. But, what's easier—to see that \$25 is not more than \$50 or to see that $1.5j + 10$ is not more than $3j + 20$?

To recap, there are two reasons why you'd want to plug in even if you are pretty good at algebra.

Plugging In can make even the hardest algebra problems much easier to solve.

The test writers have thought about all the possible ways you might mess up the algebra while working the problem. If you make one of those mistakes, your answer will be among the answer choices and you'll most likely wind up picking the wrong answer.

What Number Should I Plug In?

While you can plug in any number, you'll find that certain numbers work better than others. Ideally, you want a number that makes it easy to perform the calculations for the problem. For most problems, you can just use small, simple numbers such as 2, 5, or 10. However, you also want numbers that make sense within the context of the problem. For example, for a problem that uses percents, plugging in 100 would be a good idea. Different numbers work for different types of problems. As you practice, you'll get better at picking good numbers—especially if you keep asking yourself “What number will make this problem easy?” You also shouldn't be afraid to change your number if the calculations start to get messy.

What to Plug In

Numbers that make the math easy!

Try small simple numbers such as 2, 5, or 10

Percents? Try 100

Hours or Minutes? 30 or 120

What NOT to Plug In

Avoid using 0 or 1

Numbers in the problem or in the answer choices

Sometimes the best way to select a number is to use a little common sense. Here's an example:

If Jim drives k miles in 50 minutes, how many minutes will it take him to drive 10 miles, at the same rate?

$\frac{500}{k}$

$\frac{k}{500}$

$60k$

$10k$

$\frac{50}{k}$

Here's How to Crack It

GMAC would like you to use the formula $distance = rate \times time$. There are variables in the answer choices, so we can plug in. Since it's a good bet that at least a few of the wrong answers are based on using the formula, let's plug in.

Any number you choose to plug in for k will eventually give you the answer to this problem, but there are some numbers that will make your task even easier.

We need to find a good number for k . Notice that we know that Jim is going to drive 10 miles. Suppose we just made k equal to half of 10? The question now reads:

If Jim drives 5 miles in 50 minutes, how many minutes will it take him to drive 10 miles, at the same rate?

Now the problem is pretty easy. Since Jim is going to drive twice the distance, it's going to take him twice the time. So, the target is 100 minutes. Now, all we need to do is find the answer that matches the target when $k = 5$. Start with answer choice A. Divide 500 by 5 to get 100. Bingo! To double check, plug 5 into the other answer choices as well. None of them match the target.

The answer to this question is choice A.

More Times to Plug In

So far, we've been looking at questions that have explicit variables in both the problem and the answer choices. When you see variables in the problem or answer choices, that's one of the signs to plug in.

However, sometimes GMAC expects you to use algebra to answer a question that doesn't have explicit variables. You can still plug in on these problems. In fact, *you should consider plugging in whenever you feel the urge to do algebra*. The urge to do algebra is the ultimate sign that the problem can be cracked using some form of Plugging In.

Let's take a look at some other ways to Plug In.

Plugging In with Hidden Variables

Some problems have a hidden variable. For these problems, all the calculations are usually based off one item but you don't know the value of that item. There's a simple solution—just plug in a value for the item!

Let's look at an example:

A merchant reduces the original price of a coat by 20 percent for a spring sale. Finding that the coat did not sell, the merchant reduces the spring price by a further 15 percent at the start of the summer. The coat's summer price is what percent of its original price?

- 35%
 64%
 65%
 68%
 80%
 Here's How to Crack It

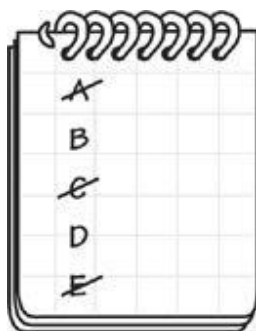
You may have noticed that this problem never gave us the coat's original price. You may have felt the urge to do algebra starting to kick in as you read the problem. For example, you might have started to say to yourself "Well, if the price of the coat is x , then the spring price is ..." That's your sign that you can do this problem as a Plug In! All you need to do is pick a price for the coat.

Let's make the original price of the coat \$100. *When you are solving a percent problem, 100 is a great number to plug in.* The merchant discounts the price of the coat by 20% for the spring sale. Twenty percent of \$100 is \$20, so the spring price is \$80. For the summer, the spring price of the coat is discounted by another 15%. Fifteen percent of \$80 is \$12, making the summer price \$68.

The question asks for the summer price as a percent of the original price. In other words, \$68 is what percent of \$100? 68%. The answer is choice D.

Easy Eliminations

If you were running out of time, you'd need to make a guess. But, you could eliminate some obviously wrong answers first. When you read the problem fast, you might be tempted to think that the overall reduction is $20\% + 15\% = 35\%$ but that's too easy. So, cross off choice A. Choice C is just $100 - 35 = 65$. Also, too easy. Finally, choice E is what you get after the first reduction. The answer is probably B or D.



Another way to tell that you can probably solve a question as a hidden plug in is to look at the answer choices. The answer choices for hidden plug in questions are typically percents, fractions, or sometimes ratios. How can you tell that this problem is a hidden plug in?

At College P, one-fourth of the students are seniors and one-fifth of the seniors major in business. If two-fifths of all students at the college major in business, the business majors who are not seniors are what fraction of all business majors?

-
- $\frac{1}{20}$
-
- $\frac{1}{8}$
-
- $\frac{7}{20}$

$\frac{7}{15}$

$\frac{7}{8}$

It Works for Ratios, Too!

You can also plug in when the answer choices are expressed as ratios. Here's how the same question would be rewritten as a ratio problem.

...what is the ratio of the senior business majors to the business majors who are not seniors?

1:3 1:5 1:7 1:8 7:8 As before, just plug in 100 for the number of students. There are 5 seniors who are business majors and 35 business majors who are not seniors. The ratio is 5:35, which reduces to 1:7. The answer is B.

Here's How to Crack It

You may have noticed that while this problem provides lots of fractions to work with, it never reveals how many students attend College P. Of course, knowing the total enrollment at the college would make solving the problem fairly straightforward. So, before you start setting up equations based on x students at College P, let's plug in a number for the total students.

An easy way to come up with a good number when the problem has fractions is to simply multiply the denominators of the fractions together. In this case, that's $4 \times 5 \times 5 = 100$. Don't worry, by the way, that some of the denominators are not distinct. Multiplying by the extra 5 may help us to avoid getting a result that leads to some fractional part of a student!

So, if there are 100 students at the college, there are 25 seniors and 75 students who are not seniors. Next, you know that one-fifth of the seniors major in business, so that's 5 seniors who are business majors. Since two-fifths of all students are business majors, the college has 40 business majors. Of those 40 business majors, $40 - 5 = 35$ of the business majors are not seniors. So, the fraction of business majors who are not

seniors is $\frac{35}{40} = \frac{7}{8}$. The correct answer is E.

Plugging In the Answers (PITA)

Some algebra questions ask for a numerical answer. GMAC expects you to write an equation, solve it and then pick the answer. However, the person who wrote the problem had to do all of that hard work. So, rather than duplicate all of the work the question writer did, why not just test out the answers to see which one works?

We call this method of solving the problem **Plugging In the Answers** (or PITA for short). You'll find that solving problems this way can save you a lot of time and help you to avoid common algebra mistakes. There are three steps involved when you Plug In the Answers.

Plugging in the Answers

Write down the answers, determine what they represent and label them.

Start with choice C and work the steps of the problem.

Look for some sort of condition that must be met to make the answer correct.

Let's take a look at an example.

At a certain restaurant, the price of a sandwich is \$4.00 more than the price of a cup of coffee. If the price of a sandwich and a cup of coffee is \$7.35, including a sales tax of 5%, what is the price of a cup of coffee, EXCLUDING the sales tax?

\$1.50 \$3.00 \$4.00 \$5.50 \$7.00 **Here's How to Crack It**

If there were no answer choices, you'd be forced to write an equation and solve it. However, because you know the answer must be one of the five provided choices, it will be easier and faster to simply try the answers.

Start by writing down the answers and labeling them as "coffee." Now, start with choice C. If the cup of coffee costs \$4.00, what can you figure out? The problem states that the sandwich costs \$4.00 more than the cup of coffee, so the sandwich is \$8.00. Make a column for "sandwich" and write down \$8.00 next to choice C. You now know that the cost for the sandwich and the cup of coffee is \$12.00. Choice C is too big because the cost for the sandwich and the cup of coffee is only supposed to be \$7.35 including the sales tax. Go ahead and cross off choice C.

Scratchwork

When you Plug In the

Answers, make your scratch-work look like an Excel spreadsheet. Label your columns and put your results for each column next to the answer choice you are checking. Doing so will help you to cut down on mistakes and check subsequent answer choices more quickly.

So far, your work should look like this:

Coffee	Sandwich	Total
A) \$1.50		
B) \$3.00		
C) \$4.00	\$8.00	\$12.00
D) \$5.50		
E) \$7.00		

Now, its time to decide if you need a bigger number or a smaller numbers. It's a pretty easy choice for this problem. Since \$4.00 turned out to be too big, it makes sense to try a smaller number. There's no need to debate over choice A or B. One of them must be correct, so just try choice B. If it works, you're done. If it doesn't, choose choice A and you're still done.

If the cup of coffee costs \$3.00 (choice B), then the sandwich is \$7.00. That would make the total cost for both items \$10.00. That's still too big! The answer must be A.

Here's what the work should look like at this point:

Coffee	Sandwich	Total
A) \$1.50		
B) \$3.00	\$7.00	\$10.00
C) \$4.00	\$8.00	\$12.00
D) \$5.50		
E) \$7.00		

There's really no need to test choice A. However, if the coffee costs \$1.50, then the sandwich costs \$5.50. Together the two items cost \$7.00. The tax on the two items is 5% of \$7.00 or \$0.35. So, the total with tax is \$7.35, which meets the condition stated in the problem. The answer is choice A.

Plugging In the Answers: Advanced Principles

When you solve a problem using Plugging In the Answers (PITA), you'll usually know if you need a bigger or smaller number if choice C didn't work. However, there are times that you won't be sure. Rather than wasting time trying to decide if you need a bigger or smaller number, just pick a new number and try it. You'll actually waste less time testing an extra answer choice or two than you will trying to decide which type of number to try next.

Jim is now twice as old as Fred and two years older than Sam. Four years ago, Jim was four times as old as Sam. How old is Jim now?

- 8 12 16 20 24 **Here's How to Crack It**

This question has numbers in the answers and you probably started to think “Well, if Jim is x years old, then Fred is ...” The urge to do algebra means that it's time to plug in the answers. Start with choice C.

The answers represent possible ages for Jim. If Jim is 16 years old, then Fred is 8 because Jim is twice as old as Fred. Next, you know that Jim is two years older than Sam, so Sam is 6. Now, you need to compare Jim's age and Sam's age four years ago. Four years ago, Jim was 12 and Sam was 2. Remember that there's always a condition in the problem that must be met by the correct answer.

In this case, Jim's age four years ago must be four times that of Sam. Is 12 four times 2? No. So, choice C can be eliminated.

When to Plug In the Answers

There are numbers in the answer choices.

The question asks for a specific amount.

You have the urge to set up and solve an equation.

Here's what your work should look like up to this point.

	Now			4 years ago	
	Jim	Fred	Sam	Jim	Sam
A) 8					
B) 12					
C) 16		8	6	12	2
D) 20					
E) 24					

Now, it's time to choose a bigger or smaller number. But, it isn't really clear which direction to go, is it? So, rather than waste a lot of time trying to figure that out, just pick an answer and try it. If Jim is 20 years old now (choice D), then Fred is 10 and Sam is 8. Four years ago, Jim was 16 and Sam was 4.

Here's what your work should look like.

	Now			4 years ago	
	Jim	Fred	Sam	Jim	Sam
A) 8					
B) 12					
C) 16		8	6	12	2
D) 20		10	18	16	4
E) 24					

Since $4 \times 4 = 16$, the condition in the problem is met. Choice D is the correct answer.

Most of the time, starting at C when doing PITA makes the most sense. By starting at C, you can usually cut down on the number of answer choices that you need to test. However, there can be times when it makes sense to start with a different answer choice.

If x is a positive integer such that $x^2 + 5x - 14 = 0$, what is the value of x ?

- 7 -5 0 2 5 **Here's How to Crack It**

Notice that the question states that x is a positive integer. Don't waste time with choices A, B, or C—cross them off immediately. For this problem, it makes sense to start with choice D. Plug 2 into the equation for x to get $(2)^2 + 5(2) - 14 = 0$. Since the equation is true when $x = 2$, choice D is the correct answer.

Plugging in the Answers Advanced Tips

If you're not sure whether you need a bigger or smaller number, don't waste time. Just pick a new number and try it.

You may be able to eliminate some numbers that are too big or too small before you start plugging in. If you can, just start with the middle number that you have left.

If you have both easy to work with numbers and messy numbers in the answer choices, try the easy to work with numbers first.

Must Be

Some questions will use the words "must be." For example, the question may ask which of the expressions in the answers must be even or must be divisible by 3. These questions can be solved easily by plugging in. However, you'll probably need to plug in at least twice to find the answer.

Here's all you need to do.

Must Be Plugging In

Pick numbers for the variables in the problem. Be sure to satisfy any restrictions for the variables.

Eliminate any answer choices that don't match what you are looking for.

Plug in the most different kind of number you are allowed to try. For example, if you tried an even number, try an odd number.

Repeat until only one answer remains.

Try the ZONEF Numbers

For some 'must be' questions, the different number you need is one of the ZONEF numbers.

These are the numbers that most people forget to think about.

Zero

One

Negatives

Extremes (like 100)

Fractions

If n is a positive integer, which of the following must be even?

- (A) $(n - 1)(n + 1)$
 (B) $(n - 2)(n + 1)$
 (C) $(n - 2)(n + 4)$
 (D) $(n - 3)(n + 1)$
 (E) $(n - 3)(n + 5)$ **Here's How to Crack It**

Start by picking a value for n . How about $n = 2$? Now, evaluate each answer choice. For choice A, the expression equals 3, so cross it off. For choice B, the expression equals 0. Remember that 0 is an even number so keep this answer choice. Keep checking the answers. Choice C is also equal to 0, so keep it as well. Choice D equals -3 . Don't be fooled by the negative sign. Negative integers can also be even or odd. Since -3 is odd, cross this answer off. Choice E equals -7 and can also be kept.

Next, try a new number. Since this problem is about even and odd numbers, it makes sense to try an odd number next. How about $n = 3$? You only need to check the two answers that remain. Choice B equals 4, which is still even. However, choice C now equals 7, so can be eliminated. The correct answer is choice B.

When doing a must be question, it's very helpful to set up your scratchwork so that it looks like a chart. Write down A, B, C, D, E and the actual expressions. Make a new column for each number that you plug in. Be sure to cross off answers as you go.

Here's what the work looks like for this problem.

	$n = 2$	$n = 3$
A) $(n - 1)(n + 1)$	3	
B) $(n - 2)(n + 1)$	0	4
C) $(n - 2)(n + 4)$	0	7
D) $(n - 3)(n + 1)$	-3	
E) $(n - 3)(n + 5)$	-7	

BASIC ALGEBRA

You can solve most GMAT algebra problems using some form of Plugging In. However, there are some questions that you may need to solve using some relatively basic algebra.

Two Simple Rules

Before we review some very specific types of algebra that GMAC likes to test, let's review the two basic rules that are true for any algebraic situation. These two rules are used pretty much any time that you solve a problem algebraically.

Collect like terms. Get all the x 's on one side of the equal sign and all the numbers on the other.

Whatever you do to one side of an equation, you need to do to the other side of the equation. Did you multiply one side by 5? Then, you need to multiply the other side of the equation by 5, as well.

Avoiding Common Errors

We'll add a third rule that you won't find written in any math book.

3. Equations cannot become expressions

If you've ever started working with one side of an equation without writing down both sides of the equation, you've broken this rule. By always writing down both sides of the equation, you can avoid wasting time and making silly mistakes.

Solving Equalities

Even the simplest equalities can be solved by Plugging In the Answers, but it's probably easier to solve a simple equation algebraically. If there is one variable in an equation, isolate the variable on one side of the equation and solve it. Let's try an example of this type, although a question this easy wouldn't actually be seen on the GMAT. This one is just for practice.

The Solvability Rule

You must have at least as many distinct equations as you have variables for the equations to be solvable. That is, if you are trying to figure out what x , y , and z are, you need at least three distinct equations.

If $x - 5 = 3x + 2$, then $x =$

- 8
- $-\frac{7}{2}$
- 7
- $\frac{10}{3}$

$\frac{7}{5}$ **Here's How to Crack It**

Get all of the x 's on one side of the equation. If we subtract x from both sides we have:

$$\begin{array}{r} x - 5 = 3x + 2 \\ -x \quad \quad -x \\ \hline -5 = 2x + 2 \end{array}$$

Now subtract 2 from both sides:

$$\begin{array}{r} -5 = 2x + 2 \\ -2 \quad \quad -2 \\ \hline -7 = 2x \end{array}$$

Finally, divide both sides by 2:

$$\frac{-7}{2} = \frac{2x}{2}$$

$$x = -\frac{7}{2}$$

The answer is choice B.

Solving Inequalities

To solve inequalities, you must be able to recognize the following symbols:

$>$ is greater than $<$ is less than \geq is greater than or equal to \leq is less than or equal to
As with an equation, you can add a number to or subtract a number from both sides of an inequality without changing it; you can collect similar terms and simplify them. In fact, an inequality behaves just like a regular equation except in one way:

If you multiply or divide both sides of an inequality by a negative number, the direction of the inequality symbol changes.

For example,

$$-2x > 5$$

To solve for x , you would divide both sides by -2 , just as you would in an equality. But when you do, the sign flips:

$$\frac{-2x}{-2} < \frac{5}{-2}$$

$$x < -\frac{5}{2}$$

Solving Simultaneous Equations

Simultaneous equations are almost always tested in data sufficiency format on the GMAT. It's impossible to solve one equation with two variables. But if there are two equations, both of which have the same two variables, then it is possible to solve for both variables. An easy problem might look like this:

$$\text{If } 3x + 2y = 6 \text{ and } 5x - 2y = 10, \text{ then } x = ?$$

To solve simultaneous equations, add or subtract the equations so that one of the variables disappears.

$$\begin{array}{r} 3x + 2y = 6 \\ + 5x - 2y = 10 \\ \hline 8x = 16 \\ x = 2 \end{array}$$

Equation Tricks and Traps

$$x + 3y - 7 = x^2(x^{-1}) + y$$

This looks like two variables in one equation, which would mean we need at least one more equation to solve, but look again. Because $x^2(x^{-1}) = x^{(2-1)} = x$, each side of the equation has only one x . The x 's can be subtracted, leaving you with just one variable, y . The equation can be solved.

In more difficult simultaneous equations, you'll find that neither of the variables will disappear when you try to add or subtract the two equations. In such cases you must multiply both sides of one of the equations by some number in order to get the coefficient in front of the variable that you want to disappear to be the same in both equations. This sounds more complicated than it is. A difficult problem might look like this:

$$\text{If } 3x + 2y = 6 \text{ and } 5x - y = 10, \text{ then } x = ?$$

Let's set it up the same way:

$$3x + 2y = 6$$

$$5x - y = 10$$

Unfortunately, in this example, neither adding nor subtracting the two equations gets rid of either variable. But look what happens when we multiply the bottom equation by 2:

$$\begin{array}{rcl} 3x + 2y = 6 & \text{or} & 3x + 2y = 6 \\ (2)5x - (2)y = (2)10 & & + 10x - 2y = 20 \\ & & \hline & & 13x \quad = 26 \quad x = 2 \end{array}$$

Quadratic Equations

On the GMAT, quadratic equations always come in one of two forms: factored or expanded. Here's an example:

$$\begin{array}{cc} \text{factored} & \text{expanded} \\ (x + 2)(x + 5) & = x^2 + 7x + 10 \end{array}$$

The first thing to do when solving a problem that involves a quadratic equation is to see which form the equation is in. If the quadratic equation is in an unfactored form, factor it immediately. If the quadratic equation is in a factored form, unfactor it. The test writers like to see whether you know how to do these things.

To unfactor a factored expression, just multiply it out using FOIL (First, Outer, Inner, Last):

$$\begin{aligned} (x+2)(x+5) &= \overset{\text{F}}{\curvearrowright} (x+2) \overset{\text{O}}{\curvearrowright} (x+5) \\ &\quad \underset{\text{I}}{\curvearrowleft} \underset{\text{L}}{\curvearrowleft} \\ &= (x \text{ times } x) + (x \text{ times } 5) + (2 \text{ times } x) + (2 \text{ times } 5) \\ &= x^2 + 5x + 2x + 10 \\ &= x^2 + 7x + 10 \end{aligned}$$

To factor an unfactored expression, put it into the following format and start by looking for the factors of the first and last terms.

$$\begin{aligned} x^2 + 2x - 15 \\ = (\quad) (\quad) \end{aligned}$$

For the first term of the unfactored expression to be x^2 , the first term of each parentheses of the factored expression has to be x .

$$\begin{aligned} x^2 + 2x - 15 \\ = (x \quad) (x \quad) \end{aligned}$$

For the last term of the unfactored expression to be 15, the last term in each parentheses of the factored expression must be either 5 and 3 or 15 and 1. Since there is no way to get a middle term for the unfactored expression with a coefficient of 2 if the terms were 15 and 1, we are left with

$$\begin{aligned} x^2 + 2x - 15 \\ = (x - 5)(x + 3) \end{aligned}$$

To decide where to put the pluses and minuses in the factored expression, look to see how the inner and outer terms of the factored equation would combine to form the middle term. If we put a minus in front of the 5 and a plus in front of the 3, then the middle term would be $-2x$ (not what we wanted). Therefore, the final factored expression looks like this

$$\begin{aligned} x^2 + 2x - 15 \\ = (x + 5)(x - 3) \end{aligned}$$

Quadratic equations are usually set equal to 0. Here's an example:

What are all the values of x that satisfy the equation $x^2 + 4x + 3 = 0$?

-3 -1 -3 and -1 3 and 4 4 **Here's How to Crack It**

This problem contains an unfactored equation, so let's factor it.

$$x^2 + 4x + 3 = 0$$

$$(x \quad)(x \quad) = 0$$

$$(x - 3)(x - 1) = 0$$

$$(x + 3)(x + 1) = 0$$

In order for this equation to be correct, x must be either -3 or -1 . The correct answer is choice C.

Note: This problem would also have been easy to solve by Plugging In The Answers. It asked a specific question, and there were five specific answer choices. One of them was correct. All you had to do was try the choices until you found the right one. Bear in mind, however, that in a quadratic equation there are usually two values that will make the equation work.

The Equation Rule

You must have as many equations as you have variables for the data to be sufficient. For example, $x = y + 1$ cannot be solved without another *distinct* equation.

Favorites of GMAT Test Writers

There are three types of quadratic equations the GMAT test writers find endlessly fascinating. These equations appear on the GMAT with great regularity in both the problem-solving format and the data-sufficiency format:

$$(x + y)^2 = x^2 + 2xy + y^2$$

$$(x + y)(x - y) = x^2 - y^2$$

$$(x - y)^2 = x^2 - 2xy + y^2$$

Memorize all three of these. As with all quadratic equations, if you see the equation in factored form, you should immediately unfactor it; if it's unfactored, factor it immediately. Here's an example:

If $\frac{x^2 - 4}{x + 2} = 5$, then $x =$

- 3
 5
 6
 7
 9
 Here's How to Crack It

It is unfactored, so let's factor it:

$$\frac{(x+2)(x-2)}{(x+2)} = 5$$

The $(x + 2)$ s cancel out, leaving us with $(x - 2) = 5$. So $x = 7$, and the answer is choice D.

Summary

Most of the algebra problems on the GMAT are simpler to solve *without* algebra, using two Princeton Review techniques: **Plugging In** and **Plugging In The Answers**.

Plugging In is easy. There are three steps: Pick numbers for the variables in the problem. (Write them down in your scratch booklet.) Using your numbers, find an answer to the problem. (Write that answer down and circle it.) Plug your numbers into the answer choices to see which choice equals the answer you found in the previous step.

When you plug in, try to choose convenient numbers—those that are simple to work with and make the problem easier to manipulate.

When you plug in, avoid choosing 0, 1, or a number that already appears in the problem or in the answer choices.

On problems with variables in the answers that contain the words “must be” or “could be,” you may have to plug in more than once to find the correct answer.

Plugging In The Answers is easy. There are three steps: Always start with answer choice C. Plug that number into the problem and see whether it makes the problem work. If choice C is too small, try the next larger number. If choice C is too big, try the next smaller number. If you’re not sure which way to go, don’t sweat it. Just pick a direction and try it out!

If you see a problem with a quadratic equation in factored form, the easiest way to get the answer is to expand the equation immediately. If the equation is expanded, factor it immediately.

Memorize the factored and expanded forms of the two most common quadratic equations on the GMAT: $(x + y)^2 = x^2 + 2xy + y^2$

$$(x + y)(x - y) = x^2 - y^2$$

On problems containing inequalities, remember that when you multiply or divide both sides of an inequality by a negative number, the sign flips.

In solving simultaneous equations, add or subtract one equation to or from another so that one of the two variables disappears.

Chapter 12

Applied Arithmetic

Applied arithmetic involves knowing how to solve word problems involving rate and work, functions, probability, permutations, and combinations. In this chapter, we cover the important facets of each type of problem and show you how they appear on the GMAT.

It's time to look at some applied arithmetic subjects that the GMAT test writers love to use. In this chapter, we'll cover

Rate problems

Work problems

Function problems

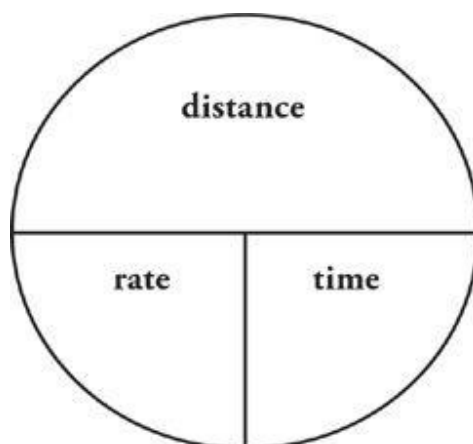
Probability problems

Permutation and Combination problems

RATE PROBLEMS

Any problem that mentions planes, trains, cars, bicycles, distance, miles per hour, or any other travel-related terminology is asking you to solve a rate problem. You may remember that you can use the formula $distance = rate \times time$ to solve these types of problems.

We're going to use a **rate pie** to keep track of the information in a rate problem. Here's what it looks like:



Two Out of Three Ain't Bad

For Data Sufficiency problems, as soon as you have two of the pieces of the rate pie, you have sufficient information to find the other piece.

If a problem gives you the rate and time, the pieces on the bottom, you multiply to get the distance. If you have the distance, the piece on the top, and one of the pieces on the bottom, you divide to get the other bottom piece. As soon as you know that you are dealing with a rate problem, draw a rate pie and start filling in what you know.

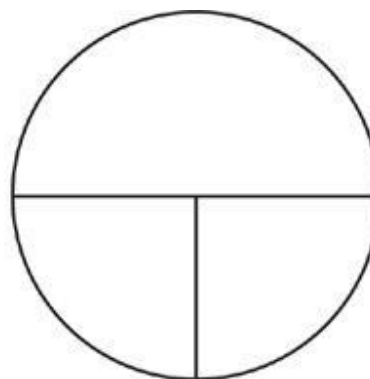
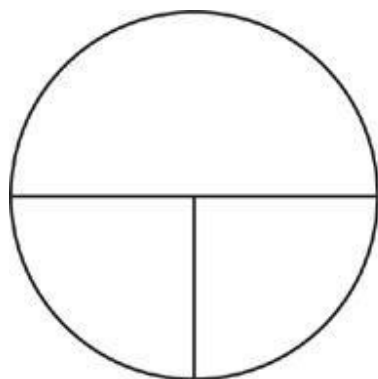
The rate pie is really just a different way of writing the $distance = rate \times time$ formula. It works well for GMAT problems, however, because GMAT problems often involve multiple steps. So, the pie helps you to see what information you have and what you need to find.

Let's try a problem:

Pam and Sue drove in the same car to a business meeting that was 120 miles away. Pam drove to the meeting at 60 miles per hour and Sue drove back, along the same route, at 50 miles per hour. How many more minutes did it take Sue to travel the distance than it took Pam?

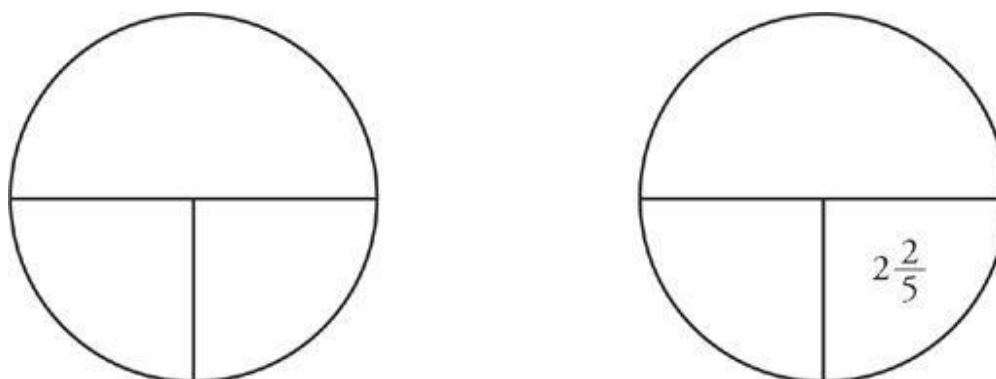
- 4 10 20 24 30 **Here's How to Crack It**

Since the problem deals with rates, you need a rate pie. In fact, since there is rate information for both Pam and Sue, you need two rate pies—one for Pam and one for Sue.



Once you draw the pies, you can transfer the information that you know to each pie. Since Pam and Sue drove along the same route, the distance is 120 miles for each pie. Pam's rate is 60 miles per hour and Sue's rate is 50 miles per hour. Transfer that information to the pies, too.

To use the pie, remember that if you have the piece at the top and one of the pieces on the bottom, you divide to find the other piece. So, Pam's time is $120 \div 60 = 2$ and Sue's time is $120 \div 50 = 2\frac{2}{5}$. The pies made it easy to see how to find the time for each driver.



The problem asks how many more minutes it took Sue to drive the distance than it took Pam. Start by subtracting $2\frac{2}{5} - 2 = \frac{2}{5}$ to find that it took Sue $\frac{2}{5}$ of an hour longer. Now, just convert to minutes: $60 \times \frac{2}{5} = 24$. The answer is choice D.

Now, let's look at a slightly harder problem:

Fred and Sam are standing 45 miles apart and they start walking in a straight line toward each other at the same time. If Fred walks at a constant 4 miles per hour and Sam walks at a constant 5 miles per hour, how many miles has Sam walked when they meet?

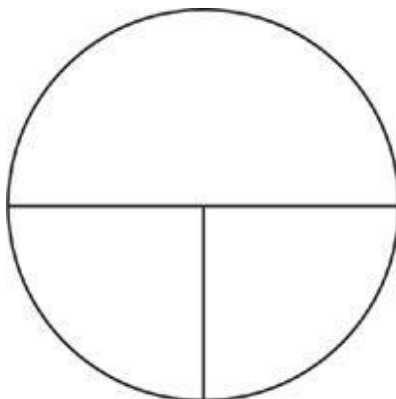
- 5 9 25 30 45

Easy Eliminations

Choices A and E are unlikely because they are numbers in the problem. Choice B is just $45 \div 5$, which is Fred's time to walk the whole distance.

Here's How to Crack It

Since the problem is about rates, draw a rate pie. In this case, you may be wondering if you need one pie or two. You actually need one. Here's why: When dealing with rates, it is often helpful to think about what happens in a certain amount of time like an hour. In one hour, Fred walks 4 miles and Sam walks 5 miles. Since they are walking toward each other in a straight line, they have covered 9 miles of the distance between them at the end of an hour. Wait! Nine miles in an hour? That means that their combined rate is 9 miles per hour. That's what goes on the pie for the rate.

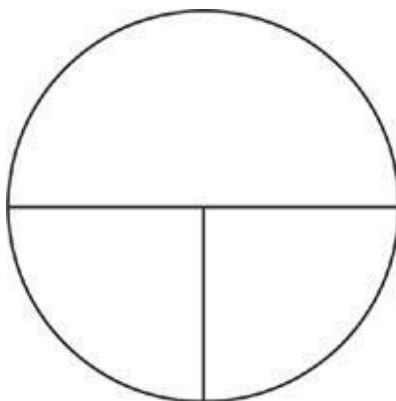


Here's A Tip!

When two items travel in a straight line toward each other, you can add their rates.

The other piece that you could fill in on the pie from the problem was the distance, 45 miles. Then, use the pie to find that Fred and Sam walk for 5 hours before they meet. (Remember that you divide the top piece of the pie by one of the pieces on the bottom to find the other bottom piece.)

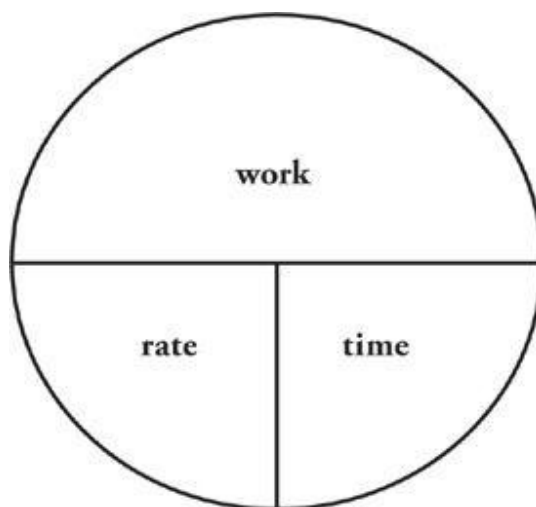
The problem wants to know how many miles Sam had walked when he met Fred. So, set up one more pie. This time you know Sam's rate, 5 miles per hour, and you know that he walked for 5 hours.



So, Sam walks 25 miles when he meets Fred. The answer is choice C.

WORK PROBLEMS

Work problems are a type of rate problem. Rather than asking about a distance, these problems ask about a job or a part of a job. You can use a variation of the rate pie to solve these problems. Here's what it looks like:



All that changes is that *work* replaces *distance* at the top of the pie. You use the **work pie** in the same way as the rate pie.

Working at a constant rate, Sam can finish a job in 3 hours. Mark, also working at a constant rate, can finish the same job in 12 hours. How many hours does it take Mark and Sam to finish the job if they work together each at his respective, constant rate?



1



$\frac{2}{5}$

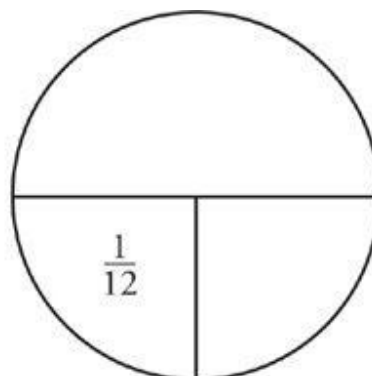
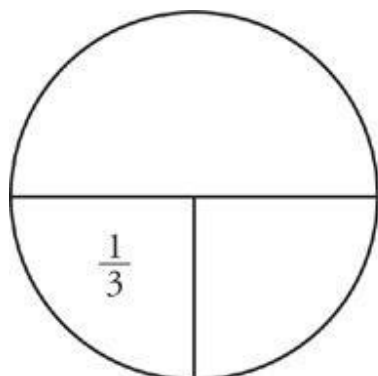


$\frac{5}{8}$



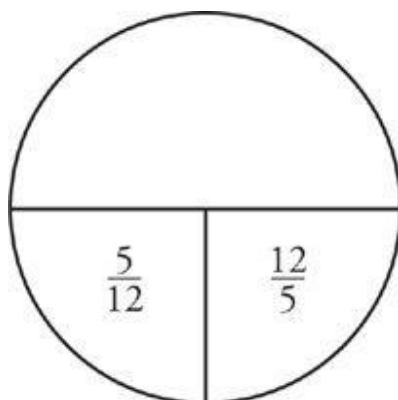
$\frac{1}{4}$

- 4 Since the problem mentions a job being completed, you can use a work pie. You'll actually need two pies for the first step of the problem since you'll want to find each worker's individual rate. Once you draw your pies, you can put each worker's time on the pie. You can also put 1 for the work since they each complete 1 job.



So, Sam's rate is $\frac{1}{3}$ and Mark's rate is $\frac{1}{12}$. What does that mean? Well, it means that Sam completes $\frac{1}{3}$ of the job every hour while Mark completes $\frac{1}{12}$ of the job every hour.

To finish the problem, note that Mark and Sam work together. Since they are working together, you can combine their rates to find that they complete $\frac{1}{3} + \frac{1}{12} = \frac{5}{12}$ of the job every hour. When people work together, you can combine their rates. Now, set up one more work pie. Use 1 for the amount of work and $\frac{5}{12}$ for the rate.



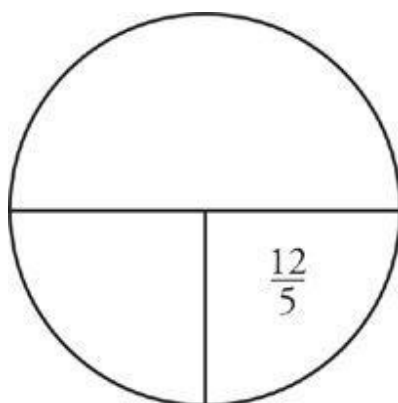
Divide the amount of work by the combined rate to find that the time to complete the job is $1 \div \frac{5}{12} = \frac{12}{5} = 2\frac{2}{5}$ hours. The correct answer is B.

Same Problem, Different Approach

Another way to look at this problem is to realize that the actual job is never specified. But, wouldn't the problem be much easier to solve if you knew how many of something Sam and Mark needed to make? In other words, this problem can be approached as a Plug In.

Suppose that Sam and Mark were making widgets. Let's say that the complete job is to make 24 widgets. If Sam finishes the job in 3 hours, then he makes 8 widgets per hour. If Mark finishes the job in 12 hours, he makes 2 widgets per hour. Working together, they make $8 + 2 = 10$ widgets per hour.

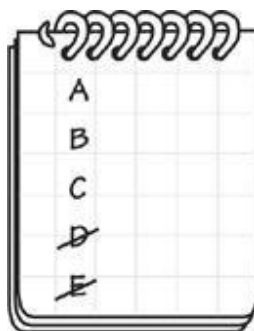
Now, let's set the last step up using a work pie.



Again, it takes them $\frac{12}{5} = 2\frac{2}{5}$ hours to complete the job. The answer is choice B.

Easy Eliminations

It stands to reason that two men working together would take less time to finish a job than they would if each of them worked alone. Because Sam, working alone, could finish the job in 3 hours, it must be true that the two of them, working together, could do it in less time. The answer to this question has to be less than 3. Therefore we can eliminate answer choices D and E.

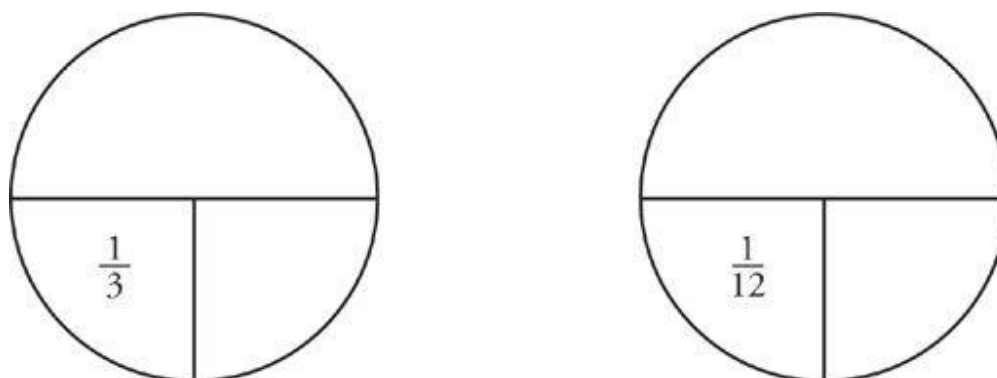


Here's a slightly harder version of the problem above:

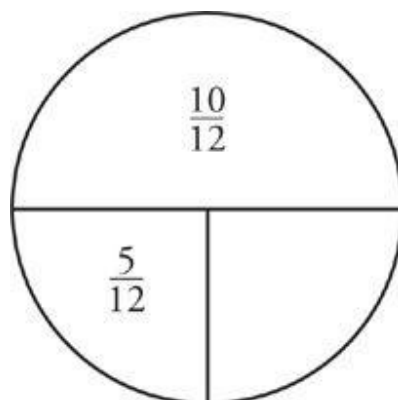
Working at a constant rate, Sam can finish a job in 3 hours. Mark, also working at a constant rate, can finish the same job in 12 hours. If they work together for 2 hours, how many minutes will it take Sam to finish the job, working alone at his constant rate?

- 5
 20
 30
 60
 120
 Here's How to Crack It

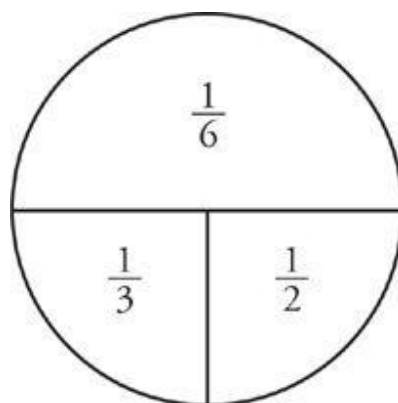
This problem starts in the same way so you can use the same work pies to find each worker's rate.



Now, you need a new pie. For this pie, you know the combined rate, $\frac{1}{3} + \frac{1}{12} = \frac{5}{12}$, and that they work together for two hours.



So, you now know that $\frac{5}{12} \times 2 = \frac{10}{12} = \frac{5}{6}$ of the job has been completed when Mark goes home. Sam must finish $\frac{1}{6}$ of the job on his own. Of course, you know Sam's rate, so just set up one last work pie.



To find the time for Sam to finish the job, use the pie to find that $\frac{1}{6} \div \frac{1}{3} = \frac{1}{2}$ or 30 minutes. The correct answer is C.

FUNCTIONS

You know you've hit a function problem by the sensation of panic and fear you get when you see some strange symbol (\$ or # or * or Δ) and say, "I studied for two months for this test and somehow managed to miss the part where they told me about # or * or Δ." Relax. Any strange-looking symbol on the GMAT is just a function, and on this test, functions are easy.

**Functions?
No Problem**

If you can follow a recipe, you can do a GMAT function problem. Because function questions freak so many people out, they often show up in the medium to difficult area of a section. If you can become comfortable with function problems, you'll pick up a point on a question that you might otherwise feel tempted to guess on.

A function is basically a set of directions. Let's look at an example:

$$\frac{\Delta 30}{\Delta(-5)}$$

If $\Delta x = x$ for $x \geq 0$ and $2x$ for $x < 0$, $\frac{\Delta 30}{\Delta(-5)} =$

- 12 -6 -3 6 30 **Here's How to Crack It**

A function is basically a set of directions. In this case, the directions tell you what to do with the number that comes after the symbol Δ . If the number that follows the symbol is greater than or equal to 0, then the output of the function is just the number x . However, if the number that follows the symbol is negative, the output of the Δ function is $2x$. So, we can evaluate the given expression thus:

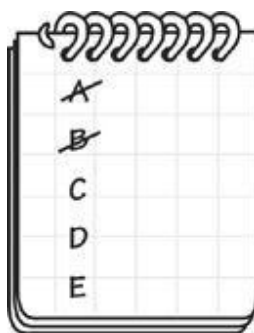
$$\frac{\Delta 30}{\Delta(-5)} = \frac{30}{2(-5)} = \frac{30}{-10} \text{ or } -3. \text{ The answer is choice C.}$$

Easy Eliminations

Joe has no idea what to do with Δ , so he just ignores it. Because $\frac{30}{-5} = -6$, Joe picks answer choice B. On the other hand, Joe might also think he can reduce functions. In other words, he might think he could do this:

$$\frac{\Delta 30}{\Delta(-5)} = \Delta(-6)$$

The function of $-6 = -12$, so Joe might also select answer choice A.



You may remember seeing a different notation for functions in school. The standard math notation for functions is $f(x)$ —pronounced f of x —and the GMAT test writers will sometimes ask function questions using this notation, too.

Let's look at an example.

For which of the following functions is $f(x) = f(-x)$ for all values of x ?

- $f(x) = x^3 + 3$
 $f(x) = -x$
 $f(x) = 2x + 3$
 $f(x) = -x^2 + 2$
 $f(x) = 5x - 4$

Working with $f(x)$

When you see $f(x)$, all you need to remember is that the number inside the parentheses gets plugged into the expression on the right of the equal sign. The output of a function is a y -value. So, $y = f(x)$ means that x values go into the function and y values come out.

Here's How to Crack It

Plug in a value for x and use that value to see if $f(x) = f(-x)$ for each of the functions in the answer choices. So, for example, look at answer A if $x = 2$. Does $(2)^3 + 3 = (-2)^3 + 3$? No, so eliminate answer A.

Only for answer D does $f(2) = f(-2)$. In this case, $f(2) = -(2)^2 + 2 = -2$ and $f(-2) = -(-2)^2 + 2 = -2$. So, D is the correct answer.

PROBABILITY

Probability, Part 1

Just the word is enough to cause math-phobes to run for the exits—but, at least as it appears on the GMAT, probability really isn't all that bad. Check out the easy example below:

A six-sided die, with faces numbered one through six is rolled once. What is the probability that the face numbered 2 is facing upward?

Well, of course, there's only one possibility of this happening, and there are six possible outcomes, so there's a one-in-six chance. In essence, this is all that probability is about. On the GMAT, probability is usually expressed as a fraction: The total number of possibilities is always the denominator. The number of possibilities that match what you

want is the numerator. In the example above, that translates to $\frac{1}{6}$.

$$\text{Basic probability formula} = \frac{\text{number of outcomes you want}}{\text{total number of possible outcomes}}$$

Let's make this example a little harder:

A six-sided die with faces numbered one through six is rolled once. What is the probability that either the face numbered two or the face numbered three is facing up?

The total number of possible outcomes (the denominator) is still the same: 6. But the numerator is different now. There are two possibilities that would match what we

want, so the numerator becomes 2. The probability is $\frac{2}{6}$, or $\frac{1}{3}$.

Let's make the example a little harder still.

A six-sided die with faces numbered one through six is rolled twice. What is the probability that the face numbered 2 is facing up after both rolls?

Obviously, the odds of this happening are much smaller. How do you figure out the probability of something happening over a series of events? It's actually pretty easy. To find the probability of a series of events, you multiply the probabilities of each of the

individual events. Let's start with the first roll of the die. We already figured out that the probability of the die landing with its "2" side facing up on a single toss is $\frac{1}{6}$. Now, let's think about the second toss. Well, actually, the probability of this happening on the second toss is exactly the same: $\frac{1}{6}$.

However, to figure out the probability of the "2" side facing upward on *both* tosses, you multiply the first probability by the second probability: $\frac{1}{6} \times \frac{1}{6} = \frac{1}{36}$.

The probability that A **and** B will both happen: $A \times B$

Here's an example of a moderately difficult GMAT problem.

There are 8 job applicants sitting in a waiting room—4 women and 4 men. If 2 of the applicants are selected at random, what is the probability that both will be women?

-
- $\frac{1}{4}$
-
- $\frac{3}{7}$
-
- $\frac{1}{4}$
-
- $\frac{3}{14}$
- $\frac{1}{10}$

Here's How to Crack It

Let's take the first event in the series. The total number of possibilities for the first selection is 8, because there are 8 applicants in the room. Of those 8 people, 4 are

women, so the probability that the first person chosen will be a woman is $\frac{4}{8}$, or $\frac{1}{2}$. You might think that the probability would be exactly the same for the second choice (in which case you would multiply $\frac{1}{2} \times \frac{1}{2}$ and choose answer choice C), but in fact, that's not true. Let's consider: The first woman has just left the room, and they are about to choose another applicant at random. How many total people are now in the room? Aha! Only 7. And how many of those 7 are women? Only 3. So the probability that the second choice will be a woman is actually only $\frac{3}{7}$, which is choice B. But we aren't done yet. We have to figure out the probability that BOTH choices in this series of two choices will be women. The probability that the first will be a woman is $\frac{1}{2}$. The probability that the second will be a woman is $\frac{3}{7}$. The probability that they both will be women is $\frac{1}{2} \times \frac{3}{7}$, or $\frac{3}{14}$. The answer is choice D.

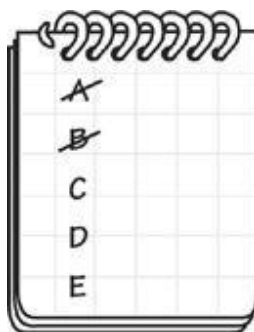
Admissions Insight
No. 6: Letters of Recommendation, Part 1

Most MBA programs require two to three letters of recommendation. The best recommendations are from people who know you well in a professional capacity and can discuss the same points you have already made in your essays.

Unlike admissions committees for other graduate programs, MBA admissions committees generally prefer professional recommendations to academic ones.

Easy Eliminations

The GMAT test writers like to see if they can trick you into picking partial answers—i.e., numbers that you get in the course of solving a problem that are not quite the final answer. The probability that the first choice will be a woman is $\frac{1}{2}$, choice A—but does it feel like you’ve done enough work to “deserve” to get this problem right yet? Nope—this is only an intermediate step. The probability that the second choice will be a woman is $\frac{3}{7}$, choice B. But again, this is just another intermediate step. Don’t fall for these trick choices—cross off choices A and B.



Probability, Part 2: One Thing or Another

So far, we’ve been dealing with the probability of one event happening and then another event happening (for example, in that last problem, the first event was choosing a female job applicant; the second event was choosing ANOTHER female job applicant). But what if you are asked to find the probability of either one thing OR another thing happening? To solve this type of problem, you simply add the probabilities. Note that pure versions of these ‘or’ problems are incredibly rare on the GMAT. Understanding the idea can be helpful on other problems, however.

The probability that A **or** B will happen: $A + B$

Here’s an example:

Sally and Sam are watching a magician perform with 16 of their friends. If the magician chooses one child at random to assist with a trick, what is the probability that either Sally or Sam is chosen?

Here’s How To Crack It

By this point, you should have no problem figuring out that the probability of $\frac{1}{18}$ Sally being chosen is $\frac{1}{18}$. And the probability of Sam being chosen? That's right: $\frac{1}{18}$. So what is the probability of Sally or Sam being chosen?

$$\frac{1}{18} + \frac{1}{18} = \frac{2}{18} \text{ or } \frac{1}{9}$$

Probability, Part 3: The Odds That Something Doesn't Happen

But what if you are asked to find the probability that something will NOT happen? Well, think of it this way: If the probability of snow is 70% or $\frac{7}{10}$, what's the probability that it won't snow? That's right: 30% or $\frac{3}{10}$. To figure out the probability that something won't happen, simply figure out the probability that it WILL happen, and then subtract that fraction from 1.

$$\text{WON'T} = 1 - \text{WILL}$$

Here's an example:

Sally and Sam are watching a magician perform with 16 of their friends. If one child is chosen at random to assist with a trick, what is the probability that neither Sally nor Sam is chosen?

Here's How to Crack It

As we already know, the probability that Sally will be chosen is $\frac{1}{18}$. The probability that Sam will be chosen is also $\frac{1}{18}$. So what is the probability that neither Sally nor Sam will be chosen?

$$1 - \frac{2}{18} = \frac{16}{18} = \frac{8}{9}$$

Probability, Part 4: The Odds That at Least One Thing Will Happen

What if the problem asks the probability of something happening at least once? To calculate the probability of at least one thing happening, just use this equation: The probability of what you WANT to happen plus the probability of what you DON't want to happen equals one.

$$\text{WILL} = 1 - \text{WON'T}$$

Here's an example:

Nine boys and nine girls are watching a magician perform. Four times during the performance a child is chosen at random to assist with a trick. If any of the children can be chosen to assist with each of the four tricks, what is the probability that at least one girl is chosen?

Here's How to Crack It

To find out the odds of at least one girl being chosen, let's begin by figuring out the odds that a girl isn't chosen. The magician will make a total of four choices. What are the odds that the magician will not pick a girl in the first round? If you said $\frac{9}{18}$ or $\frac{1}{2}$, you are doing just fine. And what are the odds that the magician will not pick a girl the second, third, and fourth round? Each time, the odds of not picking a girl stay the same, because the children are returned to the pool of possible candidates, so each time the odds will be $\frac{9}{18}$ or $\frac{1}{2}$. The probability of not picking a girl all four times is:

$$\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{16}$$

But we aren't done. The probability of a girl being picked at least once is 1 minus the probability that she will not be picked. So the correct answer is:

$$1 - \frac{1}{16} = \frac{15}{16}$$

PERMUTATIONS AND COMBINATIONS

In general, permutation and combination problems tend to show up as medium-hard to hard problems on the GMAT.

Here's a very simple example of a combination problem:

At a restaurant, you must choose an appetizer, a main course, and a dessert. If there are 2 possible appetizers, 3 possible main courses, and 5 possible desserts, how many different meals could you order?

- 60 30 10 6 3 **Here's How to Crack It**

You could just carefully write down all the different combinations:

Shrimp cocktail with meatloaf with cherry pie

Shrimp cocktail with meatloaf with ice cream

Shrimp cocktail with meatloaf with...

You get the idea. But first of all, this is too time-consuming, and second of all, there's a much easier way.

For a problem that asks you to choose a number of items to fill specific spots, when each spot is filled from a different source, all you have to do is multiply the number of choices for each of the spots.

So, because there were 2 appetizers, 3 main courses, and 5 possible desserts, the total number of combinations of a full meal at this restaurant would be $2 \times 3 \times 5$, or 30. The answer is choice B.

Permutations: Single Source, Order Matters

The same principle applies when you're choosing from a group of similar items—with one slight wrinkle. Take a look at this easy permutation problem:

Three basketball teams play in a league against each other. At the end of the season, how many different ways could the 3 teams end up ranked against each other?

- 1 3 6 36 72 **Here's How to Crack It**

You could just carefully write down all the different combinations. If we call the three teams A, B, and C, then here are the different ways they could end up in the standings:

ABC ACB BAC BCA CAB CBA

**Admissions Insight
No. 7: Letters of
Recommendation, Part 2**

What to give to your
recommenders:

- 1) Background information about yourself, such as a resumé or statement of purpose, plus talking points (if appropriate) to get them started
- 2) A list of schools to which you're applying
- 3) Stamped envelopes already addressed to the schools
- 4) The recommendation deadlines for each of the schools
- 5) A thank-you note, mailed after the letters are submitted

In general, it is best to waive your right to see the recommendations, because this will give the schools more confidence in their veracity.

But again, this approach is time-consuming (even more so for more difficult problems). As you probably suspected, there's a simpler and faster way to solve this problem.

For a problem that asks you to choose from the same source to fill specific spots, all you have to do is multiply the number of choices for each of the spots—but the number of choices keeps getting smaller.

Let's think for a moment about how many teams could possibly end up in first place. If you said 3, you're doing just fine.

Now, let's think about how many teams could finish second. Are there still 3 possibilities? Not really, because one team has already finished first. There are, in fact, only 2 possible teams that could finish second.

And finally, let's think about how many teams could finish third. In fact, there is only 1 team that could finish third.

To find the number of different ways these teams could end up in the rankings, just multiply the number of choices for first place (in this case, 3) times the number of choices for second place (in this case, 2) times the number of choices for third place (in this case, 1).

$$3 \times 2 \times 1 = 6$$

The correct answer is choice C.

In general, no matter how many items there are to arrange, you can figure out the number of permutations of a group of n similar objects with the formula:

$$n(n - 1)(n - 2)\dots \times 3 \times 2 \times 1, \text{ or } n!$$

So if there were 9 baseball teams, the total number of permutations of their standings would be $9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$, also sometimes written as $9!$ If 4 sailboats sailed a race, the total number of permutations of the orders in which they could cross the finish line would be $4 \times 3 \times 2 \times 1$, also sometimes written as $4!$

Single Source, Order Matters but Only for a Selection

The problems we've shown you so far were necessary to show you the concepts behind permutation problems—but were much too easy to be on the GMAT. Here's a

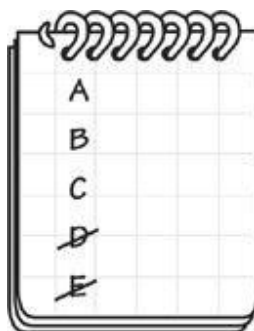
problem that would be more likely to appear on the test:

Seven basketball teams play in a league against each other. At the end of the season, how many different arrangements are there for the top 3 teams in the rankings?

- 6
 42
 210
 5,040
 50,450

Easy Eliminations

If you were to see this problem on the computer-adaptive section of the actual GMAT, you should first stop and give yourself a pat on the back, because it means you're doing pretty well—permutation and combination problems usually only show up only among the more difficult problems. But after you've congratulated yourself, stop and think for a moment. Could the answer to this difficult problem simply be a matter of finding $7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$, choice D? Too easy. Because the question is asking for the permutations for only 3 of the 7 slots, the number must be less than that. So get rid of choices D and E.



Here's How to Crack It

To find all the possible permutations of the top 3 out of 7 baseball teams, simply multiply the number of combinations for each spot in the standings. How many teams are possibilities for the first place slot? If you said 7, you're right. How about for the second slot? Well, one team is already occupying the first place slot, so there are only 6 contenders left. And for the third place slot? That's right: 5.

So, the correct answer is $7 \times 6 \times 5 = 210$, or choice C.

In general, no matter how many items there are to arrange, you can figure out the number of permutations of r objects chosen from a set of n objects with the formula:

$$n(n - 1)(n - 2) \dots \times (n - r + 1)$$

So if there were 9 baseball teams (n), the total number of permutations of the top 4 teams (r) would be $9 \times 8 \times 7 \times 6$. If 4 sailboats sailed a race (n), the total number of

permutations of the first 3 boats to cross the finish line (r) would be $4 \times 3 \times 2$. Here is another way to write this same formula:

$$\frac{n!}{(n-r)!}$$

(where n = total items and r = the number selected)

$$\frac{9 \times 8 \times 7 \times 6 \times 5!}{5!}$$

Because $9 \times 8 \times 7 \times 6$ is the same as $5!$

Combinations: Single Source, Order Doesn't Matter

In the previous problems, the order in which the items are arranged actually matters to the problem. For example, if the order in which the three teams finish a season is Yankees, Red Sox, Orioles—that's entirely different than if the order were Red Sox, Yankees, Orioles, especially if you're from Boston.

Not Sure If It's a Permutation or a Combination Problem?

Here's a good clue:

Permutation problems usually ask for "arrangements." Combination problems usually ask for "groups."

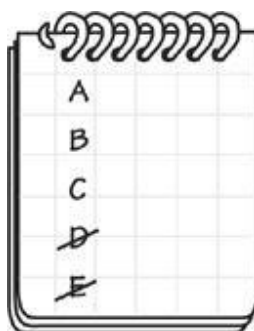
But combination problems don't care about the order of the items.

Six horses are running in a race. How many different groups of horses could make up the first 3 finishers?

- 6 18 20 120 720

Easy Eliminations

If we cared about the order in which the top 3 horses finished the race, then the answer would be the number of permutations: $6 \times 5 \times 4$, or 120. But in this case, we only care about the number of *unique* permutations, and that means the number will be smaller because we don't have to count the set of, for example, (Secretariat, Seattle Slew, and Affirmed) and the set of (Seattle Slew, Secretariat, and Affirmed) as two different permutations. If the correct answer must be smaller than 120, then we can eliminate choices D and E—they're too big.



Here's How to Crack It

To find the number of combinations, first find the number of permutations. If 6 horses run in the race, and we are interested in the top 3 finishers, then the number of permutations would be $6 \times 5 \times 4$, or 120. But if we don't care about the order in which they finished, then a bunch of these 120 permutations turn out to be duplicates.

How many? Let's think of one of those permutations. Let's say the first 3 finishers were Secretariat, Seattle Slew, and Affirmed. How many different ways could we arrange these 3 horses? If you said 6, you're thinking like a permutation master. There are $3!$, or $3 \times 2 \times 1$ permutations of any 3 objects. So, of those 120 permutations of the top 3 horses, each combination is being counted $3!$, or 6 times. To find the number of combinations, we need to divide 120 by 6. The correct answer is choice C.

In general, no matter how many items there are to arrange, you can figure out the number of combinations of r objects chosen from a set of n objects with the formula:

$$\frac{n(n-1)(n-2)\dots \times (n-r+1)}{r!}$$

So if there were 9 baseball teams, the total number of combinations of the top 4 teams would be:

$$\frac{9 \times 8 \times 7 \times 6}{4 \times 3 \times 2 \times 1}$$

Another way to write this same formula is:

$$\frac{n!}{r!(n-r)!}$$

because $\frac{9 \times 8 \times 7 \times 6}{4 \times 3 \times 2 \times 1}$ is the same as $\frac{9 \times 8 \times 7 \times 6 \times 5!}{(4 \times 3 \times 2 \times 1) \times 5!}$

Summary

Rate problems and work problems can be solved using your handy rate or work pies.

The key to work problems is to think about how much of the job can be done in one hour. But remember, it is often easier to simply plug in.

A function problem may have strange symbols like \$, Δ, or *, but it is really just a set of directions.

Probability problems can be solved by putting the total number of possibilities in the denominator, and the number of possibilities that match what you are looking for in the numerator.

Permutation and combination problems ask you to choose or arrange a group of objects. To choose a number of items to fill specific spots, when each spot is filled from a different source, all you have to do is multiply the number of choices for each of the spots. To choose from a set of n objects from the same source to fill specific spots, when order matters, all you have to do is multiply the number of choices for each of the spots—but the number of choices keeps getting smaller, according to the formula: $n(n - 1)(n - 2) \dots \times 3 \times 2 \times 1$, or $n!$ To find the number of permutations of r objects chosen from a set of n objects, when order matters, use the formula: $n(n - 1)(n - 2) \dots \times (n - r + 1)$, also expressed as $\frac{n!}{(n - r)!}$ To find the number of combinations of r objects chosen from a set of n objects, use the formula: $\frac{n(n - 1)(n - 2) \dots \times (n - r + 1)}{r!}$

1), also expressed as $\frac{n!}{(n - r)!}$ To find the number of combinations of r objects chosen from a set of n objects, use the formula: $\frac{n(n - 1)(n - 2) \dots \times (n - r + 1)}{r!}$

Chapter 13 Geometry

The geometry tested on the GMAT is but a small fraction of the geometry you probably studied during high school. In this chapter, we cover the geometry the test-makers actually test: angles, triangles, circles, quadrilaterals, volume, surface area, and coordinate geometry.

Fewer than one-quarter of the problems on the computer-adaptive section of the GMAT will involve geometry. And while this tends to be the math subject most people remember least from high school, the good news is that the GMAT tests only a small portion of the geometry you used to know. It will be relatively easy to refresh your memory.

The bad news is that unlike some standardized tests, such as the SAT, the GMAT does not provide you with the formulas and terms you'll need to solve the problems.

You'll have to memorize them.

The first half of this chapter will show you how to eliminate answer choices on certain geometry problems without using traditional geometry. The second half will review all the geometry you need to know in order to answer the problems that must be solved using more traditional methods.

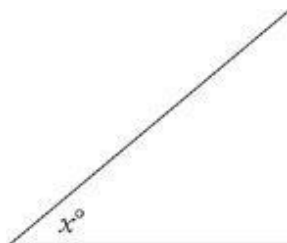
CRAZY ANSWERS

Eliminating choices that don't make sense has already proven to be a valuable technique on arithmetic and algebra questions. On geometry questions you can develop this technique into an art form. The reason for this is that many geometry problems come complete with a diagram *drawn to scale*.

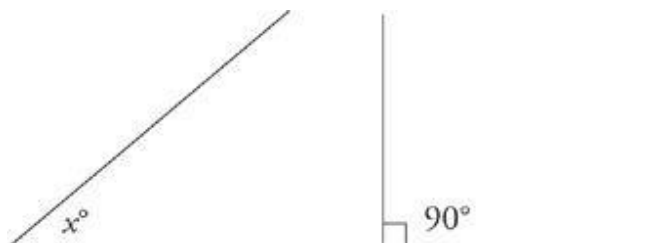
Most people get so caught up in solving a geometry problem geometrically that they forget to look at the diagram to see whether their answer is reasonable.

Crazy Answers on Easy Questions

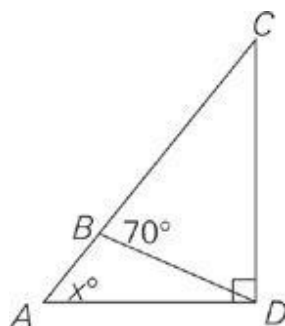
How big is angle x ?



Obviously you don't know exactly how big this angle is, but it would be easy to compare it with an angle whose measure you *do* know exactly. Let's compare it with a 90-degree angle:



Angle x is less than 90 degrees. How much less? It looks as though it's about half of a 90-degree angle, or 45 degrees. Now look at the following problem that asks about the same angle, x .



In the figure above, if $BC = CD$ and angle $ADC = 90$ degrees, then what is the value of x ?

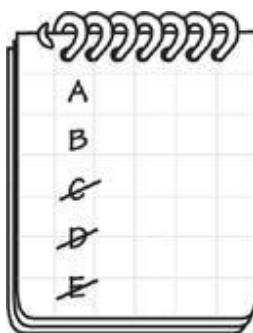
- 45 50 70 75 100

Easy Eliminations

We've already decided that angle x is less than 90 degrees, which means that the last answer choice (what we call choice E) can be eliminated. How much less is it? Well, we estimated before that it was about half, which rules out answer choices C and D as well.

There is another way to eliminate choices C and D. We can compare angle x with the other marked angle in the problem—angle DBC . If the answer to this problem is choice C, then angle x should look like angle DBC . Does it? No. Angle x looks a little bit smaller than angle DBC , which means that both choices C and D can be eliminated.

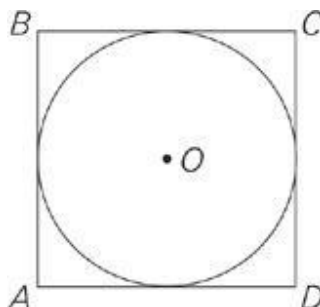
Eliminating crazy answers will prevent you from making careless mistakes on easy problems.



Crazy Answers on Difficult Questions

If it's important to cross off crazy answer choices on easy questions, it's even

more important to eliminate crazy answer choices when you're tackling an average or difficult geometry problem. On these problems, you may not know how to find the answer geometrically, and even if you do, you could still fall victim to one of the traps the test writers have placed in your path. Take a look at the following difficult geometry problem:



In the figure above, the circle with center O , is inscribed inside square $ABCD$ as shown. What is the ratio of the area of circle O to the area of square $ABCD$?

-
- $\frac{\pi}{2}$
-
- $\frac{4}{\pi}$
-
- $\frac{\pi}{3}$
-
- $\frac{\pi}{4}$
- $\frac{\pi}{5}$

Easy Eliminations

But before you start guessing at random, let's see whether you can eliminate any of the answer choices just by looking at the diagram and using some common sense.

The problem asks you for the ratio of the area of the circle to the area of the

square. Just by looking at the diagram, you can tell that the circle is smaller than the square. The correct answer to this question has to be the ratio of a smaller number to a bigger number. Let's look at the answer choices.

In choice A, the ratio is π over 2. An approximate value of π is 3, so this really reads $\frac{3}{2}$.

Is this the ratio of a smaller number to a bigger number? Just the opposite. Therefore choice A is a crazy answer. Eliminate it.

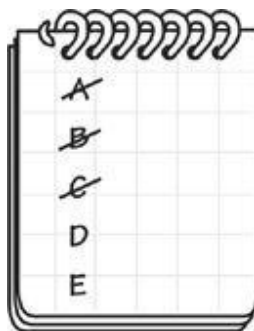
In choice B, the ratio is 4 over π . This really reads $\frac{4}{3}$.

Is this the ratio of a smaller number to a bigger number? No. Choice B is a crazy answer. Eliminate it.

In choice C, the ratio is π over 3. This really reads $\frac{3}{3}$.

Is this the ratio of a smaller number to a bigger number? No. Choice C is a crazy answer. Eliminate it.

Answer choices D and E both contain ratios of smaller numbers to bigger numbers, so they're both still possibilities. However, we've eliminated three of the answer choices without doing any math. If you know how to solve the problem geometrically, then proceed. If not, guess and move on. (By the way, we will show you how to solve this problem using geometry later in the chapter.)



How to Drive Math Teachers Insane

Teachers will never know if
you use our approximations.

We promise. Use them.

Many students freeze up
when they see π : It's just
a number. Think of it as 3
(and a little extra).

The Basic Tools

In eliminating crazy answers, it helps to have the following approximations
memorized.

$$\pi \approx 3$$

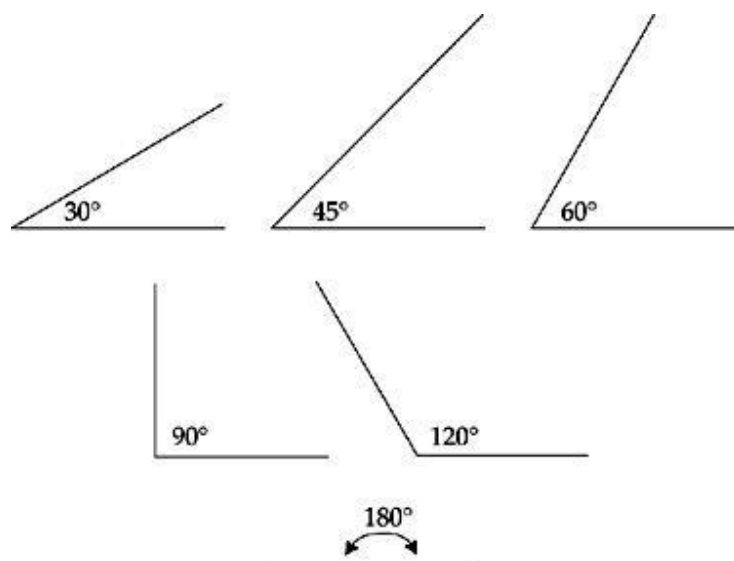
$$\sqrt{1} = 1$$

$$\sqrt{2} \approx 1.4$$

$$\sqrt{3} \approx 1.7$$

$$\sqrt{4} = 2$$

It's also useful to have a feel for the way certain common angles look:

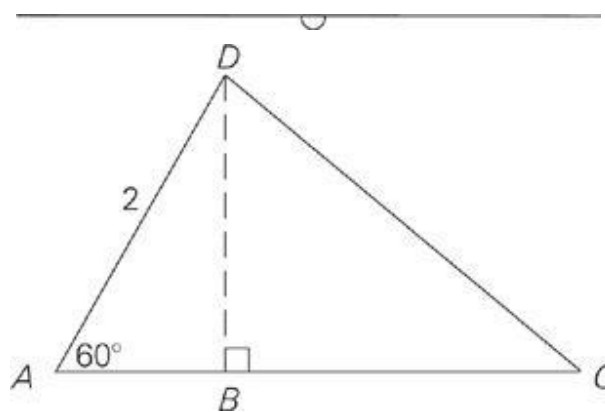


Getting More Precise

When a geometry problem contains a diagram that's drawn to scale, you can get even more precise in eliminating wrong answer choices.

How? By measuring the diagram.

Look at the problem below:



In the figure above, if a line segment connecting points B and D is perpendicular to AC and the area of triangle ADC is $\frac{3\sqrt{3}}{2}$, then $BC = ?$

- $\sqrt{2}$
 $\sqrt{3}$
 2
 $3\sqrt{3}$
 6
 Here's How to Crack It

Practice measuring the diagram with your pen or pencil. If you measure carefully, you'll notice that the distance between A and D is the same as the distance between B and C —exactly 2. Let's look at the answer choices. Because you memorized the values we told you to memorize earlier, you know that answer choice A is equal to 1.4. Eliminate it. Answer choice B is equal to 1.7. This is close enough for us to hold on to it while we look at the other choices. Choice C is exactly what we're looking for—2. Choice D is 3 times 1.7, which equals 5.1. This is much too large. Choice E is even larger. Eliminate D and E. We're down to choices B and C. The correct answer is choice C.

Two Important Notes

Diagrams in questions using the problem-solving format may be drawn to scale (unless otherwise indicated), but they are not all drawn to the same scale.

Diagrams marked “not drawn to scale” cannot be measured. In fact, the drawings in these problems are often purposely misleading to the eye.

What Should I Do if There Is No Diagram?

Draw one. It's always difficult to imagine a geometry problem in your head. The first thing you should do with any geometry problem that doesn't have a diagram is sketch it out in your scratch booklet. And when you draw the diagram, try to draw it to scale. That way, you'll be in a position to estimate.

Geometry Hint

If there's no diagram, draw one yourself.

What Should I Do if the Diagram Is Not Drawn to Scale?

The same thing you would do if there were no diagram at all—draw it yourself. Draw it as accurately as possible so you'll be able to see what a realistic answer should be.

Basic Principles: Fundamentals of GMAT Geometry

The techniques outlined above will enable you to eliminate many incorrect choices on geometry problems. In some cases, you'll be able to eliminate every choice but one. However, there will be some geometry problems in which you will need geometry. Fortunately, GMAC chooses to test only a small number of concepts.

For the sake of simplicity, we've divided GMAT geometry into six basic topics:

degrees and angles

triangles

circles

rectangles, squares, and other four-sided objects

solids and volume

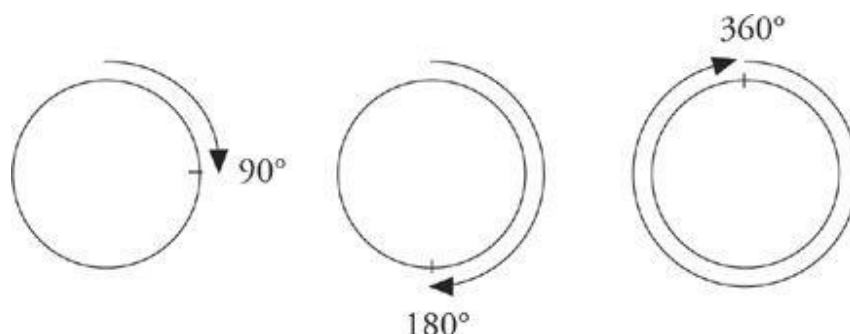
coordinate geometry

The 180° Rule, Part I

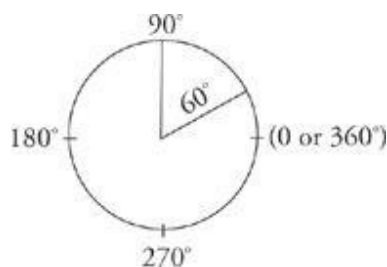
When you see a geometry problem that asks about angles, always look to see if two angles form a line, which tells you that the total of the two angles is 180 degrees. This is often the crucial starting point on the road to the solution. The test writers like to construct problems in such a way that it is very easy to miss this.

DEGREES AND ANGLES

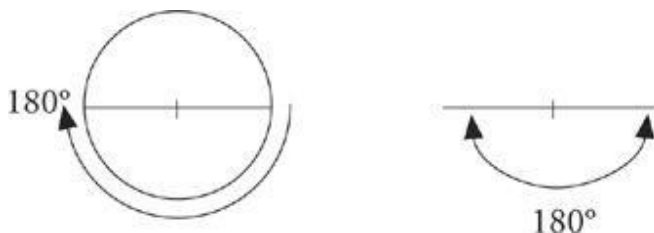
There are 360 degrees in a circle. No matter how large or small a circle is, it still has precisely 360 degrees. If you drew a circle on the ground and then walked a quarter of the distance around it, you would have traveled 90 degrees of that circle. If you walked halfway around the circle, you would have traveled 180 degrees of it.



An angle is formed when two line segments extend from a common point. If you think of that point as the center of a circle, the measure of the angle is the number of degrees enclosed by the lines when they pass through the edge of the circle.



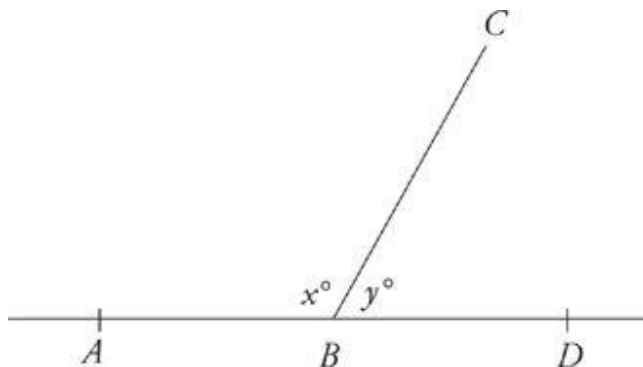
A line is just a 180-degree angle.



ℓ is the symbol for a line. A line can be referred to as ℓ or by naming two points on that line. For example, in the diagram below, both points A and B are on the line ℓ . This line could also be called line AB . Also, the part of the line that is between points A and B is called a line segment. A and B are the end points of the line segment.

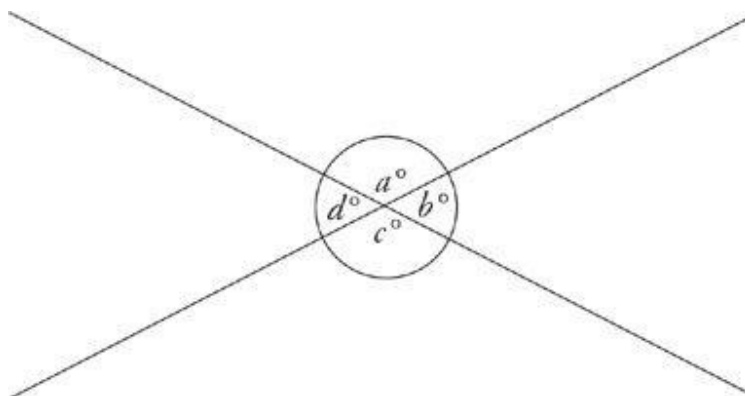


If a line is intersected by another line, as in the diagram below, angle x and angle y add up to one straight line, or 180 degrees. So, for example, if you know that angle x equals 120 degrees, you can find the measure of angle y by subtracting 120 degrees from 180 degrees. Thus angle y would equal 60 degrees.

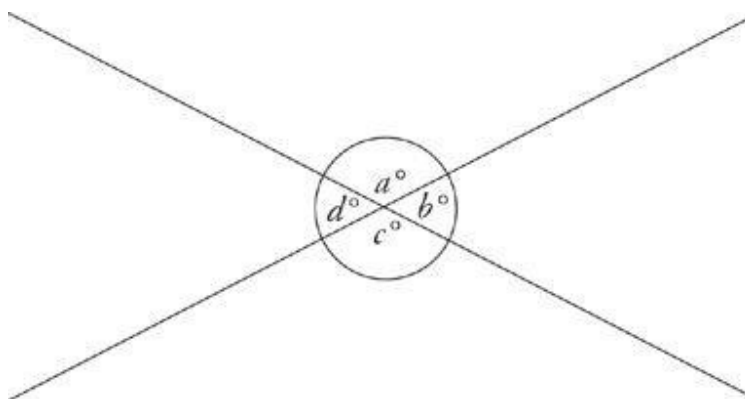


Note that in the diagram above, angle x could also be called angle ABC , with B being the point in the middle.

When two lines intersect—as in the diagram below—four angles are formed. The four angles are indicated by letters.

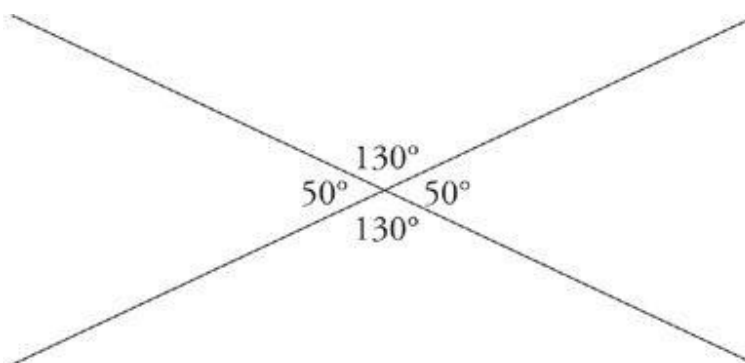


The four angles add up to 360 degrees (remember the circle).



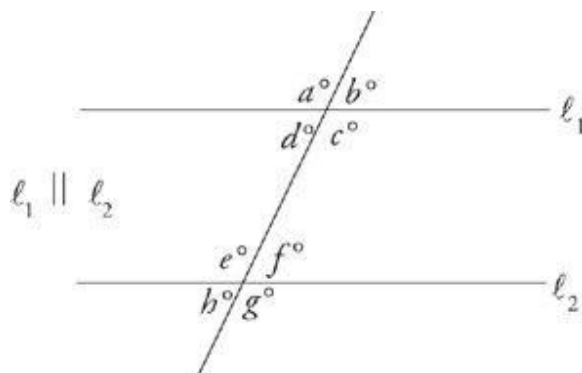
$a^\circ + b^\circ + c^\circ + d^\circ = 360$ degrees. Angle a + angle b , because they form a straight line, are equal to 180 degrees. Angle b + angle c also form a straight line, as do $c + d$ and $d + a$. Angles that are opposite each other are called *vertical angles* and have the same number of degrees. For example, in the diagram above, angle a is equal to angle c . Angle d is equal to angle b .

Therefore, when two lines intersect, there appear to be four different angles, but there are really only two:



Two lines in the same plane are said to be parallel if they extend infinitely in both directions without intersecting. The symbol for parallel is \parallel .

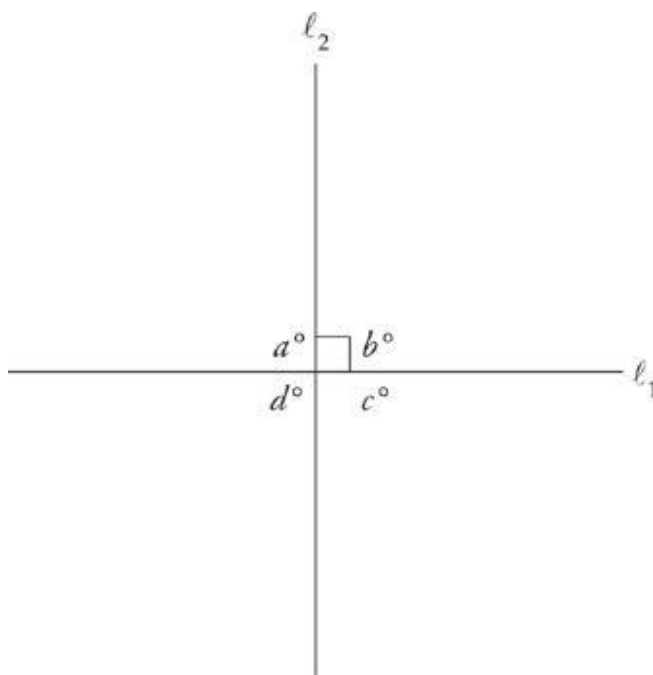
Look at the diagram below:



When two parallel lines are intersected by a third line, there appear to be eight different angle measurements, but there are really only two.

There is a big one (greater than 90°) and a little one (less than 90°). Angle a (a big one) is equal to angles c , e , and g . Angle b (a little one) is equal to angles d , f , and h .

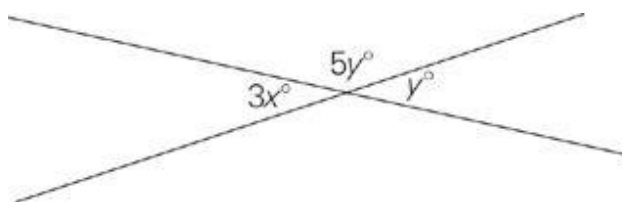
If two lines intersect in such a way that one line is perpendicular to the other, all the angles formed will be 90° -degree angles. These are also known as right angles:



Angles a , b , c , and d each equal 90° . The little box at the intersection of the two lines is the symbol for a right angle.

Let's practice on a problem:





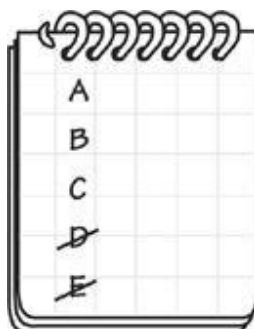
In the figure above, what is the value of x ?

- 10
 15
 20
 30
 40
 Here's How to Crack It

On a GMAT geometry problem, you may not know exactly how to solve at first glance, but there is almost always something you can do to get started. Did you notice that $5y$ and y together make up a straight line? In other words, $6y = 180$ degrees. Noticing this is the key to solving the problem. If $6y = 180$ degrees, then y equals 30 degrees. You might be tempted to pick choice D, but remember—we aren't looking for the value of y , we're looking for the value of x . Opposite angles formed by two straight lines are always equal—so y is equal to $3x$. Therefore, $3x$ also equals 30 degrees, and the correct answer to this problem is choice A, 10 degrees.

Easy Eliminations

Remember that all problem solving diagrams on the GMAT are drawn to scale unless labeled otherwise. So be sure to take a step back and think about which answer choices are even within the realm of possibility. Looking at the angle labeled $3x$, would you say it is greater than 90 degrees or less than 90 degrees? If you said less than 90 degrees, you are doing just fine. So if $3x$ is less than 90, then x must be smaller than 30 degrees. Eliminate choices D and E.

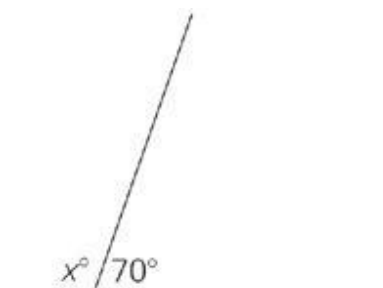


DRILL 6 (Angles and Lengths)

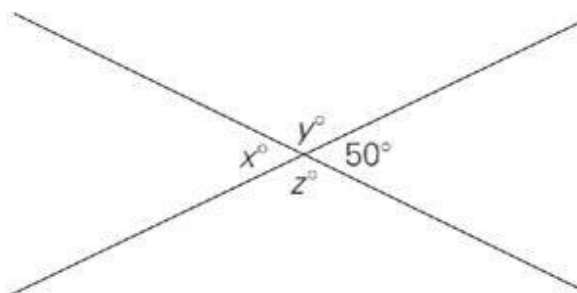
In the following figures, find numbers for all the variables. The answers to these

problems can be found in Part VI.

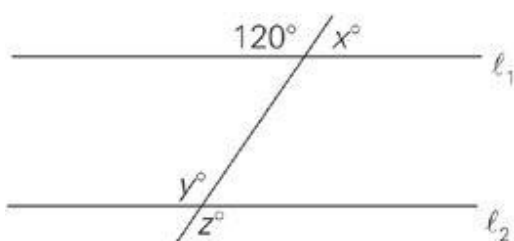
1.



2.



3.



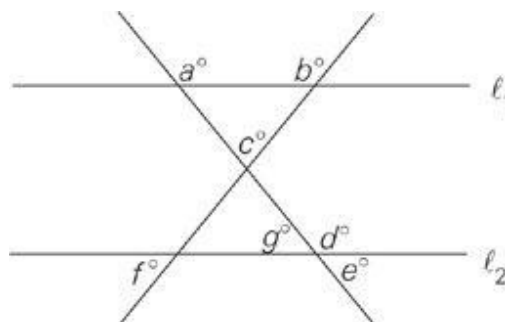
4. If a driver has traveled 270 degrees around a circular race track, what fractional part of the track has he driven?

Drawn to Scale?

In a problem solving question, if it doesn't say *not drawn to scale*, then it *is* drawn to scale.

When they give you a scaled drawing, use it to eliminate answers that are out of proportion.

A real GMAT angle problem might look like this:



Note: Figure not drawn to scale.

5. In the figure above, if $l_1 \parallel l_2$, then which of the following angles must be equivalent?

a and b g and f d and e a and d f and d You might see a very straightforward data sufficiency problem like this on the GMAT:

6. What is the degree measure of angle x ?

(1) Angle $y = 40$ degrees.

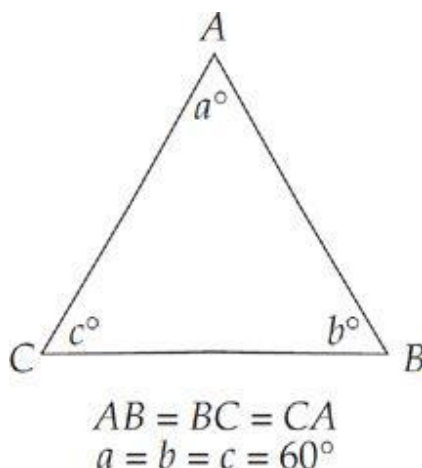
(2) Angle x and angle y add up to a straight line.

TRIANGLES

A triangle is a three-sided figure that contains three interior angles. The sum of the degree measures of the three angles in a triangle is 180 degrees. Several kinds of triangles appear on the GMAT:

The 180° Rule, Part II

When a question involving angles has a triangle or several triangles in it, remember that the interior angles of a triangle add up to 180 degrees. Apply that rule in every possible way you can. It is one of the things that the GMAT writers love to test most.



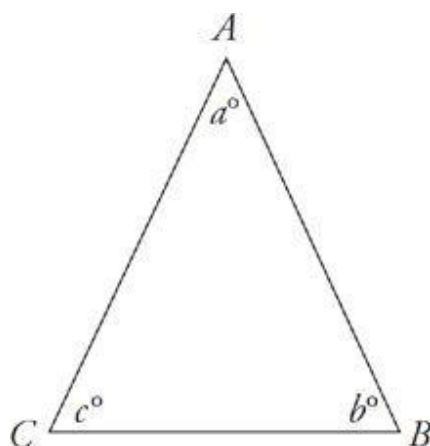
An **equilateral triangle** has three sides that are equal in length. Because the angles opposite equal sides are also equal, all three angles in an equilateral triangle are equal.

An **isosceles triangle** has two sides that are equal in length. The angles opposite the two equal sides are also equal.

Triangles

Triangles are by far the test writers' favorite geometric shape. If you get stuck on a geometry problem that doesn't have triangles in it, ask yourself:

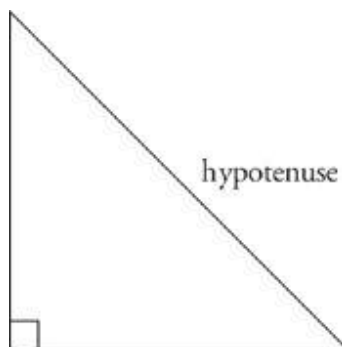
Can the figure in this problem be divided into triangles (especially right triangles) that I can work with? This will sometimes be the key to the solution.



$$AB = AC$$

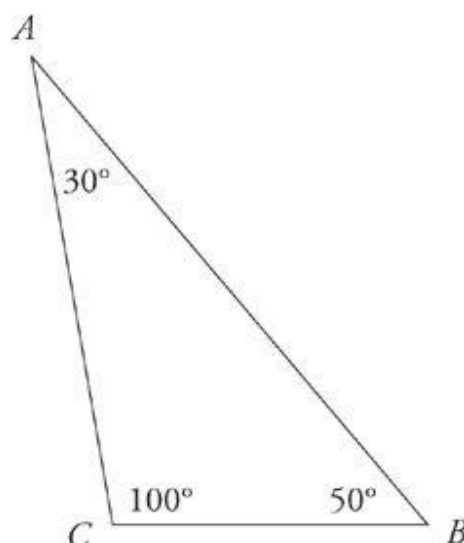
$$b = c$$

A **right triangle** has one interior angle that is equal to 90 degrees. The longest side of a right triangle (the one opposite the 90-degree angle) is called the *hypotenuse*.



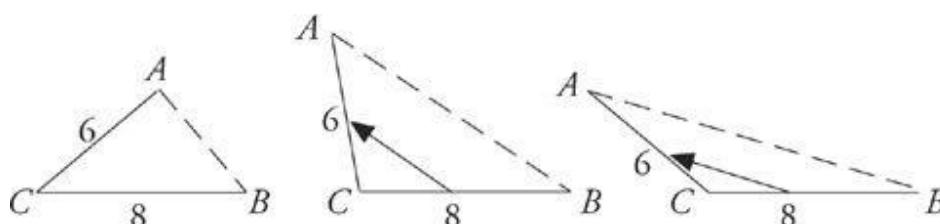
Everything Else You Need to Know About Triangles

1. The sides of a triangle are in the same proportion as its angles. For example, in the triangle below, which is the longest side?



The longest side is opposite the largest angle. The longest side in the triangle above is AB . The next longest side would be AC .

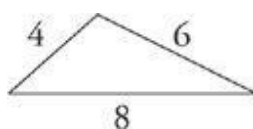
2. One side of a triangle can never be longer than the sum of the lengths of the other two sides of the triangle, or less than their difference. Why? Look at the diagrams below:



At the point where angle $ACB = 180$ degrees, this figure ceases to be a triangle. Angle ACB becomes 180 degrees when side AB equals the sum of the other two sides, in this case $6 + 8$. Side AB can never quite reach 14.

By the same token, if we make angle ACB smaller and smaller, at some point, when angle $ACB = 0$ degrees, the figure also ceases to be a triangle. Angle ACB becomes 0 degrees when side AB equals the difference of the other two sides, in this case $8 - 6$. So AB can never quite reach 2.

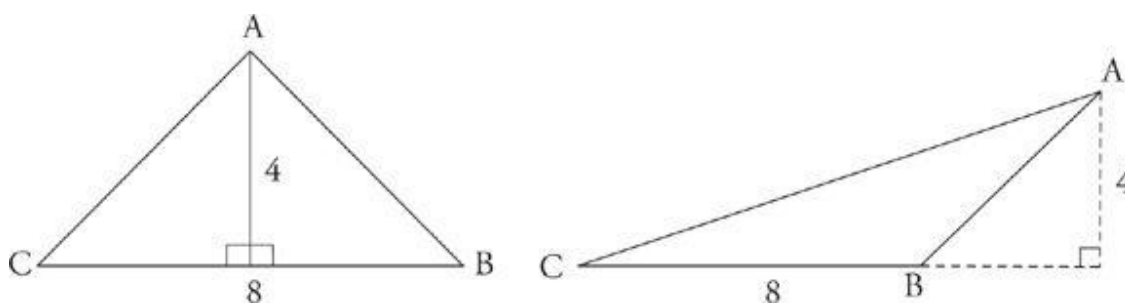
3. The *perimeter* of a triangle is the sum of the lengths of the three sides.



$$\text{perimeter} = 18$$

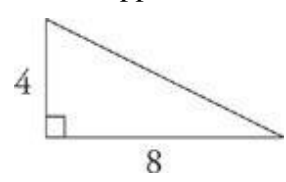
$$\frac{\text{height} \times \text{base}}{2}$$

4. The *area* of a triangle is equal to $\frac{\text{height} \times \text{base}}{2}$. By definition, the base and height must be perpendicular to each other.

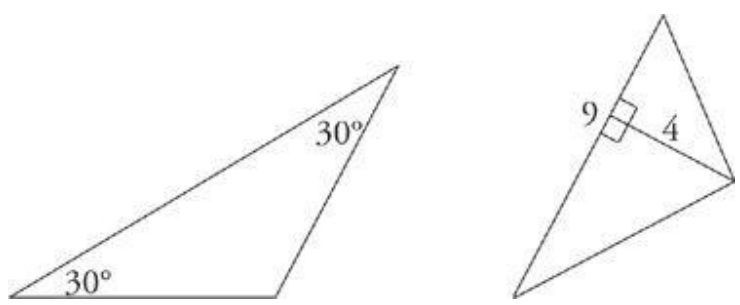


$$\frac{4 \times 8}{2} = 16$$

In both of the above triangles, the area = $\frac{4 \times 8}{2} = 16$.
 In a right triangle, the height also happens to be one of the sides of the triangle:



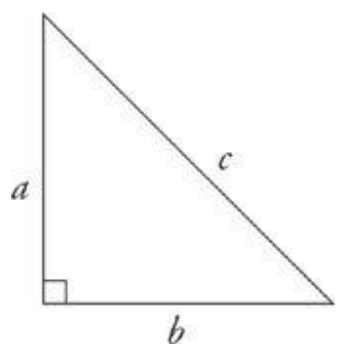
5. Don't expect triangles to be right side up:



This is an isosceles triangle.

The area of this triangle is $A = \frac{9 \times 4}{2}$, or 18.

6. In a right triangle, the square of the hypotenuse equals the sum of the squares of the other two sides. In the triangle below:



$$a^2 + b^2 = c^2$$

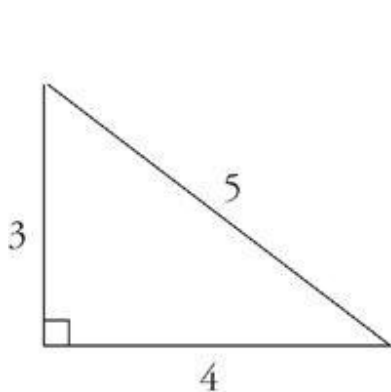
This is called the **Pythagorean theorem**. The test writers love to test this theorem, but usually you won't actually have to make use of it if you've memorized a

few of the most common right-triangle proportions.

The Pythagorean triangle that comes up most frequently on the GMAT is one that has sides of lengths 3, 4, and 5, or multiples of those numbers. Look at the following examples:

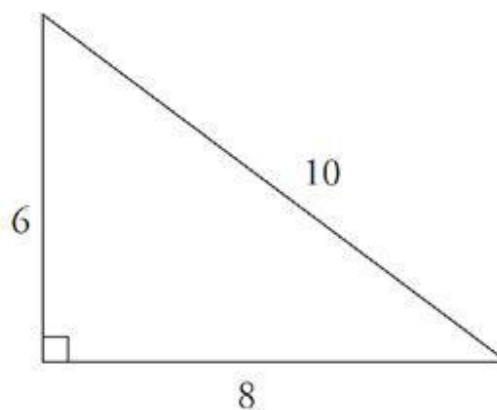
Pythagoras's Other Theorem

Pythagoras also developed a theory about the transmigration of souls. So far, this theory has not been proven.



$$3^2 + 4^2 = 5^2$$

$$9 + 16 = 25$$



$$6^2 + 8^2 = 10^2$$

$$36 + 64 = 100$$

There are two other kinds of right triangles that GMAC loves to test. These are a little complicated to remember, but they come up so often that they're worth memorizing.

Pythagorean Triples

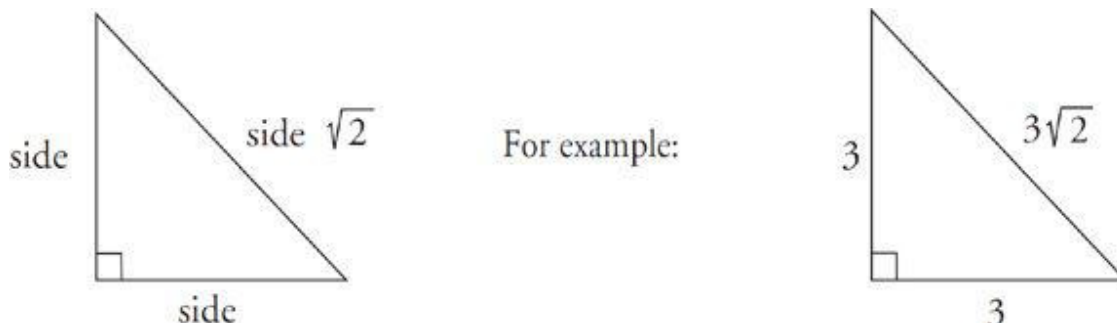
The right triangle in the ratio 3 : 4 : 5 is the most common Pythagorean triple, but it's not the only one that shows up on the GMAT:

$$3 : 4 : 5$$

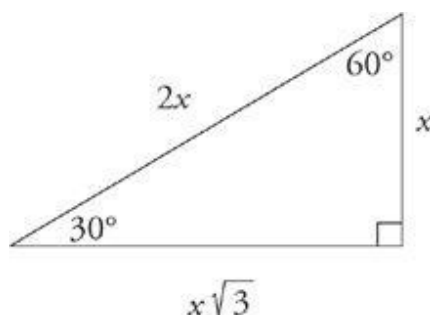
$$5 : 12 : 13$$

$$7 : 24 : 25$$

7. A right isosceles triangle always has proportions in the ratio side: side: side $\sqrt{2}$.



8. The second special right triangle is called the **30-60-90** right triangle. The ratio between the lengths of the sides in a 30-60-90 triangle is constant. If you know the length of any of the sides, you can find the lengths of the others. The ratio of the sides is always $x:x\sqrt{3}:2x$.

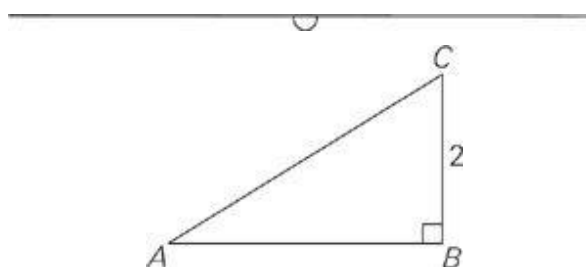


That is, if the shortest side is length x , then the hypotenuse is $2x$, and the remaining side is $x\sqrt{3}$.

How to Label a 30-60-90 Triangle

Remembering how to label the 1, 2, $\sqrt{3}$ sides of a 30-60-90 triangle is easy if you remind yourself that the largest side goes opposite the largest angle and the smallest side opposite the smallest angle, *and* if you remind yourself that $\sqrt{3}$ is roughly 1.7, okay?

Try this problem:



In $\triangle ABC$ shown above, if $\angle CAB$ equals 30° , then what is the area of the triangle?

- 2
 $2\sqrt{2}$
 $2\sqrt{3}$
 $3\sqrt{2}$
 4
 Here's How to Crack It

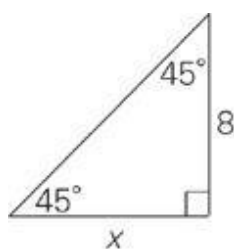
As with all geometry problems, even if you aren't exactly sure how to solve, there may be something you can do to get started—always half the battle. In this case, since we know that is a right triangle, and the problem tells you that equals 30° , do we know the value of? We do: it must be 60° (since there are a total of 180 degrees in a triangle). Because this is a 30-60-90 triangle (which always has sides in proportion of x , $2x$, and), and the diagram gives us all the measurement of one of those sides, we actually know the measurement of all sides: 2, $2\sqrt{2}$, and 4. To find the area, we simply multiply the base times the height and divide by 2:

$$A = \frac{2 \times 2\sqrt{3}}{2} = 2\sqrt{3}, \text{ and the answer is choice C.}$$

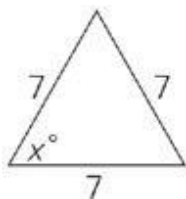
DRILL 7 (Triangles)

Find the value of the variables in the following problems. The answers can be found in Part VI.

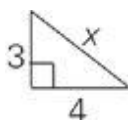
1.



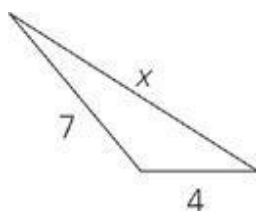
2.



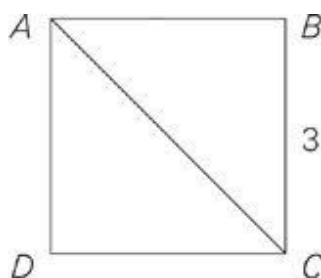
3.



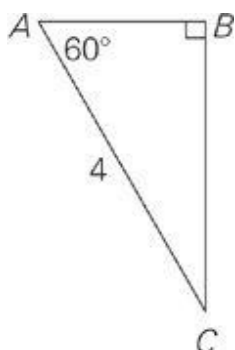
4. What value must x be less than in the triangle below? What value must x be greater than?



5. In the square $ABCD$ below, what is the length of line segment AC ?

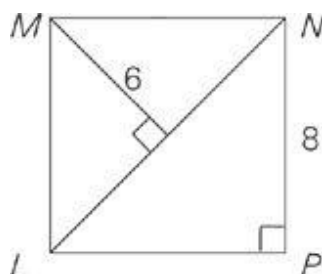


6. In the triangle below, what is the length of the line segment BC ?



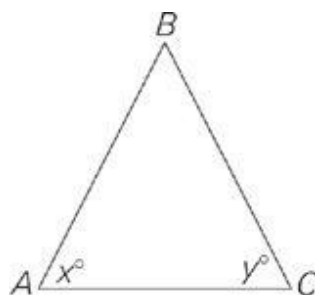
A real GMAT triangle problem might look like this:

7. In the diagram below, if the area of triangle LNP is 32, then what is the area of triangle LMN ?



Note: Figure not drawn to scale.

24
 $24\sqrt{2}$
 $24\sqrt{3}$
 32
 48
 You might see a data sufficiency problem like this on the GMAT:



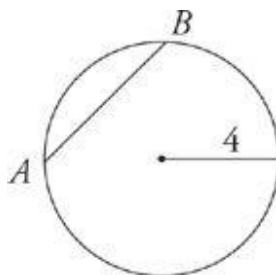
8. What is the value of x in triangle ABC shown above?

(1) Angle $y = 80$ degrees.

(2) $AB = BC$

CIRCLES

A line on the circumference of a circle is called a **chord**. The distance from the center of the circle to any point on the circle is called the **radius**. The distance from one point on the circle through the center of the circle to another point on the circle is called the **diameter**. The diameter is equal to twice the radius.



radius = 4

diameter = 8

AB is a chord.

The **circumference** (the length of the entire outer edge of the circle) = $2\pi r$ or πd .

The rounded portion of the circle between points A and B is called an **arc**.

The **area** of a circle = πr^2 .

A circle cut in half by a diameter is called a **semi-circle**.

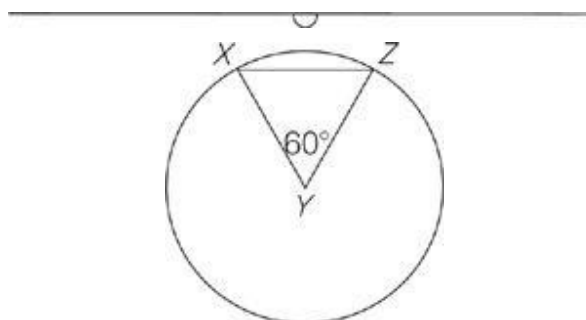
A triangle is said to be **inscribed** inside a semi-circle when one of its sides is the diameter of the circle itself, with the two other sides meeting at any point on the circle. A triangle inscribed inside a semi-circle is always a **right triangle**.

A Perfect Circle

During the fourteenth century, Pope Boniface VIII commissioned artists to send samples of their work to demonstrate their abilities. One of the artists, Giotto, responded by dipping his paintbrush in red ink and in one continuous stroke created "a perfect circle." When the pope saw it, he instantly perceived that

Giotto surpassed all other painters of his time.

Let's try a circle problem:



If the circle above has center y and area 4π , then what is the perimeter of triangle XYZ ?

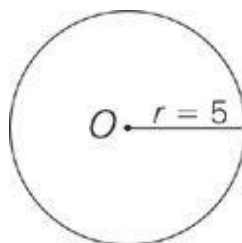
- 2
 2π
 4
 6
 6π
 Here's How to Crack It

As always, the solution to this problem will probably only become apparent once you've started doing the problem. The only apparent information you've been given: the area of the circle, 4π . Since the formula for the area of a circle is πr^2 , set that equal to 4π . Can you figure out what r equals? That's right, 2. And since both sides XY and YZ are radii of the circle, they must both equal 2. To find the perimeter of the triangle, the last thing we need to do is find the length of XZ . You might not think that you know what XZ equals, but the diagram tells us that angle XYZ equals 60 degrees. Since we know sides xy and yz are equal, that means that this triangle must be equilateral: all three sides have the same length, 2. Therefore, the perimeter of triangle XYZ is 6, and the answer is choice D.

DRILL 8 (Circles)

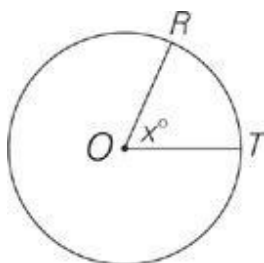
Answer the following questions. The answers can be found in [Part VI](#).

1. In the circle below with center O , what is the area of the circle? What is the circumference?

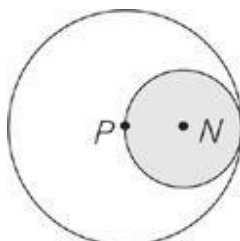


2. If the area of a circle is 36π , what is the circumference?

3. In the circle below with center O , if the arc RT is equal to $\frac{1}{6}$ of the circumference, what is the value of x ?



A real GMAT circle problem might look like this:



4. In the figure above, P is the center of the larger circle, and N is the center of the smaller, shaded circle. If the radius of the smaller circle is 5, what is the area of the unshaded region?

100π 75π 25π 20π 10π

You might see a data

sufficiency problem like this on the GMAT:

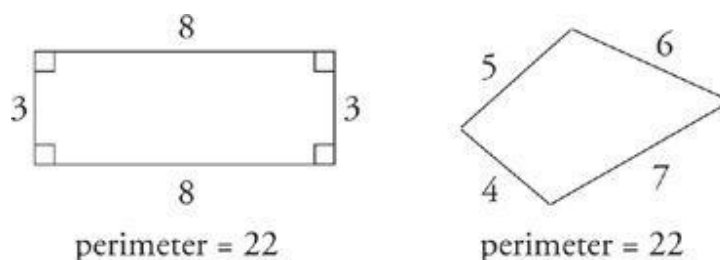
5. What is the area of circle P ?

(1) The diameter of circle Q is 6.

(2) The radius of circle Q is twice the radius of circle P .

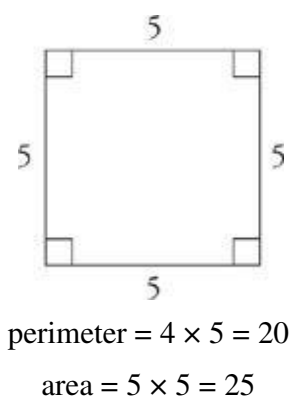
RECTANGLES, SQUARES, AND OTHER FOUR-SIDED OBJECTS

A four-sided figure is called a **quadrilateral**. The perimeter of any four-sided object is the sum of the lengths of its sides. A **rectangle** is a quadrilateral whose four interior angles are each equal to 90 degrees. Opposite sides of a rectangle are always equal.

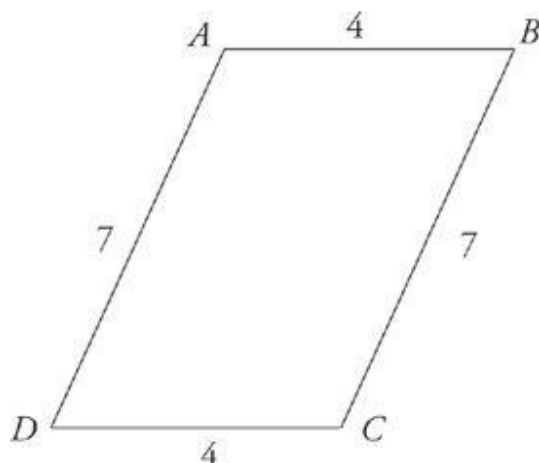


The area of a rectangle is $length \times width$. The area of the rectangle above is therefore 3×8 , or 24.

A **square** is a rectangle whose four sides are all equal in length. The *perimeter* of a square is therefore just four times the length of one side. The *area* of a square is the *length* of one of its sides squared. For example:



A **parallelogram** is a quadrilateral in which the two pairs of opposite sides are parallel to each other and equal to each other, and in which opposite angles are equal to each other. A rectangle is obviously a parallelogram, but so is a figure like this:



Angle $ADC = \text{angle } ABC$, and angle $DAB = \text{angle } DCB$.

The area of a parallelogram equals $\text{base} \times \text{height}$.



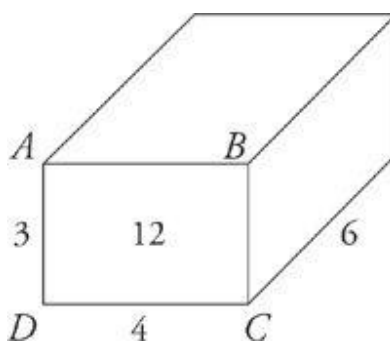
The area of parallelogram $ABCD = 8 \times 2 = 16$. (If you are having trouble picturing this, imagine cutting off the triangular region ADE and sticking it onto the other end of the figure. What you get is a rectangle with dimensions 8 by 2.)

SOLIDS, VOLUME, AND SURFACE AREA

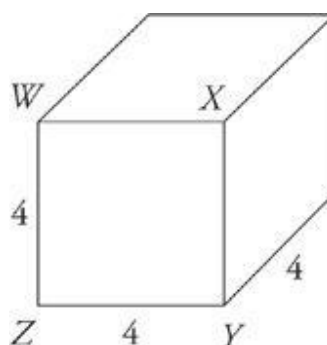
The GMAT will occasionally ask you to find the *volume* or *surface area* of a three-dimensional object.

Advance!

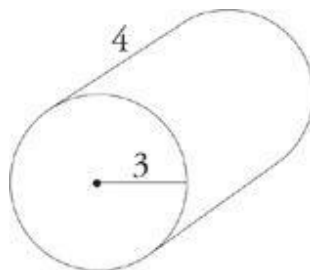
With GMAT geometry, just get going. Wade in there and do something. With each piece you add to the puzzle, the next piece to look for becomes evident.



The volume of the *rectangular solid* above is equal to the area of the rectangle $ABCD$ times the depth of the solid—in this case, 12×6 , or 72. Another way to think of it is $length \times width \times depth = 3 \times 4 \times 6$, or 72.

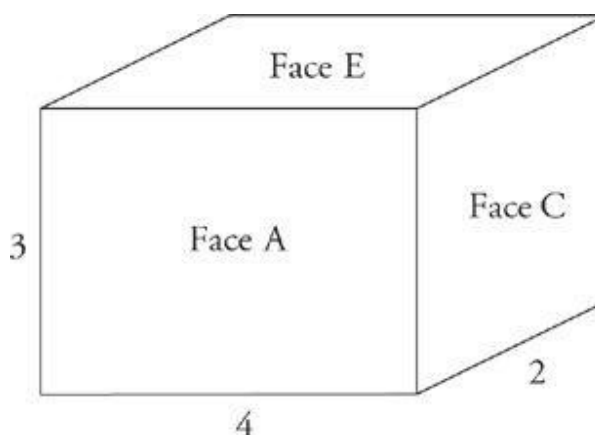


The volume of a *cube* is equal to the area of the square $WXYZ$ times the depth of the cube, or again, $length \times width \times depth$. In the case of a cube, the length, width, and depth are all the same, so the volume of a cube is always the length of any side, cubed. The volume of this cube is $4 \times 4 \times 4$, or 64.

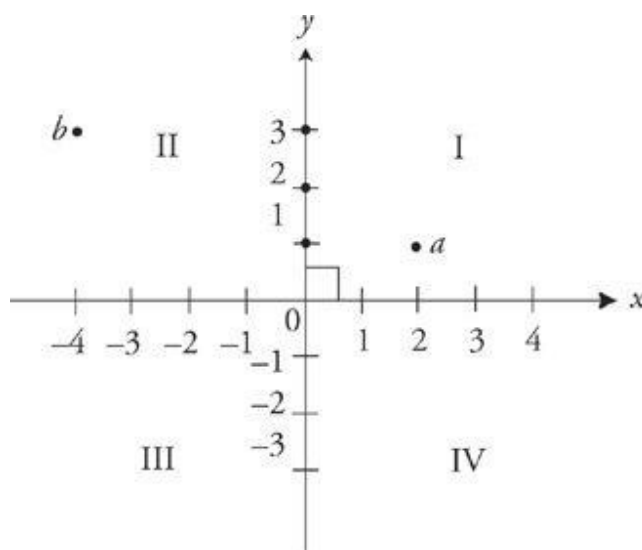


The volume of a *cylinder* is equal to the *area* of the circular base times the *depth*. The area of this circle is 9π . Thus the volume of the cylinder is 36π .

You may need to find the surface area of a solid. Surface area is just the sum of the areas of all the two-dimensional outer surfaces of the object. So, for example, the surface area of a rectangular solid is the sum of the areas of the solid's six faces. Take a look at how you'd calculate the surface area of the rectangular solid:



Face A: $3 \times 4 = 12$ **Face B:**
(opposite Face A) $3 \times 4 = 12$ **Face C:** $3 \times 2 = 6$ **Face D:**
(opposite Face C) $3 \times 2 = 6$ **Face E:** $4 \times 2 = 8$ **Face F:**
(opposite Face E) $4 \times 2 = 8$ **Surface Area:** = 52 **COORDINATE**
GEOMETRY

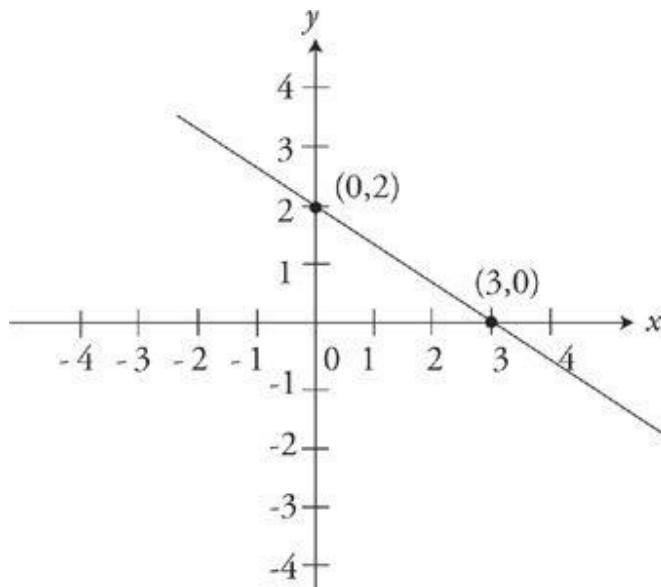


A coordinate plane, like the one above, lets you plot out lines and objects in two-dimensions. If you played the game Battleship as a child, this should feel very familiar—even if you don't remember learning about it in high school. The horizontal line is called the x -axis. The vertical line is called the y -axis. The axes divide the plane into four quadrants as shown above.

Every point on the plane has an ordered pair of numbers (x, y) that describes it. For example, in the plane above, point a is represented by the ordered pair $(2, 1)$ which simply means starting from 0, count over 2 to the right along the x -axis, and then up 1 along the y -axis. Point b above is represented by the ordered pair $(-4, 3)$, which simply

means starting from 0, count over -4 (to the left) along the x -axis, and up 3 along the y -axis.

Any straight line on this plane can be described by the equation $y = mx + b$, where b is the y -intercept (the point at which the line crosses the y -axis) and m is the slope of the line, and x and y are the coordinates of some point on that line. Slope is the measure of steepness of a line, and defines whether the line is diagonal, horizontal, or vertical, and to what degree.



For example, the y -intercept of the line shown above is 2 (that's where it crosses the y -axis). You can find the slope of any line if you know any two points on that line:

$$\text{slope} = \frac{\text{the difference in the } y\text{-coordinates}}{\text{the difference in the } x\text{-coordinates}}$$

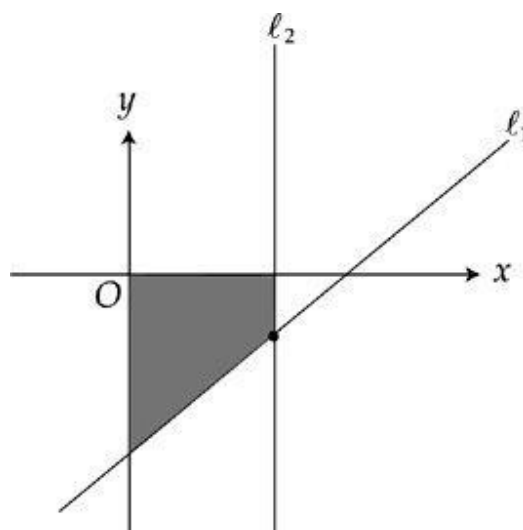
For example, the slope of the line above is

$$\frac{2 - 0}{0 - 3} \text{ or } \frac{2}{-3}$$

So the equation of this line can be written as $y = \frac{2}{-3}x + 2$.

Let's see how this might show up in a fairly tough GMAT problem:





In the coordinate plane above, if the equation of l_1 is $y = x - 3$ and the equation of l_2 is $x = 2$, then what is the area of the shaded region?

- (A) 3
- (B) 4
- (C) $3\sqrt{2}$
- (D) 4.5
- (E) 5

Here's How to Crack It

First, draw your own coordinate axes. The equation for l_1 is $y = x - 3$, which means that the y -intercept is -3 and the slope is 1 . That means the bottommost point of the large triangle is point $(0, -3)$, and the rightmost point of the large triangle is $(3, 0)$. What we have here is an upside-down right triangle with base 3 and height 3 . The area of

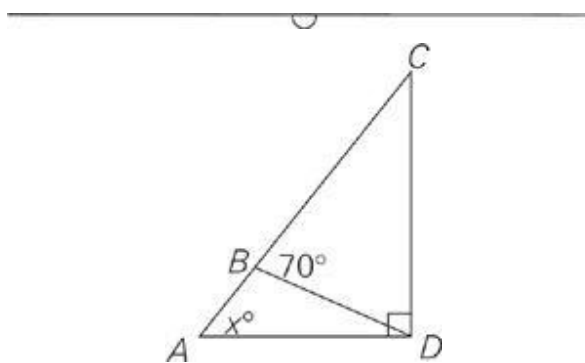
this entire triangle is $\frac{b \times h}{2}$ or $\frac{9}{2}$, which is choice D, but we aren't done yet. Now we have to find the area of the small triangle, and subtract it from the large triangle. What

remains will be the shaded region.

The equation for ℓ_2 is $x = 2$, which means that ℓ_2 is a vertical line running parallel to the y -axis. The small triangle therefore must also be an upside-down right triangle. Its base is 1 (from point (2, 0) to point (3, 0)). Eyeballing it, you might decide that its height is 1, too. The way to know for sure is to realize that these two right triangles (the small one and the large one) share an angle formed by the x -axis and ℓ_1 . The large triangle is isosceles, so its angles must measure 90-45-45. And since the small triangle shares one of the large triangle's 45-degree angles, we know that the small triangle's third angle must be 45 degrees as well. That means that the small triangle is an isosceles triangle, too, and that its height equals 1, the length of its base. Equipped with this information, we can calculate that the small triangle's area is $\frac{1}{2}$. Thus, the area of the shaded region is $\frac{9}{2} - \frac{1}{2}$, or 4. The best answer is choice B.

GMAT GEOMETRY: ADVANCED PRINCIPLES

All geometry problems (even easy ones) involve more than one step. Remember the first problem we looked at in this chapter?



In the figure above, if $BC = CD$ and angle $ADC = 90$ degrees, then what is the value of x ?

- 45
 50
 70
 75
 100
 Here's How to Crack It

Just by looking at the figure, we were able to eliminate answer choices C, D, and E. Now let's solve the problem using geometry. The figure includes two—actually three—different triangles: ABD , BCD , and ACD . The test writers want even this easy

problem to be a little challenging; there must be more than one step involved. To find angle x , which is part of triangles ABD and ACD , we must first work on triangle BCD .

What do we know about triangle BCD ? The problem itself tells us that $BC = CD$. This is an isosceles triangle. Because angle DBC equals 70 , so does angle BDC . Angle BCD must therefore equal 180 minus the other two angles. Angle $BCD = 40$.

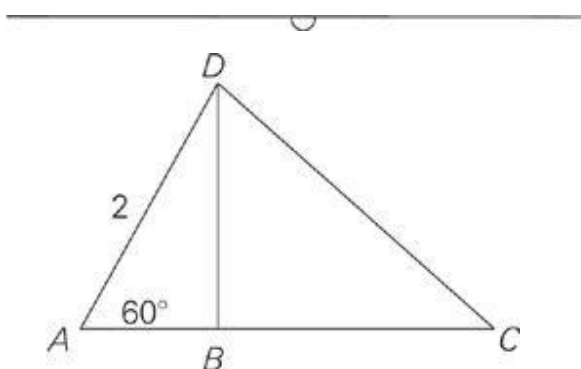
Now look at the larger triangle, ACD . We know that angle $ACD = 40$, and that angle $ADC = 90$. What does angle x equal? Angle x equals 180 minus the other two angles, or 50 degrees. The answer is choice B.

Walking and Chewing Gum at the Same Time

Most GMAT geometry problems involve more than one geometric concept. A problem might require you to use both the properties of a triangle and the properties of a rectangle, or you might need to know the formula for the volume of a cube in order to find the dimensions of a cube's surface area. The difficult geometry problems do not test more complicated concepts—they just pile up easier concepts.

Bite-Sized Pieces

With GMAT geometry, you shouldn't expect to see every step a problem involves before you start solving it. Often, arriving at the right answer involves saying, "I have no idea how to get the answer, but because the problem says that $BC=CD$, let me start by figuring out the other angle of that triangle. Now what can I do?" At some point the answer usually becomes obvious. The main point is not to stare at a geometry problem looking for a complete solution. Just wade in there and start, one bite-sized piece at a time.

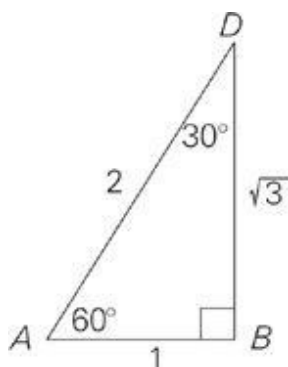


In the figure above, if a line segment connecting points B and D is perpendicular

to AC , and the area of triangle ADC is $\frac{3\sqrt{3}}{2}$, then $BC =$

- $\sqrt{2}$
 $\sqrt{3}$
 2
 $3\sqrt{3}$
 6
 Here's How to Crack It

We already got an approximate answer to this question by measuring; now let's solve it using geometry. If we draw in the line BD (which is perpendicular to line AC), we form a 30-60-90 triangle on the left side of the diagram (triangle ADB). The hypotenuse of this triangle is 2. Using the rules we've learned about 30-60-90 triangles, we can conclude that the measurements of triangle ADB are as follows:

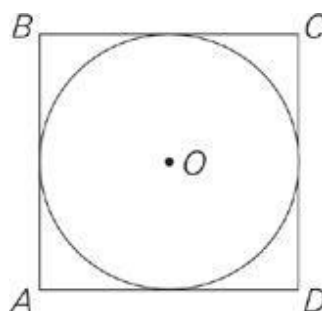


Thus $BD = \sqrt{3}$. At first you might think we're no closer to the solution, but don't despair. Just look for somewhere else to start. The problem tells us that the area of

triangle ADC is $\frac{3\sqrt{3}}{2}$. The area of a triangle is $\frac{\text{base} \times \text{height}}{2}$. BD is the height. Let's

find out what the base is. In other words, $\frac{\text{base} \times \sqrt{3}}{2} = \frac{3\sqrt{3}}{2}$, so the base equals 3. We know from the 30-60-90 triangle that $AB = 1$. What is BC ? 2. The answer is choice C.

Plugging In on Geometry?



In the figure above, circle O is inscribed inside square $ABCD$ as shown. What is the ratio of the area of circle O to the area of square $ABCD$?

- $\frac{\pi}{2}$
- $\frac{4}{\pi}$
- $\frac{\pi}{3}$
- $\frac{\pi}{4}$
- $\frac{\pi}{5}$

Here's How to Crack It

We already saw this problem in the first half of the chapter when we discussed eliminating crazy answers. As you recall, we were able to eliminate answer choices A, B, and C because we determined that the correct answer had to be the ratio of a smaller number to a bigger number.

Now let's solve this problem completely. You may have noticed that the answer choices do not contain *specific numbers* for the areas of the two figures—all we have here are *ratios* in the answer choices. Sound familiar? That's right! This is just another cosmic problem, and the best way to solve it is to Plug In.

To find the area of the circle, we need a radius. Let's just pick one—3. If the radius is 3, the area of the circle is 9π . Now let's tackle the square. The circle is inscribed inside the square, which means that the diameter of the circle is also the length of a side of the square. Because the radius of the circle is 3, the diameter is 6. Therefore the side of the square is 6, and the area is 36.

The problem asks for the ratio of the area of the circle to the area of the square:

$$\frac{9\pi}{36} = \frac{\pi}{4}$$

The answer is choice D.



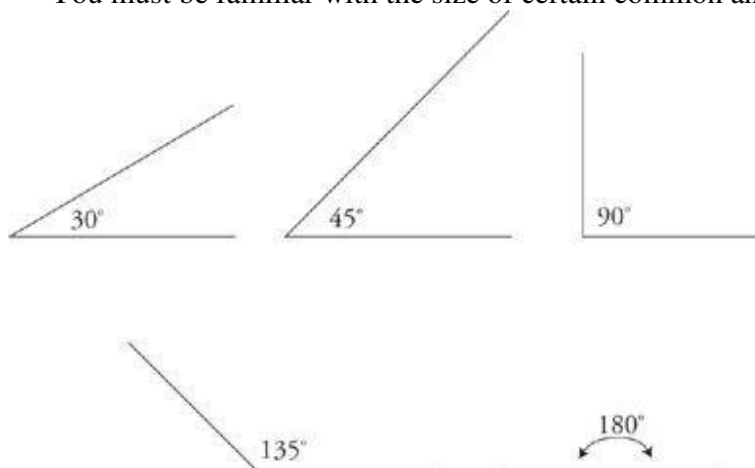
Summary

While the geometry found on the GMAT is rudimentary, you will have to memorize all of the formulas that you'll need because they are not provided on the test.

Always study any problem drawn to scale very closely in order to eliminate crazy answer choices.

You must know the following approximate values: $\pi \approx 3$, $\sqrt{2} \approx 1.4$, and $\sqrt{3} \approx 1.7$.

You must be familiar with the size of certain common angles:



You can estimate problem solving diagrams drawn to scale very precisely by using the marker that comes with your scratch booklet.

When no diagram is provided, draw your own, and make it to scale.

When the diagram is not drawn to scale, redraw it.

Degrees and angles: A circle contains 360 degrees. When you think about

angles, remember circles. A line is a 180-degree angle. When two lines intersect, four angles are formed, but in reality there are only two pairs of identical angles. When two parallel lines are cut by a third line, eight angles are formed, but in reality there are only two sets of identical angles: a set of big ones and a set of little ones.

Triangles: Every triangle contains 180 degrees. An equilateral triangle has three equal sides and three equal angles, each of which measures 60 degrees. An isosceles triangle has two equal sides, and the angles opposite those sides are also equal. A right triangle contains one 90-degree angle. The perimeter of a triangle is the sum of the

$$\frac{\text{height} \times \text{base}}{2}$$

lengths of its sides. The area of a triangle is $\frac{\text{height} \times \text{base}}{2}$. In a right triangle, the Pythagorean theorem states that the square of the hypotenuse equals the sum of the squares of the other two sides, or $a^2 + b^2 = c^2$. Some common right triangles are 3-4-5 triangles and multiples of 3-4-5 triangles, 5-12-13 triangles, and 7-24-25 triangles. Two other triangles that often appear on the GMAT are the right isosceles triangle and the 30-60-90 triangle. Memorize the formulas for these two triangles. The longest side of a triangle is opposite the largest angle; the shortest side is opposite the smallest angle. One side of a triangle can never be as large as the sum of the two remaining sides, nor can it ever be as small as the difference of the two remaining sides.

Circles: The circumference of a circle is $2\pi r$ or πd , where r is the radius of the circle and d is the diameter. The area of a circle is πr^2 , where r is the radius of the circle.

Rectangles, squares, and other four-sided objects: Any four-sided object is called a quadri-lateral. The perimeter of a quadrilateral is the sum of the lengths of the four sides. The area of a rectangle, or of a square, is equal to $\text{length} \times \text{width}$. The area of a parallelogram is equal to $\text{height} \times \text{base}$.

Solids and volume: The volume of most objects is equal to their two-dimensional $\text{area} \times \text{their depth}$. The volume of a rectangular solid is equal to $\text{length} \times \text{width} \times \text{depth}$. The volume of a cylinder is equal to the area of the circular base $\times \text{depth}$.

GMAT geometry problems always involve more than one step, and difficult GMAT geometry problems may layer several concepts. Don't be intimidated if you don't see the entire process that's necessary to solve the problem. Start somewhere. You'll be amazed at how often you arrive at the answer.

Chapter 14

Advanced Data Sufficiency

In this chapter, we'll show you how to master data-sufficiency problems, how to decipher the intermediate and advanced math hidden beneath the unfamiliar format, and how to use POE to eliminate tempting traps.

Now that you've reviewed all the important math concepts covered on the GMAT, it's time to take a second look at how these concepts are used in data-sufficiency questions.

First, a quick review:

Every data-sufficiency problem consists of a question followed by two statements:

What is x ?

(1) $x^2 = 4$.

(2) x is negative.

You have to decide NOT what the answer is, but WHETHER the question can be answered based on the information in the two statements. There are five possible answer choices:

- Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.
 - Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.
 - BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.
 - EACH statement ALONE is sufficient.
 - Statements (1) and (2) TOGETHER are not sufficient.
- The best way to answer data-sufficiency problems is to look at one statement at a time—so ignore Statement (2), and look only at Statement (1). Based on Statement (1), $x^2 = 4$, can we answer the question, "What is x ?"

At first glance, you might think so. If $x^2 = 4$, then $x = 2$, right?

Well, not necessarily; x could also equal -2 . And since Statement (1) gives us two different possible answers to this question, Statement (1) is NOT sufficient to answer the question. Choices A and D are out of the question; we are down to B, C, or E.

AD or BCE

Just by looking at Statement (1) we have already eliminated several answer choices:

If Statement (1) is sufficient, we are down to A or D.

If Statement (2) is NOT sufficient, we are down to B, C, or E.

AD or BCE. Memorize it; these are always your options. And it makes sense to write it down this way in your scratch book.

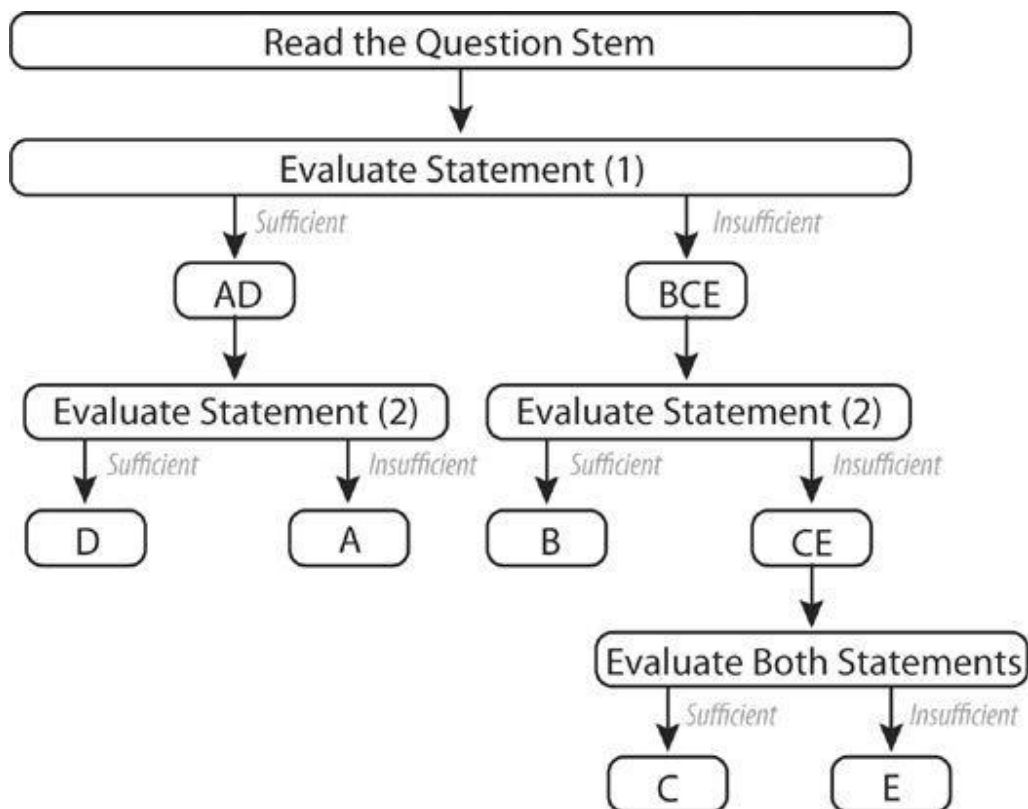
Now, ignore Statement (1) and look ONLY at Statement (2). Based on Statement (2), “ x is negative,” can we answer the question, “What is x ?”

Nope, x could be any negative number. We are now down to C or E.

Look at both statements together. If $x^2 = 4$ and x is negative, can we answer the question, “What is x ?”

Yup! Now there is only one unique number in the world that x could be: -2 . The correct answer is C.

Here’s a flowchart that walks you through each step of solving a data-sufficiency question. If you need more information about how to use the chart or the basic strategy for solving a data-sufficiency question, check out [Chapter 9](#).



DATA SUFFICIENCY: PIECES OF THE PUZZLE

In terms of mathematical content, data-sufficiency questions test the same kinds of topics tested by problem-solving questions (as we told you in [Chapter 9](#)). You’ll find problems involving integers, percents, averages, ratios, algebra, and geometry. Only the

format is different.

Your familiarity with the math content, however, can give you an advantage when working a data-sufficiency question. Most people read the question and then immediately read the statements. But that's not how you would normally work a math problem. Normally, you would read the problem and then ask yourself, "What do I already know?" and "What do I need?"

You should always attempt to do the same thing when working a data-sufficiency question. Before proceeding to the statements take stock of the information that you already know. Then, see if you can determine what sort of information the statements need to provide so that you could solve the problem.

We call this approach Pieces of the Puzzle. In a sense, data-sufficiency questions are just like jigsaw puzzles. When you work a jigsaw puzzle, you know what piece you are looking for based on the shapes of the pieces that fit around it. In a data-sufficiency question, you'll often know what sort of information you need from the statements based on what you already know from the question stem.

Here's an example:

If a store sold 30 more televisions this month than last month, by what percent has the number of televisions sold increased from last month to this month?

- (1) This month the store sold 150 televisions.
- (2) Last month the store sold 80% as many televisions as this month.

Here's How to Crack It

Start by asking, "What do I know?"

You know two things. First, the problem asks for a percent increase. That should get you thinking about the formula for percent change:

$$\% \text{ change} = \frac{\text{difference}}{\text{original}} \times 100$$

Next, notice that you already know the change, since the question states that the store sold 30 more televisions this month than last month. So, you can plug the difference into the formula to get:

$$\% \text{ change} = \frac{30}{\text{original}} \times 100$$

Now, it's time to ask yourself, "What do I need?" By looking at the formula, you can see that you'll be able to answer the question if the statements give you a way to determine the original. So, as soon as you know how many televisions the store sold last month, you have sufficient information.

Pieces of the Puzzle

What do you know?

The difference is 30.

What do you need?

The sales for last month, the original.

Now, remember to read only Statement (1). If the store sold 150 televisions this month and that represents an increase of 30 televisions, you know that the store sold 120 televisions last month. So, write down AD.

Now, forget about Statement (1) and read Statement (2). This statement is a little trickier than the first. If last month's sales were 80% of this month's sales, you know that the additional 30 televisions that were sold this month represent 20% of the total. Now, you set up a part-to-whole relationship:

$$\frac{\text{part}}{\text{whole}} = \frac{20}{100} = \frac{30}{x}$$

Can you find the value of x from this equation? Of course. Therefore, Statement (2) is also sufficient and the answer to this question is D.

Let's try the approach again on a difficult question.

What is the average (arithmetic mean) of a list of 6 consecutive two-digit integers?

- (1) The remainder when the fourth integer is divided by 5 is 3.
- (2) The ratio of the largest integer to the smallest integer is 5:4.

Here's How to Crack It

As before, apply the Pieces of the Puzzle approach by asking, “What do I know?”

Since the question asks you to find the average, you should remember that you can find an average if you have the sum of the items being averaged and the number of those items. In this case, you know that there are six integers. You also know that the integers are consecutive. Finally, since the question states that the integers are two digit, you know that each integer is between 9 and 100.

Now, it’s time to ask, “What do I need?” There are lots of possibilities. The statements could give you the sum of the six numbers. Or, the statements could give you the value of one of the integers and its position in the list. For example, if you know that the second integer is 12, you could certainly find the average.

Now, read and evaluate only Statement (1). It’s best to think about the information in this statement by plugging in some possible numbers. For example, the fourth integer could be 18 because the remainder when 18 is divided by 5 is 3. If the fourth integer is 18, the first integer is 15. The complete list would be 15, 16, 17, 18, 19, 20 and their average is 17.5. However, the fourth integer could also be 33, making the first integer 30 and the average of the six integers 32.5.

So, Statement (1) does not provide sufficient information to find the average of the six integers. Write down BCE.

Now, forget what you know from the first statement and evaluate only Statement (2). At first, Statement (2) may not seem like much help either. After all, if you are going too quickly, you may be tempted to think that the largest integer could be 15 and the smallest 12 or the largest could be 20 and the smallest 16.

However, here’s where you need to remember the puzzle piece that you already have—there are *six* consecutive integers on the list. So, while 12 and 15 may seem to fit the ratio provided in the second statement, those numbers really don’t satisfy the statement and the problem because there wouldn’t be six numbers for the list.

The only way to satisfy the information in the second statement and in the problem is to make the smallest number 20 and the largest number 25.

Therefore, the answer to this difficult question is B.

DRILL 9 (Data Sufficiency Parts and Wholes)

The answers can be found in Part VI.

1. If only people who paid deposits attended the Rose Seminar, how many people attended this year?

(1) 70 people sent in deposits to attend the Rose Seminar this year.

(2) 60% of the people who sent deposits to attend the Rose Seminar this year actually went.

- Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.
 Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.
 BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient. EACH statement ALONE is sufficient. Statements (1) and (2) TOGETHER are NOT sufficient.
2. Luxo paint contains only alcohol and pigment. What is the ratio of alcohol to pigment in Luxo paint?

(1) Exactly 7 ounces of pigment are contained in a 12-ounce can of Luxo paint.

(2) Exactly 5 ounces of alcohol are contained in a 12-ounce can of Luxo paint.

- Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.
 Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.
 BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient. EACH statement ALONE is sufficient. Statements (1) and (2) TOGETHER are NOT sufficient.
3. A car drives along a straight road from Smithville to Laredo, going through Ferristown along the way. What is the total distance by car from Smithville to Laredo?

(1) The distance from Smithville to Ferristown is $\frac{3}{5}$ of the distance from Smithville to Laredo.

(2) The distance from Ferristown to Laredo is 12 miles.

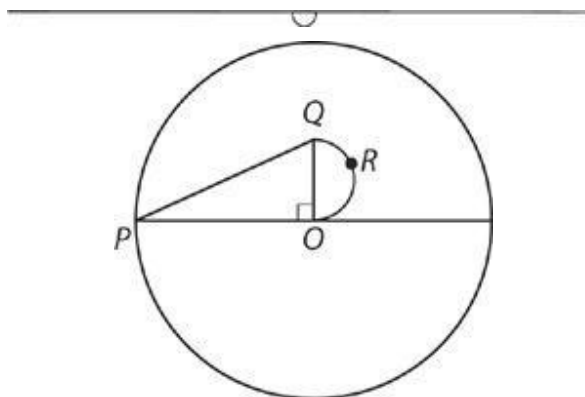
- Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient. Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient. BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient. EACH statement ALONE is sufficient. Statements (1) and (2) TOGETHER are NOT sufficient.
- Data Sufficiency and Geometry**

For problem solving questions, the figures are generally drawn to scale. Chapter 13 discussed how you can ballpark by using the figure so long as it wasn't clearly marked that it wasn't drawn to scale.

For data-sufficiency questions, however, you should be very careful when using the figure. The figures are drawn so that they represent the information in the question stem, but they need not accurately represent the information in the statements. So, you should base your conclusions about whether you have sufficient information on the statements rather than any figures provided with a data-sufficiency question.

When data-sufficiency questions are about geometry, however, you can often make very effective use of the Pieces of the Puzzle approach. The Pieces of the Puzzle approach works very well in situations in which you can use formulas and take stock of facts.

Here's an example of a medium question to illustrate:



In the figure above, arc QRO is a semicircle. What is the area of the circle with center O ?

- (1) The area of triangle PQO is 30.
- (2) The length of QRO is 2.5π .

Here's How to Crack It

Apply the Pieces of the Puzzle approach by asking, "What do I know?"

For this problem, you actually know a lot. You know that arc QRO is half a circle and that its diameter is one side of a right triangle. Of course, you also know that triangle PQO is a right triangle, so the Pythagorean theorem applies.

Pieces of the Puzzle

What do you know?

QRO is a semicircle. The triangle is a right triangle. The formulas for the area of a triangle, the circumference of a circle, and the area of a circle.

What do you need?

The length of PO , the radius of the circle.

Now, ask, “What do I need?” The question asks for the area of the circle. Since the formula for the area of a circle is $A = \pi r^2$, you’ll need a way to find the radius of the circle. If the statements provide either the length of PO or a way to find that length, you’ll have sufficient information.

Your next step is to look only at the information provided in Statement (1). The

$$A = \frac{\text{base} \times \text{height}}{2}$$

formula for the area of a triangle is . You know the area but neither the base nor the height, so you have insufficient information. Write down BCE.

Next, look only at Statement (2). Now, it’s time to remember that QRO is a semicircle. The statement gives you half of the circumference of a circle. You can use the circumference formula to find the diameter, QO . In this case, you actually have half the circumference, so use $2C = \pi d$ or $2(2.5\pi) = \pi d$ and $d = 5$. So, now you know the length of QO , but you still don’t have the radius of the circle. (You may think that you recognize a 5:12:13 right triangle, but remember that you need two sides of the triangle to use the Pythagorean theorem.) Cross off B.

Finally, put the statements together. Now, you know both the area of the triangle and its height, so you can plug those values into the formula for the area of a triangle to get $-30 = 1/2(b)(5)$. Can you use this formula to find PO ? Yes. So, the answer to the problem is C.

Data Sufficiency and the Strange Powers of Powers

The data-sufficiency question type is particularly well suited to testing your knowledge of the rules of equations and the strange powers of powers. Let's review this important information:

When working with equations, you generally need as many equations as there are variables in those equations. A single equation with two variables cannot be solved, but two distinct equations with the same two variables *can* be solved, using simultaneous equations, as you learned in Chapter 11. For example, $x = y + 1$ cannot be solved, but $x = y + 1$ and $2x = -y - 6$ can be added together, eliminating one variable so the other may be solved.

Just because there is only one variable doesn't mean that an equation has just one solution. Generally, equations have as many solutions as the greatest exponent in the equation. So, an equation with a squared term will typically have two solutions. Simple equations with a variable raised to an odd power may have only one solution. For example, if $x^2 = 4$, then x could equal either 2 or -2 . If $x^3 = 8$, then x can only equal 2.

But sometimes, it's possible to get an answer even if there is only a single equation with two variables—IF the problem asks for an expression that contains both variables.

Sometimes you can also get an answer if there is only a single equation with two variables if both of those variables can only take integer values.

Let's look at some problems that use these rules.

Mr. Jones spends \$25 on movie tickets for a party of adults and children. How many children's tickets did he buy?

- (1) Adult movie tickets cost \$3 each and children's tickets cost \$2 each.
- (2) Mr. Jones buys a total of 11 tickets.

Here's How to Crack It

Start by asking, "What do I know?" In this case, you know that Mr. Jones spends \$25 and that there are two variables—adult tickets and children's tickets.

Next, ask, "What do I need?" It's time to start thinking "two equations, two unknowns."

Now, evaluate Statement (1). From this statement, you get $3x + 2y = 25$. That's only one equation but two variables, so you do not have sufficient information. So, write

down BCE.

Next, evaluate Statement (2), from which you can get the equation $x + y = 11$. Again, there's only one equation and two variables, so cross off B.

When the statements are combined, you have two distinct equations with two variables, which means that you can solve. So, the answer is C.

Here's a harder example. This example would be an upper-medium problem.

What is the value of $\frac{a}{b}$?

(1) $7a - 3b = 0$

(2) $b = 5$

- Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.
 Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.
 BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient. EACH statement ALONE is sufficient. Statements (1) and (2) TOGETHER are not sufficient.
- Here's How to Crack It**

You're not going to get much mileage out of the Pieces of the Puzzle approach for this question. All you really know is that there are two variables involved.

So, ignore Statement (2). Based on Statement (1) ALONE, can you answer this question? At first glance, you might think not—because there are two variables in one

equation. But the question is not asking you to solve for a and for b , but for $\frac{a}{b}$. If you add $3b$ to both sides of the equation in Statement (1), you get $7a = 3b$. If you then divide

both sides of the equation by b , you get $\frac{7a}{b} = \frac{3b}{b}$, which reduces to $\frac{7a}{b} = 3$. By

dividing both sides by 7, you get $\frac{a}{b} = \frac{3}{7}$, which answers the question. Statement (1) is sufficient, and you are down to AD. Looking at Statement (2) alone, of course, you can't answer the question, so the correct answer to the problem is choice A.

The problem we just solved made use of the third rule in our review. Notice that C was a trap answer for this problem. Sure, you could find the value of a and b by

combining the statements. However, answer C states that you need to put the statements together *because* neither statement provides sufficient information by itself. So, you'll want to remember that it's possible to know the value of an expression without knowing the values of the variables that make up that expression.

Here's one more example. This one doesn't sound that bad, but it's actually a very difficult problem.

Mr. Jones spends \$76 on movie tickets for a group of adults and children. How many children's tickets did he purchase?

- (1) Adult movie tickets cost \$11 each and children's movie tickets cost \$7 each.
- (2) Mr. Jones bought two more adult tickets than children's tickets.

Here's How to Crack It

As always, start by asking, "What do I know?" In this case, Mr. Jones spends \$76 on movie tickets, and there are two variables. But, notice that there is actually one more thing that you know—movie tickets must be bought in integer quantities.

Next, ask, "What do I need?" You'll probably need two equations, but the fact that the variables can only take on integer values may change things.

Now, it's time to look at Statement (1), which gives you the equation $11x + 7y = 76$. Before dismissing this single equation with two variables as insufficient, remember that both x and y must be integers. Also, notice that the coefficients, 11 and 7, are large enough to limit the possibilities. Mr. Jones must buy fewer than 7 adult tickets. It's probably worthwhile to investigate how many of those integer values for x produce an integer value for y . As it happens, y is only an integer when $x = 5$. So, Mr. Jones bought 5 adult tickets and 3 children's tickets. So, write down AD.

Statement (2), however, does not provide sufficient information by itself. Remember that you don't even know how much the tickets cost based only on the second statement. So, the answer is A.

So, how was this problem different from the first problem in which Mr. Jones bought movie tickets? Why didn't we need to worry about the integer quantities on the first problem? Well, actually, we did. However, for the first problem, the first statement gave us the equation $3x + 2y = 25$. Had we taken some time to investigate this equation, we would have quickly discovered that there are several sets of integer solutions. For example, Mr. Jones could have bought 3 adult tickets and 8 children's tickets, or he could

have bought 5 adult tickets and 5 children's tickets.

So, how do you know when to look for a single integer solution? Well, first make sure that the variables can only be integers! Since you can't buy half a movie ticket, that was part of the tip-off. Next, if there is going to be only one integer solution, it is likely that at least one of the coefficients will be a larger prime number like 11 or 17 or 29.

Finally, think about your current scoring level. A problem like that last one would show up only in one of the GMAT's most difficult question bins—because the test writers think so few people will get it right. You aren't likely to encounter this problem on your computer-adaptive section of the GMAT unless you are scoring in the mid to high 40s on your practice math tests.

DRILL 10 (Strange Powers of Powers)

The answers can be found in [Part VI](#).

Equation Tricks and Traps

Some equations are not distinct, such as when one equation can be multiplied to equal the other equation.

For example:

$$x + y = 4$$

$$4x + 4y = 16$$

These are not distinct equations. There is not enough data yet to solve for x or y .

1. What is the value of x ?

(1) $x^2 = 4$

(2) $x < 0$

- Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.
- Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.
- BOTH statements TOGETHER are sufficient, but NEITHER statement alone is

sufficient. EACH statement ALONE is sufficient. Statements (1) and (2) TOGETHER are NOT sufficient. 2. What is the value of xy ?

(1) $x^2 = 4$

(2) $y = 0$

Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.
 Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.
 BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient. EACH statement ALONE is sufficient. Statements (1) and (2) TOGETHER are NOT sufficient. 3. What is the value of xy ?

(1) $x^2 = 4$

(2) $y^2 = 9$

Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient. *Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.* *BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.* *EACH statement ALONE is sufficient.* *Statements (1) and (2) TOGETHER are NOT sufficient.* **YES/NO DATA SUFFICIENCY**

We covered the basics of Yes/No Data Sufficiency in Chapter 9.

First, let's do a quick review by looking at a problem.

Is integer x prime?

(1) $47 < x < 53$

(2) $x > 0$

Here's How to Crack It

Notice that this question is phrased so that you would need to respond by saying “yes,” “no,” or “maybe” rather than by giving a numerical answer. That’s why this is a yes/no question. As you know from Chapter 9, you use the same process to answer a yes/no data-sufficiency question.

So, start by evaluating only Statement (1). There are 5 integers between 47 and 53—48, 49, 50, 51, and 52. Are any of these integers prime? No. But, notice that means that you can answer the question. Is x prime? No, it isn’t. So, you have sufficient information. (Remember that a statement can be sufficient for a yes/no question if it allows you to answer the question in either the affirmative or the negative.) So, write down AD.

Now, look only at Statement (2). Based on Statement (2), you don’t know whether x is prime. If x is 3, for example, the answer to the question is yes. However, if x is 4, the answer to the question is no. The best answer you could give to the question “Is x prime?” based on Statement (2) is “maybe.” So, the answer to the problem is A.

Plugging In on Yes/No Questions

Because as many as half of the data-sufficiency problems you’ll see on the GMAT will be yes/no questions, it’s a good idea to have a strategy for these questions. When yes/no questions involve variables, you can plug into the statement and use those numbers to see if you always get the same answer to the question.

In the problem we just looked at, we plugged into the second statement. Because we were able to find examples of numbers that satisfied the statement but that gave different answers to the question, we knew that Statement (2) wasn’t sufficient.

Now, let’s look at another example.

Is x an integer?

(1) $5x$ is a positive integer.

(2) $5x = 1$

Here’s How to Crack It

As always, ignore Statement (2) and look only at Statement (1). Since this question is phrased as a yes/no question and there are variables involved, let's plug in.

When you plug in on a yes/no data-sufficiency question, you start by picking a number that satisfies the statement. For example, we can start with a nice, simple number such as $x = 2$. Notice that we can use $x = 2$ because $5 \times 2 = 10$ and 10 is a positive integer.

Statements Must Be True

You can only plug in numbers that make the statement true. The answer to the QUESTION can be "yes" or "no," but the statements themselves must always be true. So, for example, if Statement (1) says " $5x$ is a positive integer," then you can't plug -2 in for x . It would make the statement UNTRUE.

Now that we've found a number that satisfies the first statement, it's time to use that number to answer the question. Be sure that you use the value that you picked for x , not the result of the statement. So, the question becomes "Is 2 a positive integer?" and the answer is, of course, yes. Careful! Don't write down AD yet!

All we've done is find one example of a number that satisfies the first statement and used that number to answer the question. Now that we have an answer of yes, we actually want to see if it's possible to get an answer of no to the question based on a number that satisfies the first statement.

What if we make $x = \frac{1}{5}$? We've satisfied the statement because $5 \times \frac{1}{5} = 1$ and 1 is a positive integer. However, now we need to use our number to get an answer to the question.

Is $\frac{1}{5}$ a positive integer? No.

So, some numbers that satisfy the first statement produce an answer of yes to the question, while other numbers that satisfy the statement produce an answer of no. So, we don't have sufficient information to state whether x is an integer. Write down BCE.

Now it's time to look at the second statement. In this case, we have an equation that we can solve to find that $x = \frac{1}{5}$. So, we ask, "Is $\frac{1}{5}$ an integer?" and give a definite answer of no.

The answer to the problem is B.

Plugging In is your most important strategy for handling yes/no data sufficiency questions.

To see how effective Plugging In can be, let's try it on a more difficult question.

Is $3^n > 2^k$?

(1) $k = n + 1$

(2) n is a positive integer.

Here's How to Crack It

This is a yes/no question involving variables, so Plugging In is a good idea.

Start by evaluating Statement (1) alone. Pick an easy number for n . If $n = 2$, then $k = 3$. The numbers satisfy the statement, so it's time to use them to answer the question. Is $3^2 > 2^3$? Yes.

Remember, however, that you can't properly evaluate the statement based on the results from only one set of numbers. Suppose we tried something a little weirder for n ? If $n = -1$, then $k = 0$. Is $3^{-1} > 2^0$? No. (Remember that negative exponents are just another way of writing a reciprocal and that any nonzero number raised to 0 is 1.)

So, we don't actually know what the answer to the question is based only on Statement (1). It looks as though the answer depends on the numbers we choose. Write down BCE.

For Statement (2), we can also plug in. Notice that the statement doesn't tell us anything about k , however. So, we could say that $n = 2$ and $k = 1$ to get an answer of yes to the question. But, we could also say that $n = 2$ and $k = 4$ to get an answer of no. Cross off B.

When we combine the statements, we can still use $n = 2$ and $k = 3$, which, as we saw when we looked at Statement (1), gives us an answer of yes to the question. However, we could also use $n = 1$ and $k = 2$ to satisfy the combined statements. Is $3^1 > 2^2$? No. So, the answer to this problem is E.

Don't Do the Work in Your Head

To remember that you need to plug in at least twice for each statement, write down the numbers you plugged in and the answers you get to the questions on your scratch pad.

Yes or No Plugging In Checklist

First, try plugging in a normal number for your variable. The number you pick must satisfy the statement itself. If it doesn't, plug in another number. The number will yield an answer to the question—either yes or no. But you're not done yet.

Now, try plugging in a different number for your variable. This time, you might try one of the “weird” numbers, such as 0, 1, a negative number, or a fraction. If the number still answers the question the same way, then you can begin to suspect that the statement yields a consistent answer, and that you're down to AD.

If you plug in a different number and get a different answer this time (a “yes” after getting a “no,” or a “no” after getting a “yes”), then the statement does NOT definitively answer the question, and you're down to BCE.

Now, repeat this checklist with Statement (2).

DRILL 11 (Yes or No)

The answers can be found in Part VI.

1. If x is a positive number, is $x < 1$?

(1) $2x < 1$

(2) $2x \leq 2$

- Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.

- Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.
 BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient. EACH statement ALONE is sufficient. Statements (1) and (2) TOGETHER are NOT sufficient.
2. Is x positive?

(1) $xy = 6$

(2) $x(y^2) = 12$

- Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.
 Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.
 BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient. EACH statement ALONE is sufficient. Statements (1) and (2) TOGETHER are NOT sufficient.
3. Are x and y integers?

(1) The product xy is an integer.

(2) $x + y$ is an integer.

Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient. **Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.** **BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.** **EACH statement ALONE is sufficient.** **Statements (1) and (2) TOGETHER are NOT sufficient.**

More Ways to Plug In

As you have just seen, Plugging In can be a very helpful tool to evaluate whether the statements provide sufficient information to answer the question on yes/no data-sufficiency question. Sometimes, however, Plugging In can also help you discover what the question is asking.

Often, test writers make a question harder by writing the question stem in a way that hides the concept being tested. After all, if you're having a hard time understanding the question, you'll almost certainly have a hard time answering the question. You should remember, however, that no matter how confusing the question stem appears when you first read it, that GMAT questions really only test fairly straightforward math concepts. Plugging In can help you decipher the question stem.

Here's an example of how the test writers might ask a difficult question:

If l_1 and l_2 are distinct lines in the xy coordinate system such that the equation for l_1 is $y = ax + b$ and the equation for l_2 is $y = cx + d$, is $ac = a^2$?

$$(1) d = b + 2$$

(2) For each point (x, y) on l_1 , there is a corresponding point $(x, y + k)$ on l_2 for some constant x .

Here's How to Crack It

One of the hardest things about this question is understanding the question stem. It's going to be impossible to evaluate the information in the statements before we understand what we're being asked.

Let's try applying the Pieces of the Puzzle approach by first asking, "What do we know?" We know there are two lines. And, since the question tells us that the lines are distinct, we know that they are different. We also sort of have the equations for each line, but we recognize that the equations we're given are really just the general equation for any line— $y = mx + b$.

At this point, it might be a good idea to take stock of what we know about lines. In the equation $y = mx + b$, m is the slope and b is the y -intercept. For our two lines in question, a and c represent the slopes and b and d represent the y -intercepts.

Okay, now we're getting somewhere. The question is asking us something about the slopes of the lines, since a and c represent the slopes. Now, let's plug in. If we let $a = 2$ and $b = 3$, then $(2)(3) \neq 22$. How could $ac = a^2$? That could only happen if $a = c$.

Now we've got it. If $a = c$, the slopes of the lines are equal. If the slopes of two lines are equal, the lines are parallel. This question is really just asking, "Is l_1 parallel to l_2 ?" If the test writers had asked the question this way, the difficulty of the question would have dropped.

Let's check out the statements. If we look only at Statement (1), all we know is that the y -intercept of l_2 is 2 more than the y -intercept of l_1 . In that case, the slopes could be the same—producing an answer of yes to the question—or the slopes could be different—producing an answer of no. So, Statement (1) is insufficient. Write down BCE.

Now, let's look at Statement (2). Plugging In is a good way to evaluate this statement. Start by picking a value of k , which must be a constant. We'll let $k = 2$. Let's say that points $(2,6)$ and $(3,8)$ are on line l_1 , which would mean that $(2,8)$ and $(3,10)$ are on l_2 . Using those points, we can calculate that the slope of each line is 2. Since the slopes are the same, the lines are parallel. We have an answer of yes to the question.

Of course, when you plug in on yes/no data sufficiency, you shouldn't stop after plugging in just one set of numbers. This time, let $k = 3$. Let's also say that $(2,8)$ and $(3,11)$ are on l_1 , which would mean that $(2,11)$ and $(3,14)$ are on l_2 . Once again, we can calculate the slope of each line. In this case, both slopes turn out to be 3. Again, since the slopes are the same, the lines are parallel. (Don't be thrown by the fact that the slopes are different for each plug in. We're only trying to see if the slopes of the lines are the same each time we plug in.)

If you remain unconvinced, you could try plugging in again, but you'll again find that the slopes of the lines are equal. In effect, the second statement tells us that for each point on l_1 there is a corresponding point on l_2 that is a distance of k units away. That can only happen if the lines are parallel. So, the answer is B.

If that question left you shaking your head, you're not alone. It's a very difficult question. Only a handful of test takers will wind up getting it right. In effect, the test writers pulled out every trick in their book to make this question difficult. Understanding the various ways that the GMAT test writers make questions difficult can help you improve your score dramatically.

POE PRINCIPLES FOR DATA SUFFICIENCY

Data-sufficiency questions that you find difficult and confusing are a distinct possibility when you take the GMAT, so you need to be prepared for them. After all, if the computer is doing its job properly—and you can pretty much count on that—it will keep feeding you progressively harder questions during the computer-adaptive section, in the hopes that it will find one that you don't know how to do.

In other words, almost every GMAT test taker hits a wall at some point. You've just gotten a string of questions right and suddenly there's a question on your screen that you find confusing. You need to answer it to move on to the next question, but you'd like to do better than a blind guess. In fact, if you narrow your available choices, you may just guess correctly, dodge the bullet, get the next couple of questions right, and wind up with a higher score than if you didn't have a plan for handling those tough, confusing questions. Good test takers always have a good guessing plan in hand.

Part of the key to using a guessing strategy effectively is to know your current GMAT math score. If your current score indicates that you are answering mostly easy questions (a score up to roughly 25), continue to concentrate on mastering the principles that we've already covered. As you master those principles, you'll start to see more questions on practice tests that will make use of the traps that we'll discuss in a minute. To make further improvements, you'll need to learn how to spot and avoid the test writers' favorite traps.

If your score is above 25, you're already seeing data-sufficiency questions on your practice tests that contain the traps we're about to discuss. The first step to avoiding the traps is to learn to spot them. Learning to avoid the traps can be a very effective way

to improve your GMAT score.

Work With What You Know

We've already been using Process of Elimination (POE) throughout this section. On data-sufficiency questions, a little knowledge can go a long way. Suppose you saw the following data-sufficiency question:

What is the area of square $ABCD$?

(1) The length of the side of square $ABCD$ is 2.

(2) For square $EFGH$, which has sides that are 6 longer than those of square $ABCD$, the ratio of the perimeter to the area is the reciprocal of the corresponding ratio for square $ABCD$.

When we don't know something about a problem, our first impulse is to just skip the whole thing. Or to assume that there's no way to solve it. However, you can't skip questions on the GMAT, and you may not get your best score possible if you assume that everything that looks hard can't be solved.

Obviously, the second statement of this problem is wordy and confusing. You may not be sure what it says or whether it provides sufficient information to answer the question, but that doesn't mean you need to make a random guess.

Let's focus on what you DO know. To find the area of a square, you need to know the length of the side of the square—exactly what the first statement provides. Since the first statement is sufficient, your possible answers are A or D.

In other words, you have a fifty-fifty chance of getting the question right. And you get there even if you find the second statement confusing.

As long as you know something about a data-sufficiency question, you can do some shrewd guessing. Take a look at this variation of the problem we've been discussing:

What is the area of square $ABCD$?

(1) The length of the side of square $ABCD$ is greater than 1.

(2) For square $EFGH$, which has sides that are 6 longer than those of square $ABCD$, the ratio of the perimeter to the area is the reciprocal of the corresponding ratio for square $ABCD$.

You still know that you need the length of the side of the square to find its area. However, now the first statement does not provide that length. If the first statement is insufficient, you can narrow your choices down to B, C, or E.

This time, you have a 1 in 3 chance of getting the question right. As before, you didn't need to tackle the second statement to better your odds of getting the question right.

The Joe Bloggs Impulse and Data Sufficiency

Joe can help you avoid several types of traps on data-sufficiency questions. The single most important thing to remember about Joe is that he tends to choose his answers very quickly. Anytime that you are tempted to answer a data-sufficiency question in only a few seconds, you may be about to fall for a Joe Bloggs answer. That's not to say that you aren't about to pick the correct answer. However, you should take a few more seconds just to make sure that you aren't missing anything.

There are several common traps that Joe falls for. Let's take a look at them.

Trap #1) Joe Thinks Answer E Means "I Don't Know"

Let's revisit that hard question from the More Ways to Plug In section to see how Joe might approach it.

If l_1 and l_2 are distinct lines in the xy coordinate system such that the equation for l_1 is $y = ax + b$ and the equation for l_2 is $y = cx + d$, is $ac = a^2$?

$$(1) d = b + 2$$

(2) For each point (x, y) on l_1 , there is a corresponding point $(x, y + k)$ on l_2 for some constant x .

This question really confuses Joe. He has no idea what the question is asking. As a result, he has no idea how he's supposed to evaluate the information in the statements. But Joe doesn't want to admit that he doesn't know what to do. Joe's not alone in feeling that way—most people don't like to admit that they don't know how to solve a problem.

Joe tends to pick E on questions that he doesn't understand. That's because Joe thinks that answer E means "I don't know how to do this problem." Of course, answer E really means "I know exactly how to do the problem and that's how I know that the

statements don't provide sufficient information."

If you want to pick E on a question that you find confusing, make sure that you can explain why you don't have enough information. Otherwise, you may be equating answer E with "I don't know how to do this problem."

Trap #2) Joe Thinks the Statements Are Missing Information

Sometimes Joe picks answer E because he's convinced that the statements need to provide more information. Of course, Joe arrived at his conclusion pretty quickly, so it's likely that he may have missed some way to use the information provided.

Consider this example:

What is the value of $r^2 + s$?

(1) $t - u = 8$

(2) $r^2t - su + st - r^2u = 24$

Here's How to Crack It

Joe's first impulse is to pick E on this question. He sees two variables in the question stem but 4 variables in the statements. He doesn't know what t and u have to do with finding the values of r^2 and s . With four variables, Joe thinks that he needs more equations to find the values of r and s so that he can answer the question. Joe is convinced that he's missing necessary information. So, he goes with E.

Joe's answer is not correct, however. He's fallen for the trap.

Statement (1) is obviously insufficient. There's no way to determine anything about r and s from information about t and u . So, write down BCE.

Now, let's take a good look at Statement (2). The equation provided does contain the two variables we're interested in. Let's try grouping the expressions differently:

$$r^2t - su + st - r^2u = 24$$

$$(r^2t + st) - (r^2u + su) = 24$$

$$t(r^2 + s) - u(r^2 + s) = 24$$

$$(r^2 + s)(t - u) = 24$$

So, Statement (2) is insufficient. Cross off B.

However, if the statements are combined, we can see that the value of $r^2 + s$ is 3. The correct answer is C.

To Joe's credit, he did try to think about what information he needed to solve this question. However, Joe didn't really try to evaluate the second statement. He just saw all those variables and concluded that he needed a lot more information and went for E.

How can you avoid Joe's mistake? Make sure that you take the time to fairly evaluate the information in each statement. You may need to do a little algebraic manipulation or plug in some numbers to see what's going on.

Trap #3) Joe Thinks That Confusing Statements Are Not Sufficient

As previously mentioned, Joe doesn't like to admit that he doesn't understand something. So, sometimes the test writers will match up a fairly easy statement with one that is difficult to understand. Let's see how Joe responds.

What is the volume of a certain rectangular solid?

- (1) The solid can be cut into 16 cubes, each of which has a volume of 1.
- (2) The base of the rectangular solid is a square, which has a diagonal length of $2\sqrt{2}$, and the ratio of the height of the solid to its length is 2:1.

Here's How to Crack It

Joe understands Statement (1), and he knows that it tells him that the volume of the rectangular solid is 16. He doesn't know what to make of the second statement, however. He's read it a couple of times and finds it pretty confusing. So, Joe—reluctant as he is to pick anything that he doesn't understand—quickly picks A for this question and moves on to the next problem.

Obviously, the first statement is sufficient, so write down AD. We'll need to take a better look at that second statement, however.

If the base of the rectangular solid is a square, the diagonal divides the square into two 45-45-90 triangles. For a 45-45-90 triangle, the hypotenuse is $s\sqrt{2}$. In this case, the side of the square turns out to be 2. So, for the rectangular solid, we now know both its length and width. The statement tells us that the ratio of the height of the solid to its length is 2:1, which means that the height of the solid is 4. So, we now know all three dimensions of the solid. Since the second statement was also sufficient, the correct answer is D.

How can you avoid Joe's mistake? This question had a very particular format. An easy to understand statement was matched with a statement that was much harder to understand. Joe didn't want to say that the statement he didn't understand was sufficient, so he went with A. Typically, however, when the test writers match an easy statement with a statement that is wordy and confusing, the harder statement is also sufficient. If the hard statement didn't work, the question would be an easy problem.

Obviously, you need to be careful in employing this guessing strategy. The easy statement needs to be so easy that very few people will evaluate it incorrectly. If that's the case, ask yourself why you're tempted to say that the more confusing statement is insufficient. Do you know what information it doesn't supply? Or are you saying, "I really am not sure what this statement says"? If your reason boils down to not fully understanding the statement, your better bet is to say that the confusing statement probably does supply sufficient information.

Trap #4) Joe Thinks Too Many Problems Are Easy

Joe thinks that many of the hard problems he sees are actually pretty easy. That's how he winds up with an average score. Every time he starts to do well and the computer feeds him harder questions, Joe gets a lot of those harder questions wrong.

What was the average (arithmetic mean) attendance for baseball games played at Memorial Stadium during the months of June and July?

(1) The average numbers of people attending baseball games at Memorial Stadium for June and July were 23,100 and 25,200, respectively.

(2) There were 20 baseball games played in June at the stadium and 22 games played in July.

Here's How to Crack It

Joe thinks this question is pretty easy. Statement (1) gives us the average attendance for June and the average attendance for July. Joe thinks he has all the information he needs because he thinks that he can get the average for the two months by averaging the two averages. (You—having completed our chapter on arithmetic—know better.) Joe looks at Statement (2) and doesn't see any attendance figures at all. He quickly picks answer choice A.

But, of course, Joe is wrong. The answer to this question is C. An average is the total sum of values divided by the *total* number of values. We need to know the number of games in each month in order to find out the total number of people attending.

How can you avoid Joe's mistake? First, slow down! Joe goes too fast and that causes him to make a lot of mistakes. Second, remember that data-sufficiency questions most likely are not as easy as they seem.

Trap #5) Joe Makes Bad Assumptions

Data-sufficiency questions try to get test takers to make bad assumptions. The test writers know how most people think about math, and they often write the questions to take advantage of the assumptions that people routinely make.

For example, consider the following medium question:

What is the value of x ?

(1) $x > 8$

(2) $x < 10$

Here's How to Crack It

Joe assumed that numbers are always integers and chose C. As always, Joe chooses his answer very quickly.

Of course, numbers are not always integers. Statement (1) is insufficient, so write

down BCE. Statement (2) is also insufficient, so cross off B. Combining the statements only tells us that x is any number between 8 and 10— x could be 9, but it could also be 8.5. The answer is E.

How can you avoid Joe’s mistake? Again, slow down! When a problem seems too easy, go back and reread the information. Are you, for example, assuming anything about the types of numbers that fit the statements?

Trap #6) Joe Remembers Statement (1) When Evaluating Statement (2)

Joe sometimes tries to use information that he learned in Statement (1) while evaluating Statement (2).

At a business dinner, people were offered coffee or tea. If all the diners had either coffee or tea, how many of the diners had tea?

- (1) Of the 60 people at the dinner, 10% had tea.
- (2) Fifty-four people had coffee.

Here’s How to Crack It

Joe likes D for this question. He thinks the first statement is pretty easy. Joe has correctly determined that the first statement tells him that 6 people had tea. When Joe looks at the second statement, however, he thinks “54 people had coffee so that means that 6 had tea. Yeah, that works.” So, he selects D.

There’s only one small problem with Joe’s reasoning—the second statement does not tell us the number of diners. So, based on the second statement, we have no idea how many people had tea. The correct answer is A.

How can you avoid Joe’s mistake? *Always evaluate the statements independently.* Use the AD/BCE approach.

You should also be careful when the statements seem to agree. If the second statement had said “two people had coffee,” it would have been easy to conclude that the second statement was not sufficient. By choosing a number that agreed with the

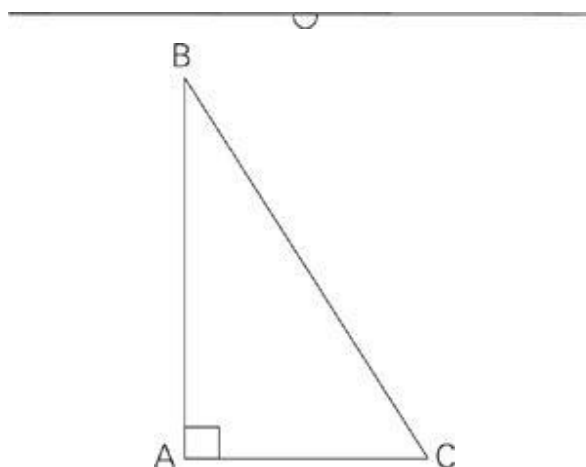
information from the first statement, the test writers made it much easier to fall for the trap. So, remember that just because one statement seems to agree with the other, that doesn't mean that they say the same thing.

Putting It All Together

Joe's biggest problem always boils down to going too fast. While we have run through a list of common ways that Joe gets questions wrong, in all cases, Joe's first mistake was thinking that it's OK to answer data-sufficiency questions quickly. Just because you don't need to compute an answer to a data-sufficiency question, however, doesn't mean that you can race through the question.

Recognizing the types of errors that Joe makes on data-sufficiency questions can sometimes help you guess your way to the right answer. That can be helpful if you find a question confusing or if you are running short on time close to the end of the section.

Let's look at one last example.



If the perimeter of right triangle ABC above is $3 + 3\sqrt{3}$, what is the area of the triangle?

- (1) $AC \neq AB$
- (2) angle $ABC = 30^\circ$

Here's How to Crack It

$$\frac{\text{base} \times \text{height}}{2}$$

The area of a triangle is $\frac{\text{base} \times \text{height}}{2}$. Joe looks at Statements (1) and (2) and sees neither the base nor the height of the triangle. So, he quickly concludes that the answer is E because he doesn't see any way to get the area of the triangle from the information in the statements.

Let's see how close we can get to the answer using Process of Elimination. Ignore Statement (2). The first statement only tells us that the base and height have different lengths. Even with the value for the perimeter, there's no way we're going to get the values of the base or height. So, cross off AD.

We're down to B, C, or E. We know that E, Joe's answer, is very unlikely, so let's cross that off. The remaining choices are B or C. Now, let's look at that second statement. From it, we can conclude that this triangle is a 30-60-90 triangle. If the triangle is 30-60-90, that would also mean that the base and the height of the triangle are different—exactly what the first statement told us. It doesn't sound like combining the statements adds anything that we don't know from just the second statement. So, C is unlikely. It seems very likely that the correct answer is B.

And the correct answer is B. If you were running out of time or not exactly sure how to solve this question, you can get to the right answer just by knowing how Joe would respond and employing a little deductive reasoning.

Here's How GMAC Wants You to Crack It

Statement (2) tells us that the right triangle is a 30-60-90 triangle. If you have already read our chapter on geometry, you know that the dimensions of a 30-60-90 triangle are always in the same proportion: $x : x\sqrt{3} : 2x$. (Remember that the x in the proportion is the side opposite the 30-degree angle.) Since you can find the perimeter of any figure by adding up the sides, the perimeter of a 30-60-90 triangle is $3x + x\sqrt{3} + 2x$. And we can use what we know from the question stem to solve for the short side of the triangle:

$$3x + x\sqrt{3} + 2x = 3 + 3\sqrt{3}$$

Remember that you don't need to solve. You just need to know that you can solve, since this is a data-sufficiency problem. (Just in case you're curious, $x = \sqrt{3}$.) Once you've got the length of the base, you can find the height and then find the area of the triangle.

So, Statement (2) is sufficient and the answer is B.

That Was a Lot of Work

This question was very difficult and very time-consuming if you tried to solve it as the test writers wanted you to. Almost every test taker battles the clock on the GMAT. Knowing how to use Process of Elimination and what Joe would choose can help you make informed guesses when you are stuck on a problem and starting to run out of time.

Our guessing strategies are not infallible. However, if you must guess, it's better to make an informed guess than a random guess.

Summary

The instructions for data-sufficiency questions are very complicated. Memorize them now. Here is a pared-down checklist: The first statement ALONE answers the question. The second statement ALONE answers the question. You need both statements TOGETHER to answer the question. Both statements SEPARATELY answer the question. Neither statement together or separately answers the question.

To aid in scratch booklet eliminations, think of these answer choices as A, B, C, D, and E.

Use POE to narrow down the field. If you know that Statement (1) is sufficient, you are already down to a fifty-fifty guess: A or D. If you know that Statement (1) is not sufficient, you are already down to a one-in-three guess: B, C, or E.

If you are stuck on Statement (1), skip it and look at Statement (2). POE will be just as helpful.

If Statement (2) is sufficient, you will be down to B or D. If Statement (2) is not sufficient, you will be down to A, C, or E.

The math content of the data-sufficiency questions is exactly the same as it is on the regular math questions.

As you would in the regular math problems, look for the clues that tell you how to solve data-sufficiency problems.

When a problem asks a yes-or-no question, remember that the answer can be no.

In yes-or-no questions, a statement is sufficient if it always gives us the *same* answer: always yes or always no. If the answer is sometimes yes and sometimes no, the statement is insufficient.

In data-sufficiency questions, look for opportunities to simplify or restate the question. If a question asks, "Did the foreman reject 40% of the 12,000 computers manufactured?" you could simplify that to ask, "Did the foreman reject 4,800 computers?"

In intermediate and difficult data-sufficiency problems, you must be on guard against careless assumptions.

In *difficult* data-sufficiency problems: If Joe Bloggs *thinks* the problem is difficult, his favorite answers are choices E (“there isn’t enough information”), or C (“this problem needs all the information it can get”). If Joe Bloggs thinks the problem is easy, he will be drawn to choices A, B, or D.

On difficult data-sufficiency problems, Joe’s answer is always wrong.

Part III

How to Crack the Verbal GMAT

15 Sentence Correction

16 Reading Comprehension

17 Critical Reasoning

Chapter 15

Sentence Correction

GMAT sentence correction involves finding a grammatical mistake (if there is one) in the original sentence and then finding the answer choice that fixes it. This chapter will begin with a review of grammar as it is tested on the GMAT and then move on to show you how to *recognize* the key errors the test-writers like to test. Then you’ll learn how to use the answer choices as clues to find the correct answer.

Sentence corrections make up a little more than one-third of the 41 questions on the Verbal portion of the GMAT—approximately 16 questions that will be interspersed throughout the test. A sentence correction question consists of one long sentence that is either partially or completely underlined. You have to decide whether the sentence is grammatically correct as it’s written, or if it is not, which of the answer choices best replaces the underlined portion.

Before we begin, take a moment to read the following instructions. They are a close approximation of the instructions you’ll see on the real GMAT. Be sure you know and understand these instructions before you take the GMAT. If you learn them ahead of time, you won’t have to waste valuable seconds reading them on the day of the test.

B-School Lingo

finheads: finance heads
(see Sharks)

four Ps: elements of
marketing strategy—
Price, Promotion, Place,
Product

fume date: the date a
company will run out of
cash

*Source: Best 294 Business
Schools*

Directions: Each sentence correction question refers to a sentence, a portion or all of which has been underlined. If you think the sentence is correct as written, pick the first answer choice, which simply repeats the underlined portion exactly. If you think there is something wrong with the sentence as written, choose the answer choice that best replaces the underlined portion of the sentence.

Sentence correction questions are designed to measure your correct use of grammar, your ability to form clear and effective sentences and your capacity to choose the most appropriate words. Pick the answer that best states what was meant in the original sentence while adhering to the requirements of standard written English. Avoid constructions that are awkward, unclear, or redundant.

The Bad News

It's important to understand the fine print of the instructions you've just read. The test writers ask you to choose the "best" answer, by which they mean the answer that they think is right. The bad news is that some of the "correct" answer choices for the GMAT's sentence correction questions will probably not sound correct to you. The rules of English

as interpreted by the GMAT are very different from the rules of English that govern what we read in newspapers, hear on television, or speak in our everyday lives.

How many times have you heard your boss, or a television anchorperson, or a president of the United States, make the following statement?

“Hopefully, we will know the answer to that question, tomorrow.”

While you probably don’t want to make a habit of correcting people’s grammar, you should know that this sentence is not technically correct. According to the arbiters of grammar at GMAC, the president was supposed to say, “We hope that we will know the answer to that question tomorrow.” It may be of some comfort to you that your boss, the television anchorperson, and a president of the United States would all get a question like this wrong if they took the GMAT.

GMAT English

GMAT English should be studied the same way you would approach any other foreign language. It has its own rules and its own internal logic. GMAT English has much in common with American English, but if you rely solely on your ear, you may get into trouble.

Confronted with a poorly constructed sentence, most of us could find *a* way to fix it. Most of the time we would probably break the sentence into two separate sentences (GMAT sentences are often too long and unwieldy). Unfortunately, on this test we are forced to find *the* way to fix the sentence; that is to say, GMAC’s way to fix it.

To do well on sentence corrections, you will have to learn GMAT English.

The Good News

The people who write the GMAT try to stick to the basics. If they tested a controversial point of grammar, they might be proven wrong. They don’t want to have to change their minds after a test is given and mail 20,000 letters explaining why they’re changing the answer key (something that has happened from time to time in the past). The easiest way to avoid trouble is to test a handful of the rules of standard written English.

There are huge books devoted exclusively to the correct use of English. You could spend the next six weeks just studying grammar and never even scratch the surface of the subject. The good news is that this won’t be necessary. Although there are hundreds of rules of standard written English that could be tested, the GMAT concentrates on only a few.

In other words, GMAT English is fairly easy to learn.

SENTENCE CORRECTION: CRACKING THE SYSTEM

In this chapter, we'll show you the most common types of errors that are tested in GMAT sentences and how to spot them. We'll show you how the test writers choose the four incorrect choices for each question, and we'll show you how to use Process of Elimination to make your life a lot easier.

To forestall the objections of the expert grammarians out there, let us say at the outset that this discussion is not designed to be an all-inclusive discussion of English grammar. You are reading this chapter to do well on sentence correction *as it appears on the GMAT*. Thus, if we seem to oversimplify a point or ignore an arcane exception to a rule, it is because we do not feel that any more detail is warranted. Remember, this isn't English; it's GMAT English.

Order of Difficulty

The Verbal section of the GMAT is computer-adaptive, meaning that the GMAT chooses questions for you from a large pool, based on your responses to previous questions. Theoretically, the computer knows which questions in its pool are easy and which are difficult. However, when it comes to sentence corrections, most of our students find that they can't tell the difference; "easy" questions often seem as poorly worded as "difficult" questions. You will discover that The Princeton Review techniques make the relative difficulty of sentence correction questions pretty meaningless.

Process of Elimination

Most people approach sentence correction questions the same way. They read the original sentence and then read the entire sentence again, substituting the first answer choice for the underlined part. Then they go back and do the same thing for the second, third, and fourth answer choices. This approach is both laborious and confusing. It's hard to keep five different versions of the same sentence straight, especially when all five of them are awkward.

The Princeton Review approach uses Process of Elimination to narrow down the choices before you have to start reading the answers carefully. Because there are relatively few types of errors that appear in sentence correction questions, we will focus on teaching you how to spot these errors. Once you've spotted the error in a sentence, you'll be able to go through the answer choices and eliminate any that also contain that error. Then you can decide among the remaining choices.

Write It Down

Effective use of POE on the GMAT always involves your scratch booklet and *always* involves thinking of the answer choices as A, B, C, D, and E, even though they are not labeled that way onscreen. As you eliminate answer choices, you should cross them off in your scratch booklet.

Basic Principles

Let's look at a sentence correction question that's written in a way that you will unfortunately never see on the real GMAT—with only the correct answer listed:

Registered brokerage firms have been required to record details of all computerized program trades made in the past year so that government agencies will be able to decide whether they should be banned.

will be able to decide whether program trades should be banned. Piece of cake, right? It gets a little harder when they throw in the other four answer choices. Don't worry if you aren't sure why the last answer choice—what we call answer choice E—is better than the original sentence. We will cover how to spot this type of error (pronoun reference) a little later in the chapter. For now, it's enough to know that the "they" in the underlined portion of the sentence was ambiguous. It wasn't clear whether "they" referred to "registered brokerage firms," "details," or the "computerized program trades."

Don't bother saying it was perfectly obvious that "they" referred to the program trades. This is GMAT English, remember? It doesn't matter if you knew what the sentence meant. The sentence had to be clear to the GMAT test writer who wrote it.

Zen and the Art of Test Writing

Let's put ourselves in the place of the GMAT test writer who wrote this question. He has just finished his sentence and he has his correct answer, but he isn't finished yet. He still has to write four other answer choices. It's actually kind of difficult to come up with four answer choices that seem plausible but are wrong. If the test writer makes the incorrect choices too obviously wrong, Joe Bloggs might be able to pick the correct answer without having really understood the rule of grammar involved. If the test writer makes the incorrect answer choices too subtle, Joe won't find one that seems right to him, and therefore might guess at random. The test writer does not want Joe to guess at random. If Joe guesses at random, he might actually pick the right answer.

The GMAC on the GMAT

The GMAT does not assess the following qualifications that can help people succeed in business school and in their careers:

- 1) Job experience
- 2) Leadership ability
- 3) Motivation
- 4) Interpersonal skills

Source: *The Official Guide for GMAT Review, 11th Edition, 2005*

One Down, Four to Go

Coming up with the correct answer is easy for our test writer—after all, he wrote the question. He will probably spend much more time on the incorrect answer choices.

Answer Choice A

Composing the first wrong answer choice is also easy for our test writer; the first of the answer choices (what we call answer choice A) is always a repeat of the underlined part of the original sentence. Obviously, this is the choice to select if you think that the sentence is correct as it's written. Two down, three to go.

If You Can't Sell a Lemon, Repackage It

To see whether Joe has spotted the error in the sentence, the GMAT test writer

will include the same error in at least one, and usually two, of the other answer choices. If Joe didn't like the error in the original sentence, maybe he'll like it better surrounded by different words. Look at the same sentence again, this time with two incorrect answer choices that include the error found in the original sentence:

Registered brokerage firms have been required to record details of all computerized program trades made in the past year so that government agencies will be able to decide whether they should be banned.

will be able to decide whether they should be banned should be able to decide whether they should be banned should be able to decide whether they can be banned will be able to decide whether program trades should be banned

Joe Bloggs has no idea what point of grammar is tested in this question. He picks answers because they sound good. Our test writer hopes that one of these answer choices will sound better to Joe than the correct answer. Both choices change the sentence, but both also still contain the ambiguous word "they," so both are still wrong.

Almost Right

Our test writer has one more kind of trap to insert into a question. This time the trap isn't for Joe Bloggs; it's for the person who has spotted the error in the sentence but isn't in too big a hurry to make fine distinctions.

Usually one of the incorrect answer choices will actually fix the original error—*but will create some new error in the process*.

Spotting the original error is all well and good, but our test writer wants to make sure you really "deserve" to get this one right, so he includes an answer choice that's almost right. It will be a close variation of the "best" answer; it will correct the mistake in the original sentence, but it will be *wrong*.

Here's the same sentence with an answer choice that fixes the original mistake but creates a new one:

Registered brokerage firms have been required to record details of all computerized program trades made in the past year so that government agencies will be able to decide whether they should be banned.

will be able to decide whether they should be banned should be able to decide whether they should be banned should be able to decide whether they can be banned **will be able to decide whether program trades should be able to be banned** will be able to decide whether program trades should be banned

Answer choice D fixes the original problem; there is no longer an ambiguous "they" in the sentence. Our test writer is hoping that anyone who has spotted the original error will read just far enough to see that answer choice D fixes it, but not far enough to

see that there is something else wrong. What’s wrong? On the GMAT, only animate objects are “able” to do anything.

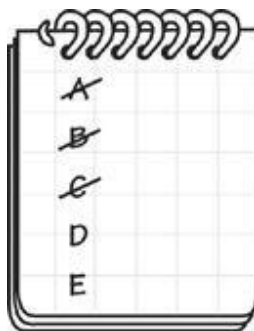
Three Down, Two to Go

Let’s look at the entire problem, now that our test writer has finished it, and count our blessings.

Registered brokerage firms have been required to record details of all computerized program trades made in the past year so that government agencies will be able to decide whether they should be banned.

- will be able to decide whether they should be banned*
 should be able to decide whether they should be banned
 should be able to decide whether they can be banned
 will be able to decide whether program trades should be able to be banned
 will be able to decide whether program trades should be banned
 Here’s How to Crack It

By spotting what was wrong in the original sentence, we could have eliminated three of the five answer choices. Choice A merely repeats the original sentence word for word. Choices B and C contain the same error that was found in the original sentence.



We’re down to choice D or E. Both fix the original error. What’s the difference between them? Three words. If you don’t see why one is correct and the other isn’t, don’t soul-search. Just click on one answer and move on. The correct answer is choice E.

Our Basic Approach

To use POE, you must be able to spot the errors in the original sentences. Fortunately, as we said before, GMAC leans heavily on only a few major types of errors. Just recognizing these errors should enable you to answer many of the sentence correction problems. There are two ways to do this.

B-School Lingo

incentivize: a verb form of the word *incentive*

low hanging fruit: tasks or goals that are very easy to achieve

Source: *Best 294 Business Schools*

Plan A

The first step in your sentence correction strategy should be to read the original sentence, looking for the very specific errors that the test writers like to test. As soon as you spot an error, you can eliminate any answer choices that repeat this error. Then, having gotten rid of several choices, you can actually read the remaining choices carefully to see which is best.

But what happens if you finish the sentence without spotting one of these errors? Unfortunately, you can't skip the question and come back to it later. So what do you do?

Plan B

If you don't spot the error as you read the original sentence, then the second step in your sentence correction strategy is to go straight to the answer choices to look for clues. Here are the answer choices to a real GMAT problem:

○ gentleman of the eighteenth century protected their clothing while having their wig powdered by poking their head ○ gentleman of the eighteenth century protected his clothing while having his wig powdered by poking his head ○ gentleman of the eighteenth century protected their clothing while having their wigs powdered by poking their heads ○ gentlemen of the eighteenth century protected his clothing while having his wig powdered by poking his head ○ gentlemen of the eighteenth century protected their clothing while having his wig powdered by poking his head Forget

about the original sentence entirely for a moment (pretty easy, because we didn't give it to you). Just look at the first word of each of the choices. Does anything strike you?

The differences in the answer choices are excellent hints as to what kind of error you might be looking for in the original sentence. For example, in the answers above, the test writer is offering you a choice of the singular noun “gentleman” or the plural noun “gentlemen.” A further fast scan of the answer choices reveals a choice of pronouns referring back to the nouns. What type of error might be involved if we're seeing singular and plural nouns, along with singular and plural pronouns? Aha—pronoun reference.

Even if the answer choices do not provide a clue, all is not lost. Remember how our GMAT test writer constructs wrong answer choices: The test writer likes to throw in one or more answer choices that fix the original error but create new errors in the process. You may not have been able to spot the original error, but you'll probably see the *new* errors in the bogus answer choices.

As you read the remaining answer choices, look for differences. Sometimes the realization that one answer choice is exactly the same as another with the exception of a couple of words will enable you to choose between them.

When you've eliminated everything you can, guess and move on.

The combination of Plan A and Plan B should allow you to get most of the sentence correction questions right—once you've learned one other important concept...

The Most Common Error Is *No Error*

While we are going to teach you to spot the eight most common errors used by the GMAT test writers, you should know that about one-fifth of the sentence correction sentences are fine just the way they are. If a sentence is correct as-is, the “best” answer is the first answer choice (what we call choice A), which repeats the original sentence. According to the law of averages, two or three of the sentence correction questions you will see on the GMAT will contain no error.

How do you tell when there is nothing wrong with a sentence?

You can tell that a sentence is correct by the *absence* of any of the other types of errors that we're going to show you how to spot. Try not to use your ear—at least not at first. As you're reading each sentence, you'll mark off a mental checklist of likely errors. If you come to the end of the list without having found a specific error, go to Plan B and look for differences in the answer choices. If you still haven't found an error in the original sentence, chances are very good that there isn't one.

We'll come back to answer choice A later in the chapter, after you've learned how to spot the major errors.

Before We Start, Some Basic Terminology

You won't be asked to name the parts of speech on the GMAT. However, an acquaintance with some of these terms is necessary to understand the techniques we're about to show you.

A *noun* is a word that's used to name a person, place, thing, or idea.

A *verb* is a word that expresses action.

Here is a very basic sentence:

Sue opened the box.

In this sentence, *Sue* and *box* are both nouns, and *opened* is a verb. *Sue* is considered the subject of this sentence because it is the person, place, or thing doing the verb. *Box* is considered the object of the sentence because it receives the action of the verb.

An *adjective* is a word that modifies a noun.

An *adverb* is a word that modifies a verb, adjective, or another adverb.

A *preposition* is a word that notes the relation of a noun to an action or a thing.

A *phrase* is a group of words acting as a single part of speech. A phrase is missing either a subject or a verb or both.

A *prepositional phrase* is a group of words beginning with a preposition. Like any phrase, a prepositional phrase does not contain both a subject and a verb.

Here's a more complicated version of the same sentence:

Sue quickly opened the big box of chocolates.

B-School Lingo

net net: end result

Source: *Best 294 Business Schools*

In this sentence, *quickly* is an adverb modifying the verb *opened*. *Big* is an adjective modifying the noun *box*. *Of* is a preposition because it shows a relation between *box* and *chocolates*. *Of chocolates* is a prepositional phrase that acts like an adjective by modifying *box*.

A *pronoun* is a word that takes the place of a noun.

A *clause* is a group of words that contains a subject and a verb.

Here's an even more complicated version of the same sentence:

Because she was famished, Sue quickly opened the big box of chocolates.

There are two clauses in this sentence. *Sue quickly opened the big box of chocolates* is considered an *independent clause* because it contains the main idea of the sentence and could stand by itself. *Because she was famished* is also a clause (it contains a subject and a verb), but it cannot stand by itself. This is known as a *dependent clause*. The word *she* is a pronoun referring to the noun *Sue*.

THE MAJOR ERRORS OF GMAT ENGLISH

1. Pronoun Errors

There are two main types of pronoun errors. The first is called *pronoun reference*. You saw an example of this in the sentence about program trading. Take a look at a simple example:

Samantha and Jane went shopping, but she couldn't find anything she liked.

This type of mistake used to drive Harold Ross, the founding editor of *The New Yorker*, crazy. He was famous for scrawling *Who he?* in the margins of writers' manuscripts. It is supposed to be absolutely clear who is being referred to by a pronoun. In the example above, the pronoun *she* could refer to either Samantha or Jane. The pronoun is ambiguous and must be fixed. It can be fixed in three different ways:

Samantha and Jane went shopping, but Samantha couldn't find anything she liked.

Samantha and Jane went shopping, but Jane couldn't find anything she liked.

Samantha and Jane went shopping, but they couldn't find anything they liked.

Admissions Insight No. 8: The Interview

- Always accept an interview opportunity if it is offered.
- Be on time, and dress appropriately.
- Prepare ahead of time—literally practice your responses out loud.

- Put together several points from your essays, and find a way to make these points during the interview.
- If there are any suspicious holes in your resume, or embarrassing incidents in your past, find a way to bring them up yourself, and have a great explanation.
- When they ask—and they will—about your biggest setback, or your greatest challenge, be prepared to give them a positive spin on a challenging situation that you were able to overcome and learn from.

The second type of pronoun error is called *pronoun number* (singular or plural). Here is a simple example:

The average male moviegoer expects to see at least one scene of violence per film, and they are seldom disappointed.

In this case, the pronoun *they* clearly refers to the average male moviegoer, so there is no ambiguity of reference. However, *the average male moviegoer* is singular. *They* cannot take the place of a singular noun. There is really only one way to fix this sentence.

The average male moviegoer expects to see at least one scene of violence per film, and he is seldom disappointed.

The people who write the GMAT are very fond of both of these types of errors and routinely make use of them. By the way, as we mentioned earlier, you don't have to memorize any of the terminology we use. You simply have to recognize a GMAT English error when you see it.

How Do You Spot a Pronoun Error?

That's easy. Look for pronouns.

A pronoun is a word that replaces a noun. Here's a list of common pronouns. (You don't need to memorize these—just be able to recognize them.)

Singular	Plural	Can Be Singular or Plural
I, me	we, us	some, he, him, they, them, none, she, her, both, ours
it	these, you	each, those, who, another, which, one, what, other, that
mine	yours	his,
hers	this	either, neither, each, everyone, nobody, no one

Every single time you spot a pronoun, you should immediately ask yourself the following two questions:

Is it completely clear, not just to me but to a pedantic GMAT test writer, who or what the pronoun is referring to?

Does the pronoun agree in number with the noun it is referring to?

Let's look at an example.

While Brussels has smashed all Western European tourism revenue records this year, they still lag well behind in exports.

this year, they still lag well behind in exports
 in the past year, they still lag well behind in exports
 in the past year, it lags still well behind in exports
 this year, they lag still well behind in exports
 this year, it still lags well behind in exports

Here's How to Crack It

Plan A: As you read the sentence for the first time, look to see if there is a pronoun. There is: *they*. Let's make sure the pronoun is used correctly. Who is the *they* supposed to refer to? *Brussels*. Is *Brussels* plural? No, it's the name of a city.

Now that you've spotted the problem, go through the answer choices. Any answer choice with the pronoun *they* in it has to be wrong. You can cross off answer choices A, B, and D. You're down to answer choices C and E.

Both of the remaining answer choices solve the original problem. Read them carefully. If you aren't sure, take a guess. If you said answer choice E, you were right. The adverb *still* in answer choice C should go in front of the verb.

Plan B: Now, what if Plan A lets you down, and you don't spot the error as you read the sentence in the first place? There is always Plan B. Go straight to the answer choices and ask yourself how they are different. Obviously, they differ in several

ways—but one huge difference is that some answer choices use the pronoun they, while others use the pronoun it. This is a clue that will remind you to check pronoun reference and number.

Admissions Insight
No. 9:
Full Time or Part Time

Most students find that the experience of attending business school full time is generally more fulfilling than attending part time, because it allows students to build relationships and devote themselves completely to their studies. However, there can be compelling reasons to go part time: for example, if you simply can't afford to take two years off without pay, or if your company is willing to pay all or part of your tuition costs.

2. Misplaced Modifiers

Misplaced modifiers come in several forms, but the test writers' favorite looks like this:

Coming out of the department store, John's wallet was stolen.

When a sentence begins with a *participial phrase* (just a fancy term for a phrase that starts with a verb ending in *-ing*), that phrase is supposed to modify the noun or pronoun immediately following it.

Was the *wallet* coming out of the department store? No.

There are two ways to fix this sentence. First, we could change the second half of the sentence so that the noun or pronoun that comes after the participial phrase is actually what the phrase is supposed to refer to:

Coming out of the department store, John was robbed of his wallet.

Or, we could change the first half of the sentence into an adverbial clause (which contains its own subject) so that it is no longer necessary for the first half of the sentence to modify the noun that follows it:

As John was coming out of the department store, his wallet was stolen.

Other forms of misplaced modifiers include:

A. participial phrases preceded by a preposition:

On leaving the department store, John's wallet was stolen.

(**Correct:** *On leaving the department store, John was robbed of his wallet.*)

B. adjectives:

Frail and weak, the heavy wagon could not be budged by the old horse.

(**Correct:** *Frail and weak, the old horse could not budge the heavy wagon.*)

C. adjectival phrases:

An organization long devoted to the cause of justice, the mayor awarded a medal to the American Civil Liberties Union.

(**Correct:** *An organization long devoted to the cause of justice, the American Civil Liberties Union was awarded a medal by the mayor.*)

In each of these examples, the modifying phrase modified the wrong noun or pronoun.

How Do You Spot a Misplaced Modifier?

That's easy. Whenever a sentence begins with a modifying phrase that's followed by a comma, the noun or pronoun right after the comma should be what the phrase is referring to. Every single time you see a sentence that begins with a modifying phrase, check to make sure that it modifies the right noun or pronoun. If it doesn't, you've spotted the error in the sentence.

The correct answer choice will either change the noun that follows the modifying phrase (the preferred method) or change the phrase itself into an adverbial clause so that it no longer needs to modify the noun.

Let's look at two examples:

Written in 1961, Joseph Heller scored a literary hit with his comedic first novel, *Catch-22*.

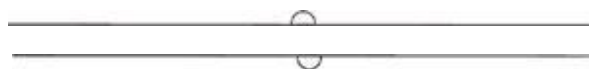
Written in 1961, Joseph Heller scored a literary hit with his comedic first novel, Catch-22. *Written in 1961, Joseph Heller scored a literary hit with Catch-22, his comedic first novel.* *Written in 1961, Catch-22, the comedic first novel by Joseph Heller, was a literary hit.* *Catch-22, which was written in 1961 by Joseph Heller, scored a literary hit with his comedic first novel.* *Catch-22, the comedic first novel, scored a literary hit for Joseph Heller by its being written in 1961.* **Here's How to Crack It**

Plan A: As you read the sentence for the first time, go through your checklist. Is there a pronoun error in the sentence? No. Does the sentence begin with a modifying phrase? Yes. Now we're getting somewhere. Let's check to see if the modifying phrase actually modifies what it is *supposed to*. Does it? No. "Joseph Heller" is not what was written in 1961. This is a misplaced modifier.

Now that you've spotted the error, look through the other answer choices and eliminate any that contain the same error. Choice B contains the same error. Get rid of it. You're down to choices C, D, and E.

Now, there are really only two ways to fix this kind of error, as you know. Do any of the answer choices change the noun that follows the modifying phrase? Yes, answer choice C. This is probably the right answer. Read through the other two choices just to make sure there's nothing better. Choices D and E contain awkward constructions. Choice C is the "best" answer.

Plan B: If you don't spot the error as you read the sentence for the first time, you have a second chance to spot it by looking for differences in the answer choices. Several contain a participial phrase followed by the noun the phrase is supposed to modify. But in one of those choices, the noun following the phrase is different. Hmmm. Could this sentence be a case of a misplaced modifier?



Although not quite as liquid an investment as a money-market account, financial experts recommend a certificate of deposit for its high yield.

Although not quite as liquid an investment as *Although it is not quite as liquid an investment as* *While not being quite as liquid an investment as*
 While it is not quite as liquid as an investment *Although not quite liquid an investment as* **Here's How to Crack It**

Plan A: Go through your checklist. Is there a pronoun in this sentence? Yes, the third to last word of the sentence is a pronoun, but it clearly refers back to the certificate of deposit. False alarm. Does the sentence begin with a modifying phrase? Yes. Now

we're getting warmer. Check to see whether the modifying phrase modifies what it's supposed to modify. Does *although not quite as liquid an investment...* refer to financial experts? No. This is a misplaced modifier.

The clearest way to fix this sentence would be to change the noun that follows the modifying phrase:

Although not quite as liquid an investment as a money-market account, a certificate of deposit is recommended by financial experts for its high yield.

However, you can't fix *this* sentence that way for the very good reason that only the first phrase of the sentence was underlined. This time, you'll have to find a way to fix the modifying phrase itself. Look for an answer choice that changes the modifying phrase into an adverbial clause with its own subject and verb.

Choices A, C, and E do not have subjects and therefore can be eliminated immediately. Choices B and D each have a subject—in both cases, the word *it* turns the modifying phrase into an adverbial clause. However, choice D contains a new error: The word *as* has been moved, leaving *money-market* stranded in the middle of the sentence with no function. While it may sound atrocious, choice B is the “best” answer.

Plan B: Again, if you didn't spot the error as you read the original sentence, the answer choices were there to provide you with a clue. Of the five answer choices, two turned the beginning phrase into a clause by means of the pronoun *it*. By noticing this, you might be reminded to check for a misplaced modifier.

A close relative of a misplaced modifier is a *dangling modifier*. You can spot the two errors in the same way. Here's a simple example:

Before designing a park, the public must be considered.

Again, this sentence starts with a modifying phrase followed by a comma. The noun following the comma is what the modifying phrase is supposed to modify. Does it? No! *The public* didn't design the park. So who did? A dangling modifier differs from a misplaced modifier in that a dangling modifier doesn't just modify the wrong word—it doesn't modify any word.

Be Careful Though!

While modifying *phrases* need to refer to the word they are modifying, modifying *clauses* (which have a subject and a verb) are a different story: “Before an architect designs a park, the public must be considered” is perfectly correct.

To fix this sentence, we would have to insert whoever is designing the park into the sentence:

Before designing a park, the architect must consider the public.

3. Parallel Construction

There are two kinds of GMAT sentences that test parallel construction. The first is a sentence that contains a list or has a series of actions set off from one another by commas. Here's an example:

Among the reasons cited for the city councilwoman's decision not to run for reelection were the high cost of a campaign, the lack of support from her party, and desiring to spend more time with her family.

When a main verb controls several phrases that follow it, each of those phrases has to be set up in the same way. In the sentence above, three reasons were listed. The three reasons *were* (main verb):

the high cost of a campaign,
the lack of support from her party,
and
desiring to spend more time with her family.

The construction of each of the three reasons is supposed to be parallel. The first two items on the list are phrases that are essentially functioning as nouns: the high *cost* (of a campaign); the *lack* (of support from her party). However, the third item on the list seems more like a verb than a noun. How could we change the word *desiring* to a noun? If you said, "the desire," you were absolutely correct. It should read:

the high cost of a campaign,
the lack of support from her party,
and
the desire to spend more time with her family.

The second kind of GMAT sentence that tests parallel construction is a sentence that's divided into two parts. Here's an example:

To say that the song patterns of the common robin are less complex than those of the indigo bunting is doing a great disservice to both birds.

If the first half of a sentence is constructed in a particular way, the second half must be constructed in the same way. The first half of this sentence begins, "To ..."; therefore; the second half has to begin the same way:

To say that the song patterns of the common robin are less complex than those of the indigo bunting is to do a great disservice to both birds.

How Do You Spot Parallel Construction?

That's easy. Every time you read a sentence correction problem, look to see if you can find a series of actions, a list of several things, or a sentence that is divided into two parts.

Here's an example:

In a recent survey, the Gallup poll discovered that the average American speaks 1.3 languages, buys a new car every 5.2 years, drinks 14 gallons of alcoholic beverages every year, and forgot to pay at least one bill per quarter.

○ *drinks 14 gallons of alcoholic beverages every year, and forgot to pay at least one bill per quarter* ○ *drinks 14 gallons of alcoholic beverages every year, and forgets to pay at least one bill per quarter* ○ *can drink 14 gallons of alcoholic beverages every quarter and forgot to pay at least one bill per quarter* ○ *drinks 14 gallons of alcoholic beverages every year, and forgets at least to pay one bill per quarter* ○ *drank 14 gallons of alcoholic beverages every year, and forgets to pay at least one bill per quarter* **Here's How to Crack It**

Plan A: As you read the sentence for the first time, run through your checklist: Is there a pronoun? No. Does the sentence begin with a modifying phrase? Yes, but the word after the phrase is what is supposed to be modified, so this is not a misplaced modifier. Is there a series or list of three things or a series of actions? Yes. Let's see if all the actions are parallel. The average American...

speaks (1.3 languages)
buys (a new car...)
drinks (14 gallons...)
and
forgot (to pay...)

The first three verbs are all in the present tense, but the fourth one is in the past tense. The problem in this sentence is a lack of parallel construction.

Now that you know what the error is, go through the answer choices. Any choice that contains the word *forgot* is wrong. We can eliminate choices A and C. Choice E, even though it fixes the parallel construction of the fourth verb, changes the construction of the third verb. Eliminate it.

Choices B and D have perfect parallel construction. If you aren't sure which one is correct, guess and move on. If you picked choice B, you were right. In choice D, the adjectival phrase *at least* had to be in front of *one bill*.

Plan B: The error on which this question hinges is easy to spot if you use Plan B. Clearly, what is at issue is the verb that begins the underlined portion of the sentence. Why would the test writers change around the form of this verb? Aha! They do it in order to create a parallel construction problem.

4. Parallel Comparison

Another form of parallel construction error that appears on the GMAT is what we call faulty comparison sentences. Here's a simple example:

The people in my office are smarter than other offices.

Taken literally, this sentence compares *the people in my office* with *other offices*. Therefore, it's an example of faulty comparison—it compares two dissimilar things (in this case, *people* and *offices*). To fix this sentence, we need to make the comparison clear or parallel. There are two ways to do this:

The people in my office are smarter than the people in other offices.

or

The people in my office are smarter than those in other offices.

We hope that you recognized *those* as a pronoun that takes the place of *the people*. The correct answer to a parallel comparison question on the GMAT almost invariably involves the use of a pronoun (*that* or *those*) rather than a repetition of the noun.

Parallel comparison problems also come up when you compare two actions:

Synthetic oils burn less efficiently than natural oils.

In this case, what is compared is not the two types of oil, but how well each type of oil *burns*. You could fix this by changing the sentence to read,

Synthetic oils burn less efficiently than natural oils burn.

However, the GMAT test writers would rather that you fix it by replacing the second verb (in this case, *burn*) with a replacement verb (*do* or *does*.) Here is how GMAC would like to see this sentence rewritten:

Synthetic oils burn less efficiently than do natural oils.

How Do You Spot Parallel Comparison?

Look for sentences that make comparisons. These sentences often include words such as *than*, *as*, *similar to*, and *like*. When you find one of these comparison words, check to see whether the two things compared are really comparable.

Let's look at an example:

Doctors sometimes have difficulty diagnosing viral pneumonia because the early symptoms of this potentially deadly illness are often quite similar to the common cold.

○ *are often quite similar to the common cold* ○ *often resemble that of the common cold* ○ *are often quite similar to those of the common cold* ○ *are often quite similar to the common cold's symptom* ○ *quite often are, like the common cold, similar* **Here's How to Crack It**

Plan A: Go through your checklist: Do you see any suspicious pronouns, misplaced modifiers, or unparallel constructions? Good. There aren't any. Do you see any comparison words? Yes, the sentence uses "are" and "similar to." Let's see exactly what is being compared. The symptoms of one illness are being compared directly to ... another illness. Aha! This is a parallel comparison error. To make this sentence correct, we need to compare the "symptoms" of one illness to the "symptoms" of the other, and the way GMAC would prefer that we do it is by using a replacement pronoun.

If we look at the answer choices, we can eliminate choices A and E because neither makes any attempt to compare symptoms to symptoms. Choice B looks promising because it uses the replacement pronoun "that"; however, "symptoms" is plural and therefore can't be replaced by the singular "that." Choice D seems promising because it looks like it's trying to compare symptoms to symptoms—but if you look more closely, you'll notice that the last word of choice D is "symptom," which is singular. The correct answer is choice C.

Plan B: There are often clues to parallel comparison questions in the answer choices as well. Just as you should be on the lookout for words like similar to in the sentences themselves, you can also often spot faulty comparison problems by looking for replacement nouns such as that of and those of, or replacement verbs such as than do and than does in the answer choices.

5. Tense

On the GMAT, tense problems are often just a matter of parallel construction. In general, if a sentence starts out in one tense, it should probably stay there. Let's look at an example:

When he was younger, he walked three miles every day and has lifted weights, too.

The clause *when he was younger* puts the entire sentence firmly in the past. Thus, the two verbs that follow should be in the past tense as well. You may not have known the technical term for *has lifted* (the present perfect tense), but you probably noticed that

it was inconsistent with *walked* (the simple past tense). The sentence should read:

When he was younger, he walked three miles every day and lifted weights, too.

Here are the tenses that come up on the GMAT:

Tense Example present

He *walks* three miles a day.

simple past

When he was younger, he *walked* three miles a day.

present perfect

He *has walked* three miles a day for the last several years.

past perfect

He *had walked* three miles a day until he bought his motorcycle.

future He *will walk* three miles a day, starting tomorrow. It isn't important that you know the names of these tenses as long as you understand how they're used. As we said before, a sentence that begins in one tense should generally stay in that tense. For example, a sentence that begins in the present perfect (which describes an action that has happened in the past, but is potentially going on in the present as well) should stay in the present perfect.

He has walked three miles a day for the last several years and has never complained.

One exception to this rule is a sentence that contains the past perfect (in which one action in the past happened before another action in the past). By definition, any action set in the past perfect must have another action that comes after it, set in the simple past.

He had ridden his motorcycle for two hours when it ran out of gas.

The only other exceptions to this rule come up when one action in a sentence clearly precedes another.

The dinosaurs are extinct now, but they were once present on the earth in large numbers.

In this case, the sentence clearly refers to two different time periods: *now*, which requires the present tense, and a period long ago, which requires the past tense.

How Do You Spot Tense Errors?

By now, you probably have a pretty good sense of what to do. Using Plan A, look for changes in verb tense in the sentence. Or, using Plan B, look for changes in verb tense in the answer choices. If the answer choices give you several versions of a particular verb themselves, then you should be looking to see which one is correct. Here's an example:

A doctor at the Amsterdam Clinic maintains that if children eat a diet high in vitamins and took vitamin supplements, they will be less likely to catch the common cold.

- took vitamin supplements, they will be less likely to catch*
 took vitamin supplements, they are less likely to catch
 take vitamin supplements, they were less likely of catching
 take vitamin supplements, they will be less likely of catching
 take vitamin supplements, they are less likely to catch
 Here's How to Crack It

Plan A: As you read the sentence, go through your checklist. There is one pronoun (*they*) in the sentence, but in this case it clearly refers only to the children. Is there a modifying phrase? No. Is there a list of things or a series of actions? Not really. Are the verb tenses inconsistent? Hmm. Now we're getting somewhere. The first verb, "maintains," is in the present tense. So is the verb "eat." But the third verb, "took," which is supposed to be a parallel action with "eat," is in the past tense.

B-School Lingo

OOC: out of cash

opportunity cost: the cost of pursuing an opportunity, e.g., b-school tuition and the forfeiture of two years' income

Look at the dependent clause that is partially underlined.

...that if children eat a diet high in vitamins and took vitamin supplements...

Obviously, the two verbs are inconsistent with each other, and because only one of them is underlined, that's the one that must be wrong. The correct sentence must have a *take* in it, so we can eliminate choices A and B. Choice C puts the rest of the sentence in the past tense, so scratch C. Choice D puts the rest of the sentence in the future tense. This *might* be acceptable, but the choice also uses the incorrect idiomatic expression

likely of catching. We'll talk more about idioms in a moment. The correct answer to this question is E, which keeps the entire sentence in the present tense.

Plan B: If you don't spot the error as you read the original sentence, look at the answer choices. Aha! Choices A and B offer us *took*, while D and E offer us *take*. One of these two alternatives must be right. Why would the test writers be offering us this choice of present- and past-tense verbs? Clearly, this is a tense question.

6. Subject-Verb Agreement Errors

A verb is supposed to agree with its subject. Let's look at an example:

The number of arrests of drunken drivers are increasing every year.

GMAT test writers like to separate the subject of a sentence from its verb with several prepositional phrases, so that by the time you get to the verb you've forgotten whether the subject was singular or plural.

On Objects and Subjects

The object of a preposition can never be the subject of a sentence. "Of arrests" is a prepositional phrase modifying "number," with arrests being the object of the preposition "of." Any word following a preposition cannot be the subject of the sentence.

Singular or Plural?

"The number of ..."
is singular.

"A number of ..." is plural.

The subject of the sentence above is *number*, which is singular. The phrase *of arrests of drunken drivers* modifies the subject. The verb of this sentence is *are*, which is plural. If we set off the prepositional phrase with parentheses, this is what the sentence looks like:

The number (of arrests of drunken drivers) are...

To fix this sentence we need to make the verb agree with the subject.

The number (of arrests of drunken drivers) is increasing every year.

How to Spot Subject-Verb Agreement Errors

Cover up the prepositional phrases between the subject and the verb of each clause of the sentence so you can see whether there is an agreement problem. You should also be on the lookout for nouns that sound plural but are in fact singular.

Nouns That Sound Plural (But Aren't)

The Netherlands (the name of any city, state, or country)

Tom or John (any two singular nouns connected by *or*)

the family

the audience

politics

measles

the number

the amount

You are already on the lookout for pronouns because they're first on your checklist. Sometimes pronouns can be the subject of a sentence, in which case the verb has to agree with the pronoun. There are some pronouns that people tend to think are plural when they are in fact singular:

Pronouns That Sound Plural (But Aren't)

everyone no
one anyone none everybody nobody anybody each everything nothing anything
Let's look at an example of a subject-verb error as it might appear on the GMAT:

Many political insiders now believe that the dissension in Congress over health issues decrease the likelihood for significant action being taken this year to combat the rising costs of healthcare.

decrease the likelihood for significant action being
 decrease the likelihood that significant action will be
 decrease the likelihood of significant action to be
 decreases the likelihood for significant action being
 decreases the likelihood that significant action will be
 Here's How to Crack It

Plan A: As you read the sentence for the first time, run through your mental checklist. Is there a pronoun, a modifying phrase, a list of several things, a series of

parallel actions, or a change in tense? Not this time. Let's check for subject-verb agreement. The subject of the independent clause is "insiders" and the correct verb, "believe," follows almost immediately, so there's no problem in the main clause.

However, let's look at the dependent clause that follows: "that the dissension in Congress over health issues decrease the likelihood..."

In this clause, the subject is "dissension," not "health issues." Remember to imagine that there are parentheses around any prepositional phrases, as if the clause looked like this:

...the dissension (in Congress over health issues) decrease...

Is this correct? No, the singular "dissension" needs the singular verb "decreases." Looking at the answers, we can immediately eliminate choices A, B, and C. Now let's examine choices D and E. Both fix the subject-verb error, but choice D uses the unidiomatic expression "likelihood for," and it also uses "being" instead of "will be." The correct answer is choice E.

Plan B: If you don't spot the error as you read the sentence the first time, it takes only a second to look at the answer choices and see that one big difference in the answer choices is the form of the verb "decrease," which means this is a subject-verb issue.

7. Idiom

GMAC likes to test certain idiomatic expressions. Here's an easy example:

There is little doubt that large corporations are indebted for the small companies that broke new ground in laser optics.

It is incorrect to say you are indebted *for* someone.

There is little doubt that large corporations are indebted to the small companies that broke new ground in laser optics.

Idiomatic errors are difficult to spot because there is no one problem to look for. In fact, there are really no rules. Each idiom has its own particular usage. There is no real reason an idiomatic expression is correct. It is simply a matter of custom.

However, you haven't been speaking English for the past 20 years for nothing. The main similarity between GMAT English and American English is that they both use the same idiomatic expressions.

You probably already know them.

How Do You Spot Idiomatic Errors?

If you've gone through the first six items on your checklist—pronouns, misplaced modifiers, parallel construction, faulty comparison, tense, and subject-verb agreement—and still haven't found an error, try pulling any idiomatic expressions out of the sentence so that you can see whether they're correct.

Then make up your own sentence using the suspect idiom:

I am indebted for my parents for offering to help pay for graduate school.

Does that sound right? Of course not. I am indebted *to* my parents. Usually, if you take the expression out of the long and awkward sentence and use it in an everyday sentence, the error (if there is one) will be obvious. Here's what an idiom question might look like on the GMAT:

The administration of a small daily dose of aspirin has not only been shown to lower the risk of heart attack, and it has also been shown to help relieve the suffering of arthritis.

- and it has also been shown to help*
 and it has also been shown helpful
 to but it has also been shown to help
 but it has been shown helpful in
addition for
 in addition it has also been shown helping
 Here's How to Crack It

Plan A: As always, run through your checklist. Is there a pronoun in the sentence? Yes, but if you check the answer choices, you'll discover that the same pronoun appears in each one. Obviously, pronoun error is *not* what is tested this time. Is there a modifying phrase? No. So much for misplaced modifiers. Is there a list of things or a series of actions? No. To be sure that there really is no parallel construction problem, we should look at the two halves of the sentence as well. The first half, "... has been shown," matches the second half, "... has also been shown," and both are in the same tense, so there is no problem with either parallel construction or tense. There are no comparison words either, so we don't have to worry about faulty comparison. Could there be something wrong with an idiomatic expression in the original sentence? Let's try a sentence of our own.

Not only is he nasty...

How would you finish this sentence? If you said something like "... but he is also disgusting," you would be absolutely correct. In GMAT English, "not only ..." is always followed somewhere in the same sentence by "but also..." Let's look at the answer choices to see which can be eliminated. A, B, and E all use some other conjunction instead of "but," which means that the only possible answers are C and D. Choice D uses "in addition" instead of "also." This *might* not be fatal, but then keep reading after the underlining: "helpful in addition for relieve the suffering of arthritis." If the word "for" seems to stick out, it is because we need to form the infinitive case of "relieve" by using

“to.” Thus, the correct answer is C.

Plan B: If you didn’t spot the idiomatic error in the sentence itself, the first word of each of the answer choices gives you a clue. Does the sentence need an “and,” a “but,” or an “in addition”?

The Idioms Most Commonly Tested on the GMAT

There are, of course, thousands of idiomatic expressions that could be tested on the GMAT. But here are a handful that seem to come up all the time.

not only ... but also... according to not so much ... as... agree with defined as appear to regard as because of neither ... nor... choose from modeled after conclude that based on contribute to a result of depend on to result in due to a debate over in order to a dispute over instead of a responsibility to rather than responsible for subject to different from worry about a consequence of think of ... as so ... as to be... see ... as so (adjective) that target ... as depicted as prohibit from define as distinguish between ... and... as great as distinguish ... from... as good as, or better than attributed to credited with **THE MINOR ERRORS OF GMAT ENGLISH**

The seven errors you’ve just learned to spot will enable you to answer most of the sentence correction problems that come up on the GMAT. However, there is one more error that shows up often enough that you will probably want to be looking out for it.

8. Quantity Words

GMAC likes to see if you know how to indicate quantity. Here’s an example:

On the flight to Los Angeles, Nancy had to choose among two dinner entrees.

If there were more than two items being compared, then “among” would be correct. However, if there are only two choices available, the correct quantity word would be “between.”

On the flight to Los Angeles, Nancy had to choose between two dinner entrees.

Below are the comparison quantity words that come up on the GMAT most frequently:

If two items If more than two

items between among more most better best less least Another type of quantity word that shows up on the GMAT from time to time involves things that can be counted as opposed to things that can't. For example, if you were standing in line at a buffet, and you didn't want as big a serving of soup as the person in front of you received, which of the following would be correct?

Could I have fewer soup, please?

or

Could I have less soup, please?

If an item can't be counted, the correct adjective would be "less." However, if we were talking about french fries (which can be counted), the correct adjective would be "fewer."

Countable items Uncountable items **fewer less number amount,**
quantity many much How Do You Spot Quantity Word
Errors?

That's easy. Look for quantity words. Whenever you see a "between," check to see if there are only two items discussed in the sentence. (If there are more, you'll need an "among.") Whenever you see an "amount," make sure that whatever is discussed cannot be counted. (If the sentence is talking about the "amount" of people, then you'll need to change it to "number.")

Here's what a "between–among" quantity word error might look like on the GMAT:

Of the many decisions facing the energy commission as it meets to decide on new directions for the next century, the question of the future of nuclear energy is for certain the more perplexing.

is for certain the more perplexing *is certainly the most perplexing* *it seems certain, is the most perplexed* *is certainly the more perplexing* *it seems certain, is perplexing the most* **Here's How to Crack It**

Plan A: If your checklist includes quantity words, the word “more” will set off red flags as you read the sentence. If there were two decisions facing the energy commission, then “the more perplexing” would be correct. However, the sentence says there are “many” decisions. Therefore the sentence must read, “the most perplexing.”

Admissions Insight
No. 10: Taking the GMAT

Limiting your GMAT attempts to two is best, but don’t take the test more than once if you don’t expect a good increase. Three tries are okay if there were unusual circumstances or if you really need another shot at it. If you take it more than three times, the admissions committee will think you have an unhealthy obsession.

Source: *Best 294 Business Schools*

This allows us to eliminate choices A and D immediately. Choice C gives the impression that it is the *question* that is perplexed. Eliminate it. Choice E incorrectly positions “the most” after the word it is supposed to modify. The correct answer is choice B.

Plan B: If you don’t notice the quantity word in the question itself, you’ll probably notice the series of different quantity words (“more” and “most”) in the answer choices.

One Last Example

The foresight that was evident in the court’s selection of an independent trustee to oversee the provisions of the agreement will probably go unremarked by the press.

that was evident in the court’s selection of an independent trustee *that was evident by the court’s selection of an independent trustee* *evidenced with the court’s*

selection of an independent trustee ○ *evidenced of the court's selection of an independent trustee* ○ *that was evident of the court's selection of an independent trustee* **Here's How to Crack It**

Plan A: As you read the sentence, go through your checklist. Is there a pronoun? No. Does the sentence begin with a modifying phrase? No. Is there a list of several things or a series of actions? No. Is there a tense error? No. Is there a subject-verb problem? No. Is there a comparison word such as “similar” or “than”? No. Are there any quantity words to check? No. Do any expressions in the sentence seem suspicious? No.

We have checked off all of the items on our list. Maybe nothing is wrong with this sentence. The “best” answer to this question is choice A.

Plan B: In cases like this in which there is nothing wrong, you want to be careful not to go off on a wild goose chase. The idea behind Plan B is to look for clues that will lead you to spot one of the major errors that the test writers like to test. If all you’re doing is trying out each of the answers in turn to see which one sounds better, you aren’t really using Plan B. If you can’t spot one of the major errors in the sentence or in the answer choices, you have to start considering that the sentence might be correct as written.

If You’re Really Gung Ho

You can expand your checklist to include as many types of errors as you like. Obviously, the more types of errors you can identify, the better prepared you’ll be to take the test. But you should bear in mind that while there are other types of errors that we haven’t discussed, these errors don’t come up very often on the GMAT. Some of the errors to consider: redundant words, misuse of the subjunctive mood, and the use of the passive voice when the active voice is possible. If you’re seriously gunning to get every sentence correction question correct, you should dig out your old grammar book from high school and study it carefully. You should also do as many of the real GMAT sentence correction questions in *The Official Guide for GMAT Review* as you can; pay special attention to the idiomatic expressions that come up in these sections, because these are sometimes repeated.

Summary

GMAT English is different from American English, and you have to learn the rules of GMAT English to do well on the test.

Fortunately, sentence correction questions test only a handful of rules. Once you

learn them, you will be able to score quite well on this type of question.

There are two Princeton Review techniques that together will help you to ace Sentence Correction: Plan A, in which you look for specific errors as you read the sentence, and Plan B, in which you treat differences among the answer choices as clues that will help you spot the error.

Make a checklist of errors to look for when you read a sentence correction question. The most common are: **Pronouns:** If a sentence contains a pronoun, check to see whether it clearly refers to the noun it is replacing; also check to see whether the pronoun agrees in number with the noun to which it refers. **Misplaced modifiers:** If the sentence begins with a modifying phrase, check to make sure that the noun it modifies comes directly after the modifying phrase. **Parallel construction:** If a sentence contains a list of things, or actions, or is broken up into two halves, check to make sure the parts of the sentence are parallel. **Parallel comparison:** When a sentence makes a comparison, check to see whether the two things compared are really comparable. **Tense:** If the answer choices contain different verb tenses, make sure that the tense of the verb or verbs in the original sentence is correct. For the most part, verb tense should be consistent throughout a sentence. **Subject-verb agreement:** GMAT test writers sometimes put extraneous prepositional phrases between the subject and the verb. Cover up or ignore these phrases so that you can see whether the subject and the verb of each clause in the sentence agree with each other. **Idiom:** If a sentence contains an idiomatic expression that seems wrong to you, try taking the expression out of the sentence and creating a sentence of your own with the suspect expression. **Quantity words:** Whenever you see a quantity word (countable vs. uncountable; two vs. three or more), check to see if it is used correctly.

If you've spotted the error, go through the answer choices and eliminate any that contain the same error. Then look at the remaining answer choices and find the one that fixes the sentence.

If you can't find the error, look to the answer choices for clues. Then consider the possibility that there might not be an error.

About one-fifth of the sentences are correct as they are. When a sentence is correct, the answer is choice A, which simply repeats the sentence word for word.

Once you've gained confidence in your ability to spot the major errors, you should expand your checklist to include other types of errors.

Chapter 16

Reading Comprehension

Each GMAT Reading Comprehension passage contains a host of information—most of which is never tested by the three or four questions you will be asked. In this chapter, you'll learn how to read passages for what is actually important and how to go back for the specific facts to quickly answer individual questions.

Reading comprehension questions make up roughly one-third of the 41 questions on the Verbal section of the GMAT—approximately 14 questions. Unlike the other questions on the test, reading comprehension questions come in clumps of three or four, and are based on reading passages that range from 200 to 350 words in length. Most test-takers report seeing four reading passages in all.

Before we begin, take a moment to read the following instructions, which are a close approximation of the instructions you will find on the real GMAT.

Directions: Every reading comprehension question refers to a passage. Answer the questions based on your knowledge of what has been directly said in the passage or what can be inferred from it. You may have to use the scroll bar to see the entire passage. Answer each question by clicking the oval in front of the best response.

Be sure you know and understand these instructions before you take the GMAT. If you learn them ahead of time, you won't have to waste valuable seconds reading them on the day you take the test.

GMAT READING COMPREHENSION: CRACKING THE SYSTEM

It's important to know the instructions for reading comprehension questions on the GMAT, but it's much more important to understand what these instructions mean; they don't tell you everything you need to know about GMAT reading comprehension questions. The rest of this chapter will teach you what you do need to know.

Our techniques will enable you to:

Read quickly in a way that will allow you to understand the main idea of the passage.

Eliminate answer choices that could not possibly be correct.

Take advantage of outside knowledge.

Take advantage of inside information (about the way the test writers think).

Find answers in some cases *without reading the passage*.

Basic Passage Types

There are only three types of passages on the GMAT:

The social science passage: This usually concerns a social or historical issue. For example, you might see a passage about world food shortages or the history of a civil rights movement.

The science passage: This might describe a scientific phenomenon, such as

gravitation or plate tectonics.

The business passage: This usually discusses a business-related topic. For example, you might see a passage about the privatization of state-owned industries or the causes of inflation.

The subject matter for one of the passages on each test may concern a minority group. There are certain useful techniques that can be used on this passage. We'll tell you more about that later in the chapter.

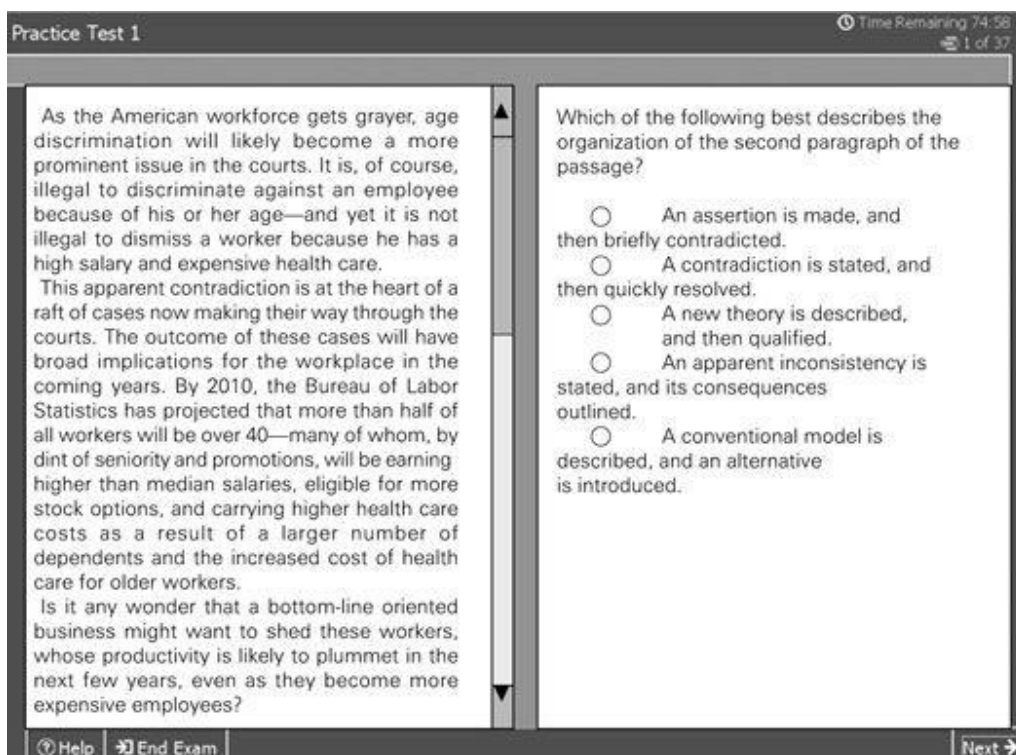
Order of Difficulty

The level of difficulty of the passages you see will depend on how you are doing on the exam, but unlike all the other questions on the GMAT, the three to four reading comprehension questions based on each passage are *not* arranged in order of difficulty. You will see the same questions based on this passage, regardless of how you answer them. The test writers found it too hard to create lots of different questions based on such brief passages.

What You Will See on Your Screen

The reading passage appears on the left side of the screen. The questions appear one at a time on the right side of the screen, so you can always refer back to the passage. You can't see the next question until you answer the one before, and as always, you can't go back to a previous question once you've moved on.

When you are working on a reading comprehension question, your screen will look a lot like this:



The reading passages come in two lengths—the shorter passages usually fit completely on the computer screen, but the longer passages will require you to use the scroll bar to read them entirely.

Is This Like Normal Reading?

GMAT reading has nothing to do with normal reading. For one thing, no one in her right mind would ever read one of these passages of her own free will. They are almost always boring.

Is This Like Business Reading?

GMAT reading has even less to do with business reading. If your boss asked you to analyze a quarterly report and make a presentation of all the points it raised, you would go home and spend hours going over it. You would look for important information, anticipate questions, and memorize statistics. In short, business reading is a careful, painstaking process. Reading on the GMAT is different.

How to Succeed on the GMAT

If you try to read GMAT passages the way you read quarterly reports, you'll never have time for the questions. Worse, you'll have spent a lot of time absorbing information that you don't need to know.

Reading Comprehension Questions Cover Only a Tiny Fraction of the Material in the Passage

Each reading passage is followed by three or four questions. You probably assume that to answer these questions correctly you need to know all of the information in the passage, but that's not true. The questions cover only a small portion of the passage. We're going to teach you how to identify the important parts and ignore most of the rest. The less time you spend reading the passage, the more time you'll have for earning points.

There are two types of questions in Reading Comprehension and neither requires you to memorize specific information:

General questions: To answer these, you need to have an understanding of the main idea and, perhaps, the *structure* of the passage.

Specific questions: Because you'll be asked about only a few specific pieces of information, it's silly to try to remember all of the specific information contained in a passage. It makes much more sense to have a vague idea of where specific information is located in the passage. That way you'll know where to look for it if you need it.

GMAT READING: THE PRINCETON REVIEW METHOD

Think of a GMAT reading passage as a house. The main idea of the passage is like the overall plan of the house; the main idea of each paragraph is like the plan of each room. Reading the passage is like walking quickly through the house. You don't want to waste time memorizing every detail of every room; you want to develop a general sense of the layout of the house.

Later, when you're asked what was sitting on the table beside the chair in the master bedroom, you won't know the answer off the top of your head, but you will know exactly where to look for it. And you'll be able to answer more questions in less time than someone who has tried to memorize every detail.

STEP ONE: READ FOR THE MAIN IDEA

Take a look at the first paragraph of a sample GMAT passage:

Biologists have long known that some types of electromagnetic radiation such as X rays and gamma rays can be dangerous to human beings. Operating at a frequency of 10^{18} through 10^{22} MHz, these rays, which are well above the visible light spectrum, were first detected in the early years of the twentieth century.

Here's How to Crack It

You should always read the first sentence of a paragraph carefully because it is often the key to understanding the entire paragraph. The first sentence of the paragraph you just read is no exception: It tells you that the paragraph is about two types of radiation and their danger to humans. When you've identified the main idea, it's a good idea to jot down a couple of key words to encapsulate it.

Taking Notes

As you make your fast read, you'll probably want to write a one- or two-word summary of each paragraph in your scratch booklet. This is partly to make yourself articulate what the main idea of each paragraph is, but it is also to help you remember them. Have you ever had the experience of reading an entire passage, getting to the end, and then saying, "I have no idea what I just read"?

Most GMAT passages inspire exactly that thought.

Once you know what the paragraph is about, it isn't necessary to pay a lot of attention to the other sentences in the paragraph. For example, you probably noticed that while the second sentence included some specific facts, it added nothing to our understanding of the main point of the paragraph. Later, if GMAC asks you a specific question about this radiation, you can go back and find the answer; it will still be there.

Think of This as *Variable Speed Reading*

Until you know what the main idea of a paragraph is, you want to read very carefully. However, as soon as you've got a handle on what's going on, you can speed

up. Let your eyes glaze over when you get to the small details. Until GMAC asks you about them, who cares?

The goal is to spend no more than a minute or two “reading” the entire passage. Impossible? Sure, if you’re going to insist on reading the way you normally do. Just remember that you don’t get any points for reading the passages; when you take the real GMAT the proctor will *not* be walking around the test room awarding extra points for great reading technique. You get points for *answering questions*.

Try reading the second paragraph in the way we’ve suggested above:

However, until now, no one has ever suggested that microwave radiation might also be harmful. In preliminary laboratory results, Cleary and Milham have found elevated growth rates in cancer cells exposed to low doses of microwaves. Cleary exposed cancer cells to levels of radiation that are commonly found in microwave ovens and found that the abnormal cells grew 30 percent faster than did unexposed cells. Milham’s study focused on ham radio operators who are commonly exposed to levels of radiation slightly higher than those emitted by cellular telephones. He discovered elevated levels of myeloid leukemia.

Here’s How to Crack It

Reading the first sentence carefully, we realize that this paragraph is going off on a tangent thought. In fact, the passage is *not* going to be about the dangers of X rays or gamma rays; it is going to be about the possible dangers of microwaves. Now that we have the main idea, we can afford to skim or skip over the rest of the paragraph. If the test writers ask us later about Cleary or Milham, we’ll know where to find them, but until then, we can let this part of the passage pass in a blur.

Now try reading the last paragraph of the passage:

The methodology of Cleary and Milham has been questioned by other scientists in the field. However, no one seriously disputes that their preliminary findings must be taken seriously or that new studies should be set up to try to duplicate their results. Although federal guidelines for how much electromagnetic energy can be allowed to enter the work and home environment have been made more stringent since they were first implemented in 1982, the recent studies pose troubling questions about the safety of microwaves.

Here’s How to Crack It

The first word of the second sentence (“however”) lets us know that the author was going to come back to the original point: Microwaves may be dangerous. Was this a conclusion? You bet.

In retrospect, the organization of the passage is pretty clear.

The **first** paragraph states the known dangers of electromagnetic radiation.

The **second** paragraph talks about the possible dangers of microwaves as shown by two studies.

The **third** questions the two studies but decides that, on balance, microwaves may indeed be dangerous.

STEP TWO: AS YOU READ, LOOK FOR STRUCTURAL SIGNPOSTS

Certain words instantly tell you a lot about the structure of a passage. For example, if you were reading a paragraph that began, *There are three reasons the Grand Canyon should be strip-mined*, at some point in the paragraph you would expect to find three reasons listed. If a sentence begins, *On the one hand*, you would expect to find an *on the other hand* later in the sentence. These structural signposts show an alert reader what’s going to happen later in a passage. Here are some structural signposts to look out for on the GMAT.

Trigger Words

The second paragraph you just read began with a word that probably automatically clued you in to the fact that a change was on its way: The word was “however.”

Trigger words (such as “however” and “but”) always signal a change in the direction of a passage. Here’s a simple example:

First paragraph:

Most economists believe that the budget deficit will take years to remedy...

Second paragraph:

HOWEVER (trigger word), some economists believe there may be a fast solution to the problem.

In this example, the trigger word signals that the second paragraph will modify or qualify what has gone before. A trigger word at the beginning of any paragraph is a sure

sign that this paragraph will disagree with what was stated in the preceding one.

Trigger words are important even if they do not appear at the beginning of a paragraph; they always signal a change of meaning, even if it is only within a sentence.

Here are the trigger words that often appear on the GMAT:

**but nonetheless although (even though) notwithstanding however
except yet while despite (in spite of) unless nevertheless on the other
hand Continuing-the-Same-Train-of-Thought Words**

Some structural signposts let you know that there will be no contradiction, no change in path. If you see a *first of all*, it stands to reason that there will be a *second of all* and perhaps a *third*. Other signs of continuation:

in addition

by the same token

likewise

similarly

this (implies a reference to preceding sentence)

thus (implies a conclusion)

One other continuing structural element that appears on the GMAT is not a word. Sentences or fragments that appear inside *parentheses* often contain information you'll need to answer a question. You should make a mental note of any sentence or fragment that is enclosed in parentheses.

Yin-Yang Words

One of the test writers' all-time favorite types of passage contrasts two opposing viewpoints, and certain words immediately give this away. See if you can supply the second half of the following sentences:

The traditional view of the causes of global warming focuses on the burning of fossil fuel...

(Second half: However, the *new* view is that there is some other cause.)

Until recently, it was thought that the Mayan civilization was destroyed as a result of drought...

(Second half: However, *now* we believe that it was destroyed by space invaders.)

The classical model of laissez-faire capitalism does not even admit the possibility of government intervention...

(Second half: But the *rock'n'roll* version of laissez-faire capitalism says, "Let me just get my checkbook.")

Before 1960, *it was commonly assumed that the atom was the smallest particle in the universe...*

(Second half: However, *after 1960* scientists began to suspect that there was something even smaller.)

Sentence Correction
Review: Quantity
Comparison Words

Comparing two items
between
more
better
less
Comparing more than
two items
among
most
best
least

Whenever you spot a "yin" word, you should realize that there is a "yang" on the way. Some other yin-yang words:

Yin Yang generally (however, this time...) the old view (however, the new view...) the widespread belief (but the in-crowd believes...) most scientists think (but Doctor Spleegle thinks...) on the one hand (on the other hand...) Getting Through the Passage Faster

Structural elements like these can help you understand a passage more quickly, with less "reading" and less wear and tear on your brain. When you spot one of these signposts, make a mental note. If it actually starts a paragraph, you might begin your three-word synopsis of the paragraph with a big "but." A structural signpost is usually more important to your understanding of a passage than any individual fact within that passage.

STEP THREE: ATTACK THE QUESTIONS

Once you've grasped the main ideas of the paragraphs, you can attack the questions aggressively. As we noted earlier, each passage is followed by up to four questions of varying levels of difficulty. These questions *generally* follow the organization of the passage. In other words, a question about the first paragraph will probably come before a question about the second paragraph.

General Questions

“What is the primary purpose of this passage?”

“What is the author's tone?”

“Which of the following best describes the structure of the passage?”

Each of the questions above is a general question. A two-minute “read” using the techniques we've shown you over the last few pages should be all that you need to answer the general questions—without going back to the passage. Always try to answer a general question in your own words *before* you look at the answer choices.

Using POE to Eliminate Wrong Answers on General Questions

Once you have your *own* idea of what the answer should be, it's time to use POE to zero in on GMAC's answer. In the chapter on Sentence Correction, you learned that it's often easier to eliminate incorrect answers than to select the correct answers. The Process of Elimination is just as useful on reading comprehension questions. How can you use POE to eliminate wrong answers to general questions?

General questions have general answers. Thus, we can eliminate any answer to a general question that focuses on only one part of the passage or is too specific in some other way. We can also eliminate answers that cite information that's not in the passage at all. For example, here's a question based on the passage you have already read:

The main topic of the passage is

- the health hazards of X rays and gamma rays on humans*
 the overly severe federal guidelines on radiation
 the potential dangers of microwaves
 to compare and contrast the work of Cleary and Milham
 the limits of study methodology in science

Here's How to Crack It

In spite of the fact that X rays and gamma rays were mentioned in the first sentence, we know that this was just an introductory thought to get to the real idea of the passage—the danger of microwaves. So eliminate choice A. The federal guidelines in choice B were mentioned in the passage, but only at the very end. Could this be the main idea of the entire passage? No way. Choice C is the best answer and exactly what we should be expecting from our fast “read.” Although Cleary and Milham are discussed several times, they are never compared, so we can eliminate choice D. And even though the passage mentions that the methodologies of the two scientists have been questioned, choice E goes much further than that to question the methodology of *all* science.

Specific Questions

“The passage suggests which of the following about the laboratory results on microwaves mentioned in the highlighted section?”

“According to the passage, a study of ham radio operators might be expected to find which of the following?”

Each of the questions above is a specific question. Specific questions have specific answers which you’ll now need to find. Naturally, your two-minute “read” has not equipped you with the answers to these questions, but every specific question gives you a clue about where to look for the answer.

Line References

Some questions refer to a highlighted portion of the passage. The highlighting will be visible only when you’re working on the question that it pertains to. In this book, we’ll use line numbers instead of highlighting, so you don’t have to look at the highlighting when you’re trying to answer other questions.

Sentence Correction Review: Countability

Different words are used depending on whether you are talking about things that you can count (french

fries) or things that are not countable (water).

Countable

fewer

number

many

Not countable

less

amount, quantity

much

So, how do you find the answer to the following question?

The passage suggests which of the following about the federal guidelines on microwaves mentioned in line 12?

That's easy: It has a line reference. All you have to do is go back to the cited (or, on the GMAT, the highlighted) line or lines. You should start reading a little above them until you come to the answer to the question.

Lead Words

How do you find the answer to *this* question?

“According to the passage, a study of ham radio operators might be expected to find which of the following?”

When a question seems to be specific but is not highlighted, look for a catchy word or phrase in the question. For example, in this question, there's a very clear specific reference: “ham radio operators.” We call this a **lead** phrase. Now that you know what you're looking for, run your finger down the passage on the screen as you scroll until you see your lead word or phrase. When you find it, you will have almost certainly found your answer.

Try this technique out right now by running your finger down the passage below until you find “ham radio operators.” Don't read; just look:

Biologists have long known that some types of electromagnetic radiation such as X rays and gamma rays can be dangerous to human beings. Operating at a frequency of 1018 through 1022 MHz, these rays, which are well above the visible light spectrum, were first detected in the early years of the twentieth century.

However, until now, no one has ever suggested that microwave radiation might also be harmful. In preliminary laboratory results, Cleary and Milham have found elevated growth rates in cancer cells exposed to low doses of microwaves. Cleary exposed cancer cells to levels of radiation that are commonly found in microwave ovens and found that the abnormal cells grew 30 percent faster than did unexposed cells. Milham's study focused on ham radio operators who are commonly exposed to levels of radiation slightly higher than those emitted by cellular telephones. He discovered elevated levels of myeloid leukemia.

The methodology of Cleary and Milham has been questioned by other scientists in the field. However, no one seriously disputes that their preliminary findings must be taken seriously or that new studies should be set up to try to duplicate their results. Although federal guidelines for how much electromagnetic energy can be allowed to enter the work and home environment have been made more stringent since they were first implemented in 1982, the recent studies pose troubling questions about the safety of microwaves.

Using POE to Eliminate Wrong Answers on Specific Questions

Specific questions have very specific answers. Before you even go to the answer choices, you should usually be able to point to the exact spot in the passage where the answer to the question is to be found.

General or Specific?

When you read a reading comprehension question, determine whether it is general or specific. To answer general questions, you need to have an understanding of the main idea and the structure of the passage. To answer specific questions, you need to have a vague sense of where to find the information based on your knowledge of the passage's structure.

Once you go to the answer choices, you'll probably be able to eliminate several right away. However, if you are down to two possibilities, don't try to prove one of the answers right. Look for something in the passage that will make one of the answers *wrong*. It's often easier to find the flaw in an incorrect answer. For example, here's a question (complete with answer choices) based on the passage you have already read:

According to the passage, a study of ham radio operators might be expected to find which of the following?

- The presence of X rays and gamma rays*
 Unusual cells growing 30% faster than normal
 A level of radiation exposure similar to that found in users of microwave ovens
 Higher levels of a particular type of leukemia
 Levels of radiation identical to those emitted by cellular phones

Here's How to Crack It

The lead words “ham radio operators” led us to the second half of the second paragraph. If you haven't already, read the relevant sentences and get an idea of what you might expect the answer to be.

Now, go to the answer choices. Would a study of ham radio operators find the presence of X rays and gamma rays? Well, neither are mentioned in *this* paragraph. The *first* paragraph did mention these rays—but only to introduce the dangers of microwaves. So much for choice A.

Both choices B and C were mentioned in this paragraph, but only in connection with *Cleary's* work—which had nothing to do with ham radio operators.

You might have been torn between choices D and E because both come from the right place in the passage. Don't try to decide which is best. Look for a reason one of them is *wrong*. Let's attack choice E. It says that ham operators were exposed to levels of radiation identical to those emitted by cellular phones. Is that *exactly* what the passage said? Well, no. According to the passage, ham radio operators were exposed to slightly *higher* levels. Choice E is history. The correct answer must be choice D.

Inference Questions

Which of the following can be inferred from the passage about the level of radiation from cellular telephones?

Although this question asks you to draw an inference, you'll find that GMAC's idea of an inference will be much more timid than yours. GMAT inferences go at most a

tiny bit further than the passage itself. If your thoughts about this type of question becomes too subtle, you'll get it wrong. Here's an example:

Which of the following can be inferred from the passage about the studies conducted by Cleary and Milham?

- Cleary's results were better documented than Milham's.*
 Neither study is scientifically valid.
 Both studies indicated that microwaves were more harmful than X rays.
 The final results were not in at the time the article was written.
 The results of both studies were based on the same scientific data.

Here's How to Crack It

The passage never said that one study was better than the other, so eliminate answer choice A. While both studies were questioned in the third paragraph, it would be inferring far too much to say that neither was scientifically valid. Eliminate choice B. The passage never said that microwaves were more harmful than X rays. It seems likely that they are less harmful. Eliminate choice C. The results of both studies were called "preliminary" in paragraph two. Thus, choice D seems so obvious that you might almost hesitate to call it an inference. This is exactly the kind of inference that the GMAT test writers feel comfortable making. Not only was choice E not stated, but it is likely to be false. Cleary concentrated on cancerous cells exposed to levels of radiation equivalent to microwave ovens. Milham studied ham radio operators. The best answer is D.

Advanced POE: Attacking Disputable Answer Choices

Say you've eliminated two answer choices on a reading comprehension question, but you can't decide which of the remaining three choices is best. All three seem to say the same thing. How do you choose among them? The test writers and GMAC want their correct answers to be indisputable so that no one will ever be able to complain

Here are three statements. Which of them is indisputable?

- Shaw was the greatest dramatist of his time.
 Shaw's genius was never understood.
 Shaw was a great dramatist, although some critics disagree.

Shaw's status as a playwright will always be a matter of opinion. If GMAC made the first statement the correct answer to a reading comprehension question, people who got the question wrong might argue that not everyone considers Shaw the greatest dramatist of his time.

If GMAC made the second statement the best answer to a reading comprehension

question, people who got the question wrong could argue that someone, somewhere in the world, must have understood poor old Shaw.

The third statement, by contrast, is indisputable. Most critics would agree that Shaw was *a* great dramatist. If there are any critics who do not, the test writers cover themselves with a little disclaimer: “although some critics disagree.” The third statement is so vague that no one could possibly argue with it.

In general, an answer choice that is highly specific and unequivocal is *disputable* and is therefore usually not the best answer.

An answer choice that is general and vague is *indisputable* and is therefore often the correct answer.

How to *Pick* an Indisputable Answer Choice

Certain words make a statement so vague that it is almost impossible to dispute. Here are some of these words:

usually can sometimes some may most If a statement says that Shaw is *sometimes* considered the greatest dramatist ever, who can dispute that?

Reading Comprehension

Trigger words that signal a change in meaning:
 but
 although (even though)
 however
 yet
 despite (in spite of)
 nevertheless
 nonetheless
 notwithstanding
 except
 while
 unless
 on the other hand

How to *Avoid* a Disputable Answer Choice

Certain words make a statement so *absolute* that it's easy to dispute. Here are some of these words:

always all must complete everybody never If a statement says that Shaw is *always* considered the greatest dramatist ever, who couldn't dispute that?

Respect for Professionals

GMAC has tremendous respect for all professionals—doctors, scientists, economists, writers, and artists. It is very unlikely that the test writers would create a right answer that implies anything negative about a professional.

By the same token, it would be unusual to find a best answer choice that took any but the lightest digs at America. Our country is pretty much beyond GMAC's reproach.

Moderate Emotion

The test writers avoid using passages that convey strong emotions on the GMAT. The author's tone might be "slightly critical," but it will not be "scornful and envious." The author's tone might be "admiring," but it will never be "overly enthusiastic." If you see strong words like these in an answer choice, it's probably wrong and can be eliminated.

The Diversity Passage

For many years, minority groups have complained—justifiably—that standardized tests like the GMAT discriminate against them. GMAC responded to this criticism by adding a diversity passage to many of its tests. One of the reading passages on the GMAT you take will almost certainly be about some marginalized group—African Americans, Mexican Americans, women.

Designed to answer charges that the GMAT is biased, the diversity passage is invariably positive in tone. This doesn't make the test any fairer to minorities, but it does sometimes make the test easier to beat. Any answer choice that expresses negative views of the marginalized group in question is almost certainly wrong. Try the following example:

The author considers women's literature to be

- derivative* *lacking in imagination* *full of promise and hope*
 much better than the literature being written by men today
 uninteresting **Here's How to Crack It**

You don't need to see the passage to answer this question. The whole purpose of the diversity passage is to illustrate to everyone how broad-minded and unbiased the GMAT really is. "Derivative," "lacking in imagination," and "uninteresting" all express negative opinions of literature written by (what the test writers consider to be) a minority group.

Answer choice D goes too far in the other direction. As far as the test writers are concerned, women's literature is just as good as, but no better than, anyone else's. The answer must be choice C.

Putting All This to Work

Now that you know something about how to tackle GMAT passages and what to look for in them, try the sample passage below. Find the main idea of each paragraph (and if you like, jot down a few key words about each one); look for structural signposts along the way.

Try to spend no more than two minutes "reading." Remember, you only get points for answering questions. (At the end of this chapter, you will find the notes that one of our teachers made when she "read" the passage.)

Remember, on the GMAT, you'll have no more than four questions per passage. We've included a few extra questions just for practice.

Until recently, corporate ideology in the United States has held that bigger is better. This traditional view of the primacy of big, centralized companies

Line is now being challenged as some of the giants of

(5) American business are being outperformed by a new generation of smaller, streamlined businesses. If it was the industrial revolution that spawned the era of massive industrialized companies, then perhaps it was the information revolution of the 1990s that spawned

(10) the era we're now in—the era of the small company.

- For most of the 20th century, big companies dominated an American business scene that seemed to thrive on its own grandness of scale. The expansion westward, the growth of the railroad and steel industries, an almost limitless supply of cheap raw materials, plus a population boom that provided an ever-increasing demand for new products (although not a cheap source of labor) all coincided to encourage the growth of large companies.
- (15) But rapid developments in the marketplace have begun to change the accepted rules of business and have underscored the need for fast reaction times. Small companies, without huge overhead and inventory, can respond quickly to a technologically advanced age in which new products and technologies can become outmoded within a year of their being brought to market.
- (20) Of course, successful emerging small companies face a potential dilemma in that their very success will tend to turn them into copies of the large corporate dinosaurs they are now supplanting. To avoid this trap, small companies may look to the example of several CEOs of large corporations who have broken down their sprawling organizations into small, semi-independent divisions capable of surviving in today's marketplace.
- (25) (30) (35)

Attacking the Questions

-
1. The primary purpose of the passage is to

present evidence that resolves a contradiction in business theory
 discuss reasons an accepted business pattern is changing
 describe a theoretical model and a method whereby that model can be tested
 argue that a traditional ideology deserves new attention
 resolve two conflicting explanations for a phenomenon
 Here's How to Crack It

This is a general question, and general questions always reflect the structure of the passage. The first words of the passage were “until recently.” We hope you recognized right away that this was “yin-yang” terminology, as was “this traditional view.” Obviously, this passage is about to present a *new* view.

Sentence Structure

While you skim a passage, be aware of its structure. Is one theory presented and then discounted? Are there lists of items? Does it provide two schools of thought? Trigger words, which act as structural signposts, can help you uncover a passage’s structure.

The old view, according to the passage, was that in America, large companies were always better off than small companies. Of course, the new view is that smaller companies are now doing better than big companies. This was probably enough for you to answer all the general questions in this section, but let’s look quickly at the rest of the passage: Paragraph two gives historical reasons why bigger used to be better; paragraph three explains why this is no longer true today; and paragraph four concludes by talking about how small companies can stay successful as they inevitably get bigger. Let’s analyze the answer choices:

(A) In yin-yang passages, new is virtually always better than old. There is really no contradiction here. Also, GMAT passages hardly ever “resolve” anything definitively. How could they in only 250 words? Eliminate this answer. (B) This is the best answer. It mirrors the yin-yang structure of the passage—the accepted pattern of almost a century is now changing. (C) If you picked this one, you were thinking too hard. Perhaps you thought the primacy of the small company was the new theoretical model, about to be tested. However, the passage seems to imply that the decline of large companies and the ascendancy of small companies started before anyone even realized what was happening, let alone came up with some smart theory about it. (D) Was the author arguing that in fact the traditional view that “bigger is better” is actually correct after all? Nope. Eliminate it. (E) Again, GMAT passages rarely “resolve” anything. Also, while there are two conflicting elements in this passage, they are not conflicting explanations for a single phenomenon.

2. According to the passage, all of the following are examples of developments that helped promote the growth of large companies earlier in this century EXCEPT

- the growth of the railroad industry America's westward expansion
 an almost inexhaustible source of raw materials the existence of an inexpensive source of labor the development of an industry to produce steel

B-School Lingo

poets: mathematically challenged students with little quantitative skill or experience

power naps: brief in-class unconsciousness that revives sleep-deprived students

power tool: someone who does all the reading and homework and sits in the front of the class with his hand up

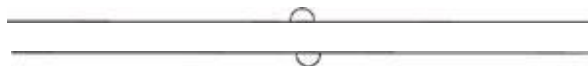
Source, *Best 294 Business Schools*

Here's How to Crack It

This is a specific question without a line number, but you probably knew just where to look. Which paragraph gives historical background on the growth of large companies? If you said paragraph two, you are absolutely correct.

The first time you “read” this passage, you may have skipped over the specifics in this paragraph because they weren’t necessary to understand the purpose of the paragraph. Now, of course, you are interested. But even if you had spent 20 minutes (you didn’t really have) memorizing the entire passage, wouldn’t you still have wanted to peek back at this paragraph just to make sure you remembered it correctly? Because you were going to have to look back anyway, it made sense to skip over the details the first time around. Remember, there was no guarantee that there would even be a question about this information. It is not unusual to find GMAT passages whose questions completely ignore whole paragraphs at a time.

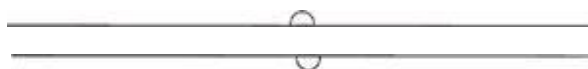
This is an “except” question, which means that every answer choice is correct but one. The answer to this question was buried inside the parentheses in lines 17–18: (“although not a cheap source of labor”). The answer to this question is choice D.



3. The author’s attitude toward the traditional view expressed in lines 1–6 can best be described as

- scornful and denunciatory*
 dispirited and morose
 critical but respectful
 admiring and deferential
 uncertain but interested
 Here’s How to Crack It

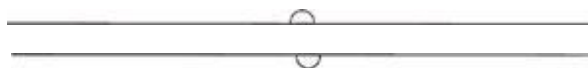
You could eliminate two of these answer choices without even reading the passage. GMAC would never include a passage in which the author’s attitude toward companies like General Motors is “scornful and denunciatory” or “dispirited and morose.” Both choices A and B are so strong and out in left field that we can safely eliminate them. As far as the passage is concerned, the traditional ideology no longer works, so we can pretty much rule out choice D, “admiring and deferential.” Choice E is a little too vague. The only possible answer is choice C.



4. It can be inferred from the passage that which of the following actions would be most consistent with the traditional ideology described in the passage?

- Splitting a manufacturing company into several smaller divisions*
 Bringing a new product to market within a year
 Creating a department to utilize new emerging technologies
 Expanding an existing company in anticipation of growing demand
 Cutting inventory and decreasing overhead
 Here’s How to Crack It

The trick in inference questions is to infer as little as possible. The traditional ideology is that bigger is better. Which of the answer choices shows a situation getting bigger? The best answer is choice D. Choices A and E both illustrate the process of downsizing as described in the passage. Choices B and C illustrate the lean-and-mean tactics attributed in the passage to small companies.



5. According to the passage, to avoid the trap posed by “a potential dilemma,” mentioned in line 29, emerging successful small companies will have to do which of the following?

Turn for advice to the industry analysts who earlier predicted the problems of large companies Avoid taking paths that will make them too successful Learn to embrace the traditional ideology of large corporations Create small interconnected divisions rather than expanding in traditional ways Hire successful CEOs from other firms **Here's How to Crack It**

Whenever you see a specific question with a line reference (indicated on the test by highlighting, or in this book by line numbers), always remember to read a little above and a little below the referenced line. In this case, we are not interested so much in the “dilemma” as we are in avoiding the trap posed by the dilemma. The answer to this question is in the last three lines of the passage.

Let's analyze the answer choices:

(A) This is an interesting idea, but it is not said in the passage, so we can eliminate it. (B) The right idea, but takes it too far. It is practically un-American to think that a company would try not to become too successful. (C) The traditional ideology is what got the big companies into trouble. Eliminate it. (D) This is the best answer and a nice paraphrase of what was said in the last three lines of the passage. (E) The passage suggests that small companies could learn from these CEOs, but does not suggest that the small companies *hire* the CEOs.

6. Which of the following best describes the organization of the first paragraph of the passage?

A conventional model is described and an alternative is introduced. An assertion is made and a general supporting example is given. Two contradictory points of view are presented and evaluated. A historical overview is given to explain a phenomenon. A new theory is described and then qualified. **Here's How to Crack It**

This is a structure question, pure and simple. Let's interpret the answers:

(A) correctly describes this yin-yang paragraph (B) ignores the structure of the passage (C) is close, but fails to show that one point of view is considered superior to the other (D) describes paragraph two instead of paragraph one (E) The word “qualified” means “limited.” The author seems to like the idea of the small company and certainly doesn't qualify it in the first paragraph.

B-School Lingo

pre-enrollment courses:
commonly known as
MBA summer camp;
quantitative courses
offered in the summer
before first year for the
mathematically challenged

pro forma:
financial presentation of
hypothetical events; for
example, how much debt
would a company have
to acquire if it grows ten
percent per year?

run the numbers: analyze
quantitatively

Source: *Best 294 Business Schools*

7. It can be inferred from the passage that small companies are better able to adapt to the new business climate due to which of the following factors?

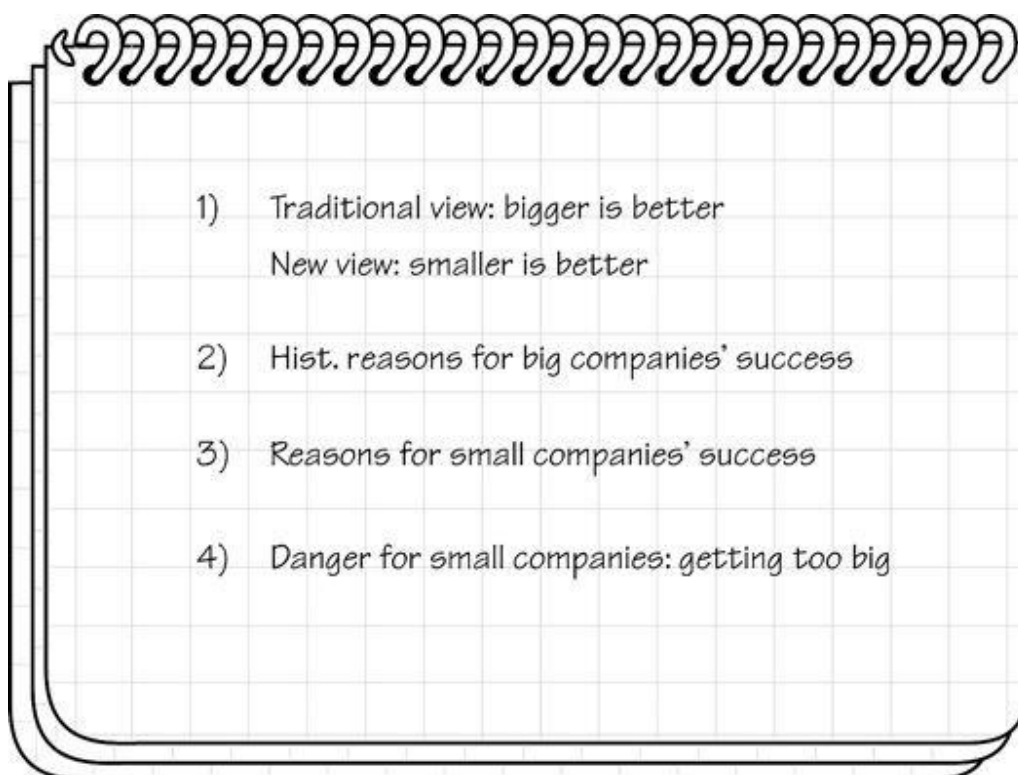
I. low overhead and inventory II. the ability to predict when new products will become outmoded III. the capacity to change quickly to meet new challenges ***I only***
 II only ***III only*** ***I and III only*** ***I, II, and III*** **Here's How to Crack It**

I, II, III–type questions are nasty because you have to answer three questions in order to get one right. Where in the passage were small companies actually described? If you said paragraph three, you were absolutely correct. Because this is an inference question, we need to make sure we don't infer too far. Let's look at Statement I. Can we infer that small companies are better able to adapt because of low inventory? Sure. In lines 23–24 the passage reads, “Small companies, without huge overhead and inventory ...”

Because we know that Statement I works, we can cross off choices B and C; why? Because neither includes Statement I. Let's look at Statement II. While it seems likely that the ability to predict ahead of time which products are going to become outmoded would help small companies adapt faster, there is no indication in the passage that anyone

has the ability to predict ahead. If you aren't sure about Statement II, you can skip it and go on to Statement III. This statement is definitely true. It is a paraphrase of lines 23–24. The best answer is choice D.

Here's What Your Notes Should Look Like After You've Finished Reading This Passage



Summary

Reading comprehension questions make up roughly one-third of the 41 questions on the Verbal section of the GMAT—approximately 13 questions. The three types of passages that may appear on the test are social science, science, and business.

Reading comprehension questions are not presented in any order of difficulty, though the level of difficulty of the passages you see will depend on how well you are doing on the exam.

Read a passage for its main idea. This will enable you to answer the general questions, and give you a good idea of where to look for the answers to specific

questions. When you read, jot down a few words summarizing each paragraph.

Structural signposts can help you see how a passage is organized. Look for trigger words, continuing-the-same-train-of-thought words, and yin-yang constructions.

Answers to specific questions can be found either through highlighted **line references** or **lead words**. When line references are given, read a little above and a little below them.

Attack answer choices that are disputable. Specific, strong statements are often wrong. Vague, wimpy statements are often correct.

The tone of a minority passage is invariably positive. This can sometimes help you to answer questions even if you haven't had time to read the entire passage.

The test writers typically do not create right answers that: are disrespectful to professionals are too strong condone prejudicial attitudes

I, II, III-type questions are best tackled by POE.

Chapter 17

Critical Reasoning

To understand Critical Reasoning passages, you need to know a bit about formal logic, how arguments are constructed, and how to weaken and strengthen an argument. In this chapter, we will break down arguments into their three parts and show you how to recognize—and ace—the 8 major types of arguments that show up on the GMAT.

Critical reasoning questions make up a little less than one-third of the 41 questions on the Verbal section of the GMAT—approximately 11 questions. They consist of very short reading passages (typically 20 to 100 words). Each of these passages is followed by one or two questions, which are supposed to test your ability to think clearly. When this section was first introduced, the test writers said that “no knowledge of the terminology and of the conventions of formal logic is presupposed.” Nevertheless, you'll find that while it may not be presupposed, some knowledge of the rudiments of formal logic—as applied by The Princeton Review—can substantially increase your score.

THE HISTORY OF CRITICAL REASONING

Over the years, the test writers have tried several different formats in an attempt to test reasoning ability.

The original GMAT contained a section called “Best Arguments.” In 1961, this

section was replaced with something called “Organization of Ideas.” In 1966, this section was also phased out, and for six years reasoning ability went unmeasured. In 1972, GMAC tried again, with a section called “Analysis of Situations.” Finally, on the October 1988 version of the GMAT, the test writers unveiled Critical Reasoning for the first time.

Well, Not Exactly the *First* Time

In fact, Critical Reasoning looks a lot like Best Arguments. Test writers have used this type of question for years on the LSAT (Law School Admission Test) and, until recently, on the GRE (Graduate Record Exam).

Before we begin, take a moment to read a close approximation of the instructions for critical reasoning questions:

Directions: Every critical reading question refers to a brief argument or set of statements. Pick the best answer among the choices given.

Obviously you won’t need to read these instructions again.

How to Attack the Critical Reasoning Questions

The terseness of these instructions implies that all you need on these questions is common sense. Common sense will certainly help, but you should also understand a bit about the formal logic on which Critical Reasoning is based.

Like the other types of questions found on the GMAT, critical reasoning questions tend to be predictable. There are only a few question types, and as you learn how the test writers use their smattering of formal logic to write critical reasoning questions, you’ll be able to anticipate the answers to certain of those questions. In this chapter we’ll teach you how to:

Use clues in the questions to anticipate the kind of answer you’re looking for in a passage.

Analyze and attack the passages in an organized fashion.

Understand the basic structure of the passages.

Use Process of Elimination to eliminate wrong choices.

A Word About GMAT Logic

GMAT logic is different from the formal logic you may have studied in college.

Our review of GMAT logic is not intended to be representative of logic as a whole. We don't intend to teach you logic; we're going to teach you *GMAT* logic.

The Passage

Most critical reasoning passages are in the form of *arguments* in which the writer tries to convince the reader of something. Here's an example:

In the past 10 years, advertising revenues for the magazine *True Investor* have fallen by 30%. The magazine has failed to attract new subscribers, and newsstand sales are down to an all-time low. Thus, sweeping editorial changes will be necessary if the magazine is to survive.

There are three main parts to an argument:

Conclusion: This is what the author is trying to persuade us to accept.

Premises: These are the pieces of evidence the author gives to support the conclusion.

Assumptions: These are unstated ideas or evidence without which the entire conclusion might be invalid.

In the passage above, the author's *conclusion* is found in the last line:

Thus, sweeping editorial changes will be necessary if the magazine is to survive.

To support this, the author gives three pieces of evidence, or *premises*: Advertising revenue is down; there are no new subscribers; and very few people are buying the newspaper at the newsstand.

Are there any *assumptions* here? Well, not in the passage itself. Assumptions are never stated by the author. They are parts of the argument that have been left out. Even the best-thought-out argument has assumptions. In this case, one important assumption the author seems to make is that it was the old editorial policy that caused the problems the magazine is now encountering. Another assumption is that editorial changes alone will be enough to restore the magazine's financial health.

A critical reasoning passage is not necessarily made up of only these three parts. The passage might contain other information as well—extraneous ideas, perhaps, or statements of an opposing point of view. This is why it's so important to find and identify the conclusion and the premises (as well as the argument's underlying assumptions).

Look for conclusions at the beginning and end of a passage. Most arguments follow one of two common structures:

premise, premise, premise, conclusion

or

conclusion, premise, premise, premise

Therefore, the conclusion can often be found in the first or last sentence of the passage.

Look for the same kinds of structural signposts we showed you in the Reading Comprehension chapter (Chapter 16). Words like the following often signal that a conclusion is about to be made:

therefore hence thus implies so indicates that Look for a statement that cannot stand alone; in other words, a statement that needs to be supported by premises.

If you can't find the conclusion, look for the premises instead. These are the parts of the argument that support the conclusion.

Premises are often preceded by another kind of signpost. Words like the following signal that evidence is about to be given to support a conclusion:

**because in view of since given that This Is Not Like Reading
Comprehension**

Reading comprehension passages are long and filled with useless facts. By now you've gotten used to reading these passages for their structure, letting your eyes skip over factual data you probably won't be tested on anyway.

By contrast, critical reasoning passages are quite short, and every single word should be considered carefully; shades of meaning are very important. Because the passages are relatively short, you will probably never have to use the scroll bar to see them on your screen in their entirety.

The Question

Immediately after the passage, there will be a question. There is usually only one question per passage—which means it is essential that you *always read the question first*.

The question contains important clues that will tell you what to look for as you read the passage.

There Are Eight Question Types

Here are examples of the eight major question types you'll see (we'll go into much greater detail later in the chapter):

1. The passage above assumes that...

Reading Comprehension Review

Trigger words that signal a conclusion:
therefore
thus
so
hence
implies
indicates

We call these **assumption questions**. As you read the passage in question, you will be looking for an unstated premise upon which the argument depends.

2. Which of the following, if true, would most strengthen the conclusion drawn above?

We call these **strengthen-the-argument questions**. This type of question is like an assumption question in that it asks you to find an unstated premise upon which the argument depends, and then bolster it.

3. Which of the following, if true, would most seriously weaken the conclusion of the passage above?

We call these **weaken-the-argument questions**. This type of question, like an assumption question, asks you to find an unstated premise of the argument and poke holes in it.

4. Which of the following can best be inferred from the passage above?

We call these **inference questions**. This question, like inference reading comprehension questions, is at most asking you to go a tiny bit further than the passage does.

5. Which of the following best resolves the apparent contradiction in the passage above?

We call these **resolve/explain questions**. This type of question asks you to pick an answer choice that explains an inconsistency between two incompatible facts.

6. Which of the following would be most useful in evaluating the logic of the argument above?

We call these **evaluate-the-argument questions**. This type of question asks you to pick an answer choice that would help to “assess” or “evaluate” part of an argument.

7. The bolded phrase plays which of the following roles in the argument above?

We call these **identify-the-reasoning questions**. This type of question asks you to identify the method or technique the author is using.

8. Which of the following most resembles the method used by the author to make the point above?

We call these **parallel-the-reasoning questions**. This type of question asks you to find a new argument among the answer choices that mimics the original argument.

While the wording of the questions may vary, these are the question types you’ll see—there are only eight. Each type of question has its own strategy, as we’ll show you.

Scope

As you read through this chapter you will notice that certain sentences keep coming up again and again in our discussions of how to eliminate wrong answers.

The ones you’ll see most often are:

“This answer choice goes too far.”

“That choice is outside of the scope of the argument.”

Why do these sentences appear so frequently? Because scope is one of the test writers’ favorite topics for critical reasoning questions. It takes a little practice to figure out how scope works. We’ll give you an introduction to the concept here, but you’ll need to work through the entire chapter (and practice on the questions in our online tests or in *The Official Guide for GMAT Review*) to understand it completely.

Here’s an example:

In an effort to save money, a country’s government is considering reducing its military spending. However, without military contracts, crucial industries in that country face bankruptcy, which could disrupt the economy. Thus, the same government that is reducing its military spending will eventually have to provide these industries with money for peacetime research and development.

Which of the following states the conclusion of the passage above?

○ The necessity of providing money to keep crucial industries from going bankrupt will discourage the government from reducing its military budget. ○ If the government decreases its military budget, it will eventually be forced to increase its military budget to its former level. ○ The industries that receive research and development money will be successful in their efforts to convert to peacetime manufacturing. ○ In the event of war, this country would be unprepared for military conflict. ○ Reducing military spending to save money will result in some increases in other types of spending.

We will discuss how to do this type of question (inference) shortly, but for now, we're going to summarize the argument and skip right to the answer choices in order to illustrate how to use scope as an elimination technique. The argument states that a country wants to save money by decreasing its military budget; however, in order to keep the industries that depend on military contracts from collapsing, the country will have to *spend* some additional money as well.

The GMAT Rewards Narrow Minds

In the Critical Reasoning section, it is easy to think too much. The first answer choice (what we call answer choice A) might look very tempting at first, because it seems to take the argument to its logical conclusion: "Hey, if cutting military spending is going to end up *costing* the country money, they may as well not do it." But the test writers consider answer choice A to be outside the scope of this argument. In fact, if you think about it, we have no idea whether or not the government will be discouraged, or even whether the costs of supplying research and development money will be greater than the savings in military spending. This answer goes much further than the argument itself.

Choice B goes too far as well. Perhaps cutting military spending will turn out to be a bad idea, but even if that is true, how do we know that the country will then eventually decide to increase military spending? What might happen in the future is well outside the scope of this argument.

We can eliminate choice C for the same reason, because it merely goes off on a tangent to speculate as to the ultimate fate of the industries mentioned in the passage. Whether these industries succeed in making the transition to peacetime manufacturing is not crucial to this argument.

If you are tempted by choice D, you're still thinking too much. When a country reduces its military spending, you could argue that it might be less prepared for war—but that is way outside the scope of this passage. Be careful not to impose your own value judgments or thought processes on these questions.

Keeping Track of POE

As you eliminate answer choices, it's vital that you physically cross them off in your scratch booklet. This will prevent you from wasting time rereading answer choices you've already eliminated.

Choice E may have seemed simplistic when you first read it, but simple is exactly what we want here. Rather than asking us to make assumptions, inferences, or explanations, this question simply asks for the conclusion of the passage—nothing more. Choice E stays within the scope of the argument.

Now let's look at the eight types of critical reading questions.

1. ASSUMPTION QUESTIONS

An assumption question asks you to identify an *unstated* premise of the passage from among the answer choices. As you read the passage, what you will be looking for is a gap in the underlying logic of the argument—a gap that can only be closed by stating out loud what is now only being assumed. There are many different kinds of assumptions the GMAT test writers can use, but let's get you started by identifying three: causal assumptions, statistical assumptions, and analogy assumptions.

Causal Assumptions

The test writers are extremely fond of these and make use of them several times on every GMAT. Causal assumptions take an effect and suggest a cause for it. Take a look at the simplified example below.

Every time I wear my green suit, people like me. Therefore, it is my green suit that makes people like me.

The author's conclusion (it is the green suit that makes people like him) is based on the premise that every time he wears it, he has observed that people like him. But this argument relies on the assumption that there is no other possible cause for people liking him. Perhaps he always wears a red tie with his green suit, and it's really the tie that people like.

Whenever you spot a cause being suggested for an effect, ask yourself if the cause is truly the reason for the effect, or if there might be an alternate cause.

Analogy Assumptions

An argument by analogy compares one situation to another, ignoring the question

of whether the two situations are comparable.

Use of this product causes cancer in laboratory animals. Therefore, you should stop using this product.

The author's conclusion (you should stop using the product) is based on the premise that the product causes cancer in laboratory animals. This argument is not really complete. It relies on the assumption that because this product causes cancer in laboratory animals, it will also cause cancer in humans.

Whenever you see a comparison in a critical reasoning passage, you should ask yourself: Are these two situations really comparable?

Statistical Assumptions

A statistical argument uses statistics to "prove" its point. Remember what Mark Twain said: "There are lies, damned lies, and statistics."

Four out of five doctors agree: The pain reliever in Sinutol is the most effective analgesic on the market today. You should try Sinutol.

The conclusion (you should try Sinutol) is based on the premise that four out of five doctors found the pain reliever in Sinutol to be the most effective. However, a literal reading of the passage tells us that the statistic that the author uses in support of his conclusion is only based on the opinions of five doctors (all of whom may be on the board of directors of Sinutol). The author's conclusion is based on the *assumption* that four out of *every* five doctors will find Sinutol to be wonderful. This may be correct, but we do not know for sure. Therefore, the most we can say about the conclusion is that it may be true.

Whenever you see statistics in an argument, always be sure to ask yourself the following question: Are the statistics representative?

Neither analogy nor statistical arguments are as prevalent on the GMAT as causal arguments.

How to Recognize an Assumption Question

Assumption questions generally contain one of the following wordings:

Which of the following is an assumption on which the argument depends?

The argument above assumes which of the following?

The claim above rests on the questionable presupposition that...

How to Attack the Answer Choices on an Assumption Question

Assumptions plug holes in the argument and help make a conclusion true. Here are some guidelines for spotting assumptions among the answer choices:

Assumptions are never stated in the passage. If you see an answer choice that comes straight from the passage, it is **not** correct.

Assumptions support the conclusion of the passage. Find the conclusion in the passage, then try out each answer choice to see whether it makes the conclusion stronger.

Assumptions frequently turn on the gaps of logic we've just discussed. If the argument proposes a cause for an effect, you should ask yourself whether there might be some other cause. If the argument uses statistics, you should probably ask yourself whether the statistics involved are representative. If the argument offers an analogy, you should ask yourself whether the two situations are analogous.

Now Let's Try the Passage

Critical Reasoning Step-By-Step

Read the question first, looking for clues as to which type of argument this might be.

Read the passage carefully (no skimming), looking for the conclusion, the premises, and—most importantly—the assumptions.

Begin eliminating answer choices based on POE.

Many people believe that gold and platinum are the most valuable commodities. To the true entrepreneur, however, gold and platinum are less valuable than opportunities that can enable him to further enrich himself. Therefore, in the world of high finance, information is the most valuable commodity.

The author of the passage above makes which of the following assumptions?

- Gold and platinum are not the most valuable commodities.*
 Entrepreneurs are not like most people.
 The value of information is incalculably high.
 Information about business opportunities is accurate and will lead to increased wealth.
 Only entrepreneurs feel that information is the most valuable commodity.

Here's How to Crack It

The question tells you that you are looking for an assumption, which means that as you read, you'll be looking for a hole in the argument.

Because an assumption supports the conclusion, it's a good idea to know what the conclusion is. Can you identify it? It was in the last sentence, preceded by "therefore": "In the world of high finance, information is the most valuable commodity."

Assumption Guidelines

- 1) Assumptions are never stated in the passage.
- 2) An assumption must support the conclusion; eliminate answer choices that do not strengthen the conclusion.
- 3) Assumptions frequently work to fill in gaps in the reasoning of the argument.
- 4) Look to see if the assumption, whether it is statistical, analogical, or causal, links the evidence to the conclusion.

As you read the passage, keep your eyes open for potential holes in the argument. For example, as you read, it might occur to you that the author is assuming that there is no such thing as bad information. Anyone who has ever taken a stock tip knows the error in that assumption.

Don't be upset if you can't find a hole in the argument as you read. The answer choices will give you a clue.

Let's attack the answer choices:

Gold and platinum are not the most valuable commodities. Does this support the conclusion? In a way, it does. If information is supposed to be the most valuable commodity, it might help to know that gold and platinum are not the most valuable commodities.

However, saying that gold and platinum are *not* the most valuable commodities does not necessarily mean that information *is* the most valuable commodity.

Entrepreneurs are not like most people. If most people find gold and platinum to be the most valuable commodities, while entrepreneurs prefer information, then it *could* be inferred that entrepreneurs are not like most people. Does this support the conclusion, though? Not really. Remember, the GMAT rewards narrow thinking.

The value of information is incalculably high. This answer merely restates the conclusion. Remember, we're looking for an assumption, which is an *unstated* premise. In addition, this answer goes beyond the scope of the argument. To say that information is valuable does not mean that its value is "incalculable."

Information about business opportunities is accurate and will lead to increased wealth. This is the best answer. If the business information is not accurate, it could not possibly be valuable. Therefore, this statement supports the conclusion by plugging a dangerous hole in the argument.

Only entrepreneurs feel that information is the most valuable commodity. Does this statement strengthen the conclusion? Actually, it might weaken it. The conclusion states that "in the world of high finance, information is the most valuable commodity." Presumably the world of high finance is not composed exclusively of entrepreneurs. If only entrepreneurs believed information to be the most valuable commodity, then not everyone in the world of high finance would feel the same way.

2. STRENGTHEN-THE-ARGUMENT QUESTIONS

If a question asks you to strengthen an argument, it is saying that the argument can be strengthened; in other words, again, you're going to be dealing with an argument that has a gap in its logic.

Like assumption questions, strengthen-the-argument questions are really asking you to find this gap and then fix it with additional information. Here are some guidelines for spotting strengthen-the-argument statements among the answer choices:

The best answer will strengthen the argument with *new* information. If you see an answer choice that comes straight from the passage, it's wrong.

The new information you're looking for will support the conclusion of the passage. Find the conclusion in the passage, then try out each answer choice to see whether it makes the conclusion stronger.

Strengthen-the-argument questions frequently turn on the gaps of logic we've already discussed. If the argument proposes a cause for an effect, you should ask yourself whether there might be some other cause. If the argument uses statistics, you should probably ask yourself whether the statistics involved are representative. If the argument offers an analogy, you should ask yourself whether the two situations are analogous.

How to Recognize a Strengthen-the-Argument Question

Strengthen-the-argument questions are generally worded in one of two ways:

Which of the following, if true, most strengthens the author’s argument?

Which of the following, if true, most strongly supports the author’s hypothesis?

Now Let’s Try the Passage

It has recently been proposed that we adopt an all-volunteer army. This policy was tried on a limited basis several years ago and was a miserable failure. The level of education of the volunteers was unacceptably low, while levels of drug use and crime soared among army personnel. Can we trust our national defense to a volunteer army? The answer is clearly “No.”

Which of the following statements, if true, most strengthens the author’s claim that an all-volunteer army should not be implemented?

- The general level of education has risen since the first time an all-volunteer army was tried.* *The proposal was made by an organization called Citizens for Peace.*
 The first attempt to create a volunteer army was carried out according to the same plan now under proposal and under the same conditions as those that exist today. *A volunteer army would be less expensive than an army that relies on the draft.* *The size of the army needed today is smaller than that needed when a volunteer army was first tried.*
- Here’s How to Crack It**

You know from reading the question first that you’re expected to fix a flaw in the argument. Even better, the question itself tells you the conclusion of the passage: “An all-volunteer army should not be implemented.”

Conclusion Is Key

The easiest way to strengthen an argument is to strengthen the conclusion.

You can do this by presenting new evidence that strengthens the underlying assumptions. Any answer choice that comes from the passage will probably be wrong. New evidence or assumptions, whether statistical, analogical, or causal, must support the conclusion.

Because the reasoning in a strengthen-the-argument question is going to contain gaps, it pays to see whether the argument is statistical, causal, or analogical. You may have noticed that the argument does, in fact, use an analogy. The author bases his conclusion on the results of one previous experience. In effect he says, “The idea didn’t work then, so it won’t work now.” This is the potential flaw in the argument.

If you didn’t spot the argument by analogy, don’t worry. You would probably have seen it when you started attacking the answer choices:

The general level of education has risen since the first time an all-volunteer army was tried. Does this support the author’s conclusion? Actually, it may weaken the conclusion. If the general level of education has risen, it could be argued that the level of education of army volunteers is also higher. This would remove one of the author’s objections to a volunteer army. Eliminate it.

The proposal was made by an organization called Citizens for Peace. This is irrelevant to the author’s conclusion. You might have wondered whether a group called “Citizens for Peace” was the right organization to make suggestions about the army. Attacking the reputation of a person in order to cast doubt on that person’s ideas is a very old pastime. There’s even a name for it: an *ad hominem fallacy*. An *ad hominem* statement does not strengthen an argument. Eliminate it.

The first attempt to create a volunteer army was carried out according to the same plan now under proposal and under the same conditions as those that exist today. This is the best answer. The passage as it stands is potentially flawed because we cannot know that a new attempt to institute an all-volunteer army would turn out the same way it did before. This answer choice provides new information that suggests that the two situations *are* analogous.

A volunteer army would be less expensive than an army that relies on the draft. Does this support the conclusion? No. In fact, it makes a case *for* a volunteer army. Eliminate it.

The size of the army needed today is smaller than that needed when a volunteer army was first tried. Like answer choice D, this answer contradicts the conclusion of the passage. If we need a smaller army today, maybe we would be able to find enough smart and honest volunteers to make a volunteer army work. Eliminate it.

3. WEAKEN-THE-ARGUMENT QUESTIONS

If a question asks you to weaken an argument, it implies that the argument can be weakened; in other words, once again, you're going to be dealing with unstated premises and a logical gap.

Like assumption questions and strengthen-the-argument questions, weaken-the-argument questions really ask you to find a hole in the argument. This time, however, you don't need to fix the hole. All you have to do is expose it. Here are some guidelines for finding weaken-the-argument statements among the answer choices:

The statement you'll look for should weaken the *conclusion* of the passage. Find the conclusion in the passage, then try out each answer choice to see whether it makes the conclusion less tenable.

Weaken-the-argument questions frequently trade on the gaps of logic that we've already discussed. If the argument proposes a cause for an effect, ask yourself whether there might be some other cause. If the argument uses statistics, ask yourself whether the statistics involved are representative. If the argument offers an analogy, ask yourself whether the two situations are analogous.

How to Recognize a Weaken-the-Argument Question

Weaken-the-argument questions are usually worded in one of the following ways:

Which of the following, if true, most seriously weakens the conclusion drawn in the passage?

Which of the following indicates a flaw in the reasoning above?

Which of the following, if true, would cast the most serious doubt on the argument above?

Now Let's Try the Passage

The recent turnaround of the LEX Corporation is a splendid example of how an astute chief executive officer can rechannel a company's assets toward profitability. With the new CEO at the helm, LEX has gone, in only three business quarters, from a 10 million dollar operating loss to a 22 million dollar operating gain.

A major flaw in the reasoning of the passage above is that

- the passage assumes that the new CEO was the only factor that affected the corporation's recent success*
 the recent success of the corporation may be only temporary
 the chief executive officer may be drawing a salary and bonus that will set a damaging precedent for this and other corporations
 the author does not define "profitability"
 rechanneling assets is only a short-term solution
Here's How to Crack It

You know from reading the question that you'll need to find a flaw in the reasoning of the argument. As you read the passage, look for the conclusion. The correct answer choice will weaken this conclusion. In this passage, the conclusion is in the first sentence: "The recent turnaround of the LEX Corporation is a splendid example of how an astute chief executive officer can rechannel a company's assets toward profitability."

Because this is a weaken-the-argument question that will almost certainly contain a gap in its reasoning, you should look to see whether the argument is causal, statistical, or analogical. In this case, the argument is causal. The passage implies that the sole cause of the LEX Corporation's turnaround is the new CEO. While this *may* be true, it is also possible that there are other causes. If you didn't spot the causal argument, don't worry. You would probably have seen it when you attacked the answer choices. Let's do that now:

- the passage assumes that the new CEO was the only factor that affected the corporation's recent success* This is the best answer. The new chief executive officer may not have been the cause of the turnaround—there may have been some other cause we don't know about.
- the recent success of the corporation may be only temporary* It may be hasty to crown LEX with laurels after only three economic quarters, but this statement doesn't point out a flaw in the *reasoning* of the passage. Eliminate it.
- the chief executive officer may be drawing a salary and bonus that will set a damaging precedent for this and other corporations* This answer choice may seem tempting because it's not in favor of the new CEO. But this alone doesn't represent a major flaw in the reasoning of the passage. Eliminate it.
- the author does not define "profitability"* An author can't define every word he uses. Profitability seems a common enough word, and a change in the balance sheet from minus 10 million to plus 22 million seems to qualify. Eliminate it.
- rechanneling assets is only a short-term solution* Like the second answer choice, this statement implies that all the votes aren't in yet. This does not affect the reasoning of the argument, however. Eliminate it.

Weaken-the-Argument Questions Come in Different Flavors

GMAT test writers use a variety of different wordings to ask the same question. One variation on the weaken-the-argument question might look like this:

A telephone poll conducted over two states asked respondents whether their homes were ever cold during the winter months. 99% of respondents said they were never cold during the winter months. The pollsters published their findings, concluding that 99% of all homes in the United States have adequate heating.

Which of the following most accurately describes what might be a questionable technique employed by the pollsters in drawing their conclusion?

- The poll wrongly ascribes the underlying causes of the problem.*
 The poll assumes conditions in the two states are representative of the entire country.
 The pollsters conducted the poll by telephone, thus relying on the veracity of the subjects they spoke to.
 The pollsters did not go to the houses in person, thus precluding the actual measurement of temperatures in the subjects' homes.
 The pollsters never defined the term "cold" in terms of a specific temperature.

Here's How to Crack It

Whether a question contains the words “weakens the argument,” or “undermines the conclusion,” or even “describes a questionable technique,” what it is really asking you to do is find a hole in the logic of the argument. And, as usual, there are three types of holes that the GMAT test writers are very fond of: statistical, causal, and analogical. Did you spot one of these as you read the passage? Whenever you see an actual statistic in an argument (in this case, 99 percent), you should examine it closely: The pollsters are basing a statistic for the entire country on a poll conducted in only two states. If you didn't spot this as you read the passage, don't worry; you'll spot it as you read the answer choices.

The poll wrongly ascribes the underlying causes of the problem. This answer choice says there might be an alternate cause for the conclusion—but does this feel like a causal argument? Let's hold onto this and keep reading.

The poll assumes conditions in the two states are representative of the entire country. Aha! This choice is saying there is a statistical flaw in the argument. What if the two states were located in the southern part of the United States? If the residents of Florida were warm in January, would that be representative of the rest of the country who might be freezing? This seems like it must be the best answer, but let's keep reading to make sure.

- The pollsters conducted the poll by telephone, thus relying on the veracity of the subjects they spoke to. While this might represent a weakness in their interviewing technique, the question to ask yourself is whether this is an inherent weakness in the way the pollsters *drew their conclusion*. It is not; eliminate it.
- The pollsters did not go to the houses in person, thus precluding the actual measurement of temperatures in the subjects' homes. Again, if the pollsters had measured the temperature in each of the houses they went to, their information would probably have been more accurate, but does this constitute a flaw in the way the conclusion was drawn? Nope. Cross this one off.
- The pollsters never defined the term "cold" in terms of a specific temperature. This choice is nitpicking. While it might have been better if the pollsters had asked the respondents what temperature they considered cold, this wouldn't really weaken the conclusion. The best answer is the second one.

4. INFERENCE QUESTIONS

Like inference questions in reading comprehension, critical reasoning inference questions do not really ask you to make an inference. In fact, you will often find that the answer to a critical reasoning inference question is so basic that you won't believe it could be correct the first time you read it. Inference questions often have little to do with the conclusion of the passage; instead they might ask you to make inferences about one or more of the premises.

How to Recognize an Inference Question

Inference questions are typically worded in one of the following ways:

Which of the following can be inferred from the information above?

Which of the following must be true on the basis of the statements above?

Which of the following conclusions is best supported by the passage?

Which of the following conclusions could most properly be drawn from the information above?

You'll note that the last two questions seem to ask about the conclusion—but, as you'll see, they in fact ask for an inference.

Let's try an example:

In film and videotape, it is possible to induce viewers to project their feelings onto characters on the screen. In one study, when a camera shot of a woman's face was preceded by a shot of a baby in a crib, the audience thought the woman's face was registering happiness. When the same shot of the woman's face was preceded by a shot of a lion running toward the camera, the audience thought the woman's face was registering fear. Television news teams must be careful to avoid such manipulation of their viewers.

Which of the following can be inferred from the passage?

- Television news teams have abused their position of trust in the past. The expression on the woman's face was, in actuality, blank. A camera shot of a baby in a crib provoked feelings of happiness in the audience. Audiences should strive to be less gullible. The technique for manipulating audiences described in the passage would work with film or videotape.

B-School Lingo

sharks: aggressive students who smell blood and move in for the kill

shark comment: comment designed to gore a fellow student in class discussion

slice and dice: running all kinds of quantitative analysis on a set of numbers

soft courses: touchy-feely courses such as human resources and organizational behavior

soft skills: conflict resolution, teamwork, negotiation, and oral and written communication

Source: *Best 294 Business Schools*

Here's How to Crack It

This is an inference question. The test writers are probably not interested in the conclusion of the passage. You'll look for a statement that seems so obvious that it almost doesn't need saying. Let's attack the answer choices:

- Television news teams have abused their position of trust in the past. If you chose this answer, you inferred too much. The passage doesn't say that news teams have ever abused their position of trust. Eliminate it.
- The expression on the woman's face was, in actuality, blank. The audience had no idea what the expression on the woman's face was, and neither do we. It would make sense for the woman's face to be blank, but we don't know whether this is so. This answer goes too far.
- A camera shot of a baby in a crib provoked feelings of happiness in the audience. This is the best answer. The passage says that the audience projects its own feelings onto characters on the screen. If the audience believes the woman's face reflects happiness, then that must have been its own reaction.
- Audiences should strive to be less gullible. This statement goes way beyond the intent of the passage. Eliminate it.
- The technique for manipulating audiences described in the passage would work with film or videotape. Again, this statement goes too far to be the correct answer to an inference question. Eliminate it.

Another Type of Inference Question

Inference questions come in one other form—and as you read them, you might think you are being asked to supply a conclusion rather than an inference. Almost invariably, the question asks you to find a “conclusion that is best supported by the passage above.” But, in fact, this is really nothing more than an inference question. And again, the key is not going too far.

Reading Comprehension Review

“Yin-Yang” Words:

Yin

generally...

the old view...

the widespread belief...

most scientists think...

on the one hand...

Yang
however, this time...
however, the new view...
but the in-crowd
believes...
but Doctor Spleegle thinks...
on the other hand...

Here's an example.

Fewer elected officials are supporting environmental legislation this year than at any time in the last decade. In a study of 30 elected officials, only five were actively campaigning for new environmental legislation. This comes at a time when the public's concern for the environment is growing by leaps and bounds.

Which of the following conclusions is best supported by the passage above?

- More elected officials are needed to support environmental legislation.*
 Elected officials have lost touch with the concerns of the public. *The five elected officials who actively campaigned for new environmental legislation should be congratulated.* *If the environment is to be saved, elected officials must support environmental legislation.* *If elected officials are truly to represent their constituents, many of them must increase their support of environmental legislation.*
- Here's How to Crack It**

Because you read the question first, you know that this is really just an inference question—and, as always with inference questions, the main thing is not to go too far. Be wary of answer choices that go further than the scope of the original argument. For example, if the passage has given you several noncontroversial facts about advertising, do not select an answer choice that says advertising is a waste of time.

Let's attack the answer choices:

- More elected officials are needed to support environmental legislation.
This statement ignores the last premise of the passage—that the public is becoming more and more concerned about the environment. Eliminate it.
- Elected officials have lost touch with the concerns of the public. This clearly goes beyond the scope of the argument and ignores parts of the first two premises that relate to the environment.
- The five elected officials who actively campaigned for new environmental legislation should be congratulated. This statement, while consistent with the

sentiments of the author, again does not deal with the last premise, relating to the concerns of the public.

If the environment is to be saved, elected officials must support environmental legislation. This answer choice again ignores the last premise in the passage and goes too far. Eliminate it.

If elected officials are truly to represent their constituents, many of them must increase their support of environmental legislation. Bingo. This answer is supported by all the premises, and it does not go beyond the scope of the argument.

FOUR DOWN—FOUR TO GO

As you begin working through the practice questions in this book or in *The Official Guide to GMAT Review*, you will quickly realize that most critical reasoning questions turn out to be one of the four major question types you have just learned: assumption, strengthen-the-argument, weaken-the-argument, or inference. The four remaining question types appear much less often. However, because of the somewhat random nature of the CAT, one of these less frequently asked questions could easily be the first one you see on the Verbal portion of the GMAT; therefore, it is just as important to be familiar with all eight.

5. RESOLVE/EXPLAIN QUESTIONS

Some GMAT questions ask you to resolve an apparent paradox or explain a possible discrepancy. In these questions, the passage will present you with two seemingly contradictory facts. Your job is to find the answer choice that allows both of the facts from the passage to be true.

How to Recognize a Resolve/Explain Question

Resolve/Explain questions are usually worded in one of the following ways:

Which of the following, if true, resolves the apparent contradiction presented in the passage above?

Which of the following, if true, best explains the discrepancy described above?

Which of the following, if true, forms a partial explanation for the paradox described above?

Here's an example:

In 1994, TipTop Airlines reported an increase in the total number of passengers it carried from the year before, but a *decrease* in total revenues—even though prices for its tickets on all routes remained unchanged during the two-year period.

Which of the following, if true, best reconciles the apparent paradox described above?

- TipTop Airlines was a victim of a mild recession in 1994.*
 - Total passenger miles were up in 1994.*
 - Fuel costs remained constant during the two-year period.*
 - Passengers traveled shorter (and thus less expensive) distances in 1994.*
 - TipTop did not buy any new airplanes or equipment in 1994.*
- Here's How to Crack It**

First, restate the contradiction in your own words.

“TipTop’s profits went down even though they flew more passengers.”

Now, let’s see which of the answer choices makes both of the facts in the argument true.

TipTop Airlines was a victim of a mild recession in 1994. If TipTop was affected by a recession, that might explain a loss of revenues. But because ticket prices remained the same, it would not explain how the number of passengers could have increased at the same time. Eliminate it.

Total passenger miles were up in 1994. If total passenger miles were up, and prices remained the same, there is no way that there could have been a loss of revenues. We can eliminate this choice as well.

Fuel costs remained constant during the two-year period. If fuel costs had *not* remained constant, the company’s profits might have fallen. An increase in fuel prices could have increased its costs and cut into profits. But it would not have cut into total *revenues*, which is what we are concerned with in this passage. Of course, because choice C told us that the costs remained constant, this choice has no bearing on the argument at all. Eliminate it.

Passengers traveled shorter (and thus less expensive) distances in 1994. Bingo! If passengers traveled on short, inexpensive flights, then they paid less money. In spite of the increase in number of passengers, the money they paid could have added up to less than that of the year before. This is the best answer, but always remember to read all the choices anyway.

TipTop did not buy any new airplanes or equipment in 1994. This answer is much like the third choice, which we call choice C. If TipTop *had* bought new planes, it

might have cut into its profits, but it would not have had any bearing on revenues. Of course, because this choice told us that TipTop did not buy any planes, there is no relevance at all. Eliminate it.

6. EVALUATE-THE-ARGUMENT QUESTIONS

A few GMAT critical reasoning questions will ask you to pick an answer choice that would help to “evaluate” or “assess” part of an argument. Like assumption questions, evaluate-the-argument questions revolve around understanding the unspoken gap in the logic of an argument.

How to Recognize an Evaluate-the-Argument Question

Evaluate-the-argument questions are generally worded in one of the following ways:

The answer to which of the following questions would be most useful in evaluating the significance of the author’s claims?

Which of the following pieces of information would be most useful in assessing the logic of the argument presented above?

Take a look at the following example:

Following a period of lingering malaise after a recent remarkable economic upturn in the solar-powered energy sector, Company X, a major maker of solar-powered generators, claimed that its rapid upturn resulted from the inventory still on hand in its warehouse.

Which of the following, if it could be carried out, would be most useful in evaluating the company’s hypothesis as to the causes of its rapid economic upturn?

- Comparing the length of the economic downturn experienced by Company X to the length of the upturn later experienced by Company X* *Comparing the rapidity of the economic upturn for Company X to that of other major makers of solar-powered generators, which did not have inventory on hand* *Calculating the average sales increases within the individual business units of Company X* *Comparing the total number of solar-powered generator sales by Company X just before the economic upturn to the total number of solar-powered generator sales by Company X just after the economic*

upturn ○ *Using economic theory to predict the most likely date of the next economic upturn for Company X* **Here's How to Crack It**

As always, you should begin by reading the question first—and the key word that should jump out at you in this question is “evaluate.” In this particular passage, the conclusion is in the second half of the argument: Company X claims that its economic upturn was particularly fast-moving because the company already had existing inventory on hand.

This is an evaluate-the-argument question and will almost certainly contain a gap in its reasoning. You should, as always, look to see whether the argument is causal, statistical, or analogical. Take a moment before you keep reading, and look at the passage again to see if you can spot which type of argument this is.

In this case, the argument was causal. Company X says the cause of its rapid turnaround was the inventory it had in its warehouses—which presumably let the company immediately take advantage of the new demand for its product. The company implies that the sole cause of the rapidity of its economic upturn was its inventory. While this may be true, it is also possible that there are other causes. If you didn’t spot the causal argument, don’t worry. You would probably have seen it when you attacked the answer choices. Let’s look at them now:

○ Comparing the length of the economic downturn experienced by Company X to the length of the upturn later experienced by Company X The length of the economic downturn that preceded the upturn seems like it would be outside the scope of this argument, and, in any case, would not have much to do with whether the speed of Company X’s upturn had anything to do with the inventory it had on hand once the upturn began. If you were thinking that the length of time would matter because the inventory might be out of date, you overthought the problem. Eliminate it.

○ Comparing the rapidity of the economic upturn for Company X to that of other major makers of solar-powered generators, which did not have inventory on hand If Company X’s competitors, which did not have inventory on hand, did just as well or better during the economic upturn, then Company X’s explanation for its speedy upturn might be incorrect. In other words, there might be some other cause. Would this comparison be useful in evaluating Company X’s argument? This seems like it would be very useful, but let’s hold onto it while we look at the other answer choices.

○ Calculating the average sales increases within the individual business units of Company X This answer choice might help us to understand in more detail the extent of the upturn at Company X, but it gives us no insights into the causes behind the rapidity of their economic upturn. Let this one go.

○ Comparing the total number of solar-powered generator sales by Company X just before the economic upturn to the total number of solar-powered generator sales by Company X just after the economic upturn Like the comparison in the previous answer choice, this comparison would no doubt detail exactly the extent of the rapid economic upturn for Company X, but not explain the cause of the rapid upturn. Eliminate

it.

Using economic theory to predict the most likely date of the next economic upturn for Company X A future economic upturn (presumably preceded by a downturn) is surely well beyond the scope of this question. We are concerned only with evaluating the reason that Company X believes is the cause of its speedy economic upturn. Eliminate it.

Given the fact that we've eliminated all the other possible answers, choice B looks even better.

7. IDENTIFY-THE-REASONING QUESTIONS

Occasionally, a critical reasoning question will ask you to identify a method, technique, or strategy used in the passage, or to identify the role of a bolded phrase in the passage. Either way, the best technique for answering this rare question type is to do what you would do to answer any of the other question types: identify the conclusion and the premise and think about how they are related.



To check out which b-schools have the “Best Professors,” take a look at your online student tools. If you haven’t registered yet, go to PrincetonReview.com/cracking

How to Recognize an Identify-the-Reasoning Question

Identify-the-reasoning questions are generally worded in one of the following ways:

The bolded phrase plays which of the following roles in the argument above?

The argument uses which of the following methods of reasoning?

Here's a typical example:

Although measuring the productivity of outside consultants is a complex endeavor, **Company K, which relies heavily on consultants for long-term projects, must find ways to assess the performance of these workers.** The risks to a company that does not review the productivity of its human resources are simply too great. **Last year, Company L was forced into receivership after its productivity declined for the third straight quarter.**

The bolded phrases play which of the following roles in the argument above?

- The first phrase states the author's conclusion, and the second phrase refutes that conclusion.*
 - The first phrase states an assumption of the argument, and the second phrase provides evidence to undermine that position.*
 - The first phrase states one of the author's premises, and the second phrase provides the argument's conclusion.*
 - The first phrase states a position, and the second phrase refutes that position.*
 - The first phrase states the conclusion, and the second phrase supports the conclusion with an analogy.*
- Here's How to Crack It**

As you read the question, the first things that should jump out at you are the words “bolded phrases,” which signal that this is an identify-the-reasoning question. And the first thing to do in an identify-the-reasoning question is to find the conclusion. Where is it? If you said “in the second half of the first sentence,” then you are doing just fine. Company K, according to the argument, should find a way to measure the productivity of its consultants. The second sentence merely reiterates the first, and the third sentence supports the conclusion with what appears to be an analogous situation.

As you look at the answer choices, look for an answer that correctly explains the purpose of the two bolded phrases. Now, let's look at the answer choices:

The first phrase states the author's conclusion, and the second phrase refutes that conclusion. The first bolded phrase is, in fact, the conclusion of the passage; so far, so good. But does the second phrase refute that conclusion? Not at all. In fact, it seems to be supporting it. Eliminate it.

The first phrase states an assumption of the argument, and the second phrase provides evidence to undermine that position. We've already determined that the first bolded phrase is the conclusion of the argument—but even if we weren't sure of that, we could rule out this answer choice because an assumption is never stated in the passage. Even if you missed that, you would probably be able to eliminate this answer choice because the second bolded phrase seems to be supporting the first phrase, not undermining it. Eliminate it.

- The first phrase states one of the author's premises, and the second phrase



provides the argument's conclusion.

To check out which b-schools have the "Greatest Opportunity for Women," take a look at your online student tools. If you haven't registered yet, go to PrincetonReview.com/cracking

A premise is evidence in support of a conclusion. The first bolded phrase (about Company K) seems less a piece of evidence than the conclusion itself. The second bolded phrase is about another company entirely and seems to be offered in support of the first sentence; in other words, it is not likely to be the conclusion of the argument. Eliminate it.

- The first phrase states a position, and the second phrase refutes that position. Like answer choices A and B, this says the second bolded phrase refutes the first. Because this is clearly not so, we can forget about this answer choice as well. Eliminate it.
- The first phrase states the conclusion, and the second phrase supports the conclusion with an analogy. Because we have eliminated all the other possibilities, you should feel hopeful that this is the best answer, but never skip the final step and assume that choice E must be right without reading it. Does the first bolded phrase state the conclusion of the argument? Yes, it does. Does the second phrase support the conclusion with an analogy? Yes, in fact it does. The argument compares Company K's situation to that of Company L. If this were a weaken-the-argument question, you would need to be asking yourself if these two companies were actually analogous. However, in this case, all we have to do is pick answer choice E and move on.

8. PARALLEL-THE-REASONING QUESTIONS

Parallel-the-reasoning questions ask you to recognize the reasoning in a passage and follow the same line of reasoning in one of the answer choices. The best way to understand the passage associated with a reasoning question is to simplify the terms. Here's an example: "If it rains, I will stay home today." We could simplify this by saying, "If A, then B."

How to Recognize a Parallel-the-Reasoning Question

Parallel-the-reasoning questions are usually worded in one of the following ways:

Which of the following most closely parallels the reasoning used in the argument above?

Which of the following supports its conclusion in the same manner as the argument above?

Which of the following is most like the argument above in its logical structure?

Here's an example:

World-class marathon runners do not run more than six miles per day when they are training. Therefore, if you run more than six miles per day, you are not world-class.

Which of the following statements supports its conclusion in the same manner as the argument above?

Sprinters always run in the morning. If it is morning, and you see someone running, it will not be a sprinter. *Paint never dries in less than three hours. If it dries in less than three hours, it is not paint.* *Little League games are more fun for the parents than for the children who actually play. Therefore, the parents should be made to play.* *If a car starts in the morning, chances are it will start again that evening. Our car always starts in the morning, and it always starts in the evening as well.* *If you sleep less than four hours per night, you may be doing yourself a disservice. Studies have shown that the most valuable sleep occurs in the fifth hour.* **Here's How to Crack It**

First, simplify the argument in the passage. World-class marathon runners do not run more than six miles per day when they are training. (If A, then B.) Therefore, if you run more than six miles per day, you are not world-class. (If not B, then not A.)

Now let's attack the answer choices:

Sprinters always run in the morning. If it is morning, and you see someone running, it will not be a sprinter. Just because this answer choice is also about running doesn't mean the reasoning will be the same. In fact, it is unlikely that the test writers would use the same subject matter for the correct answer. If we simplify this argument, we get: If A, then B. If B, then not A. Is this the same reasoning used in the passage? No. Eliminate it.

Paint never dries in less than three hours. If it dries in less than three hours, it is not paint. If we simplify this argument, we get: If A, then B. If not B, then not A. This is the best answer.

Little League games are more fun for the parents than for the children who actually play. Therefore, the parents should be made to play. Simplifying this argument, we get ... not much. The reasoning here is totally different. Also, note that the subject matter here is still about sports. Eliminate it.

If a car starts in the morning, chances are it will start again that evening. Our car always starts in the morning, and it always starts in the evening as well. If we simplify this argument, we get: If A, then B. If always A, then always B. That doesn't sound right. Eliminate it.

If you sleep less than four hours per night, you may be doing yourself a disservice. Studies have shown that the most valuable sleep occurs in the fifth hour. Simplifying this argument, we get ... again, not much. The reasoning in this answer choice is very different from the reasoning in the passage. Eliminate it.

Putting It All Together

Now that you know how to spot and how to approach each of the eight question types, the best way to proceed is to practice. As you do each critical reasoning question, force yourself to decide what type of question it is before you start reading the passage. Once identified, a critical reasoning question isn't a mystery anymore—it will adhere to the conventions you've learned, and you will have a much easier time choosing the best answer.

To get you started, here's a drill to see how you are doing at spotting the different critical reasoning question types.

DRILL 12 (Spotting Critical Reasoning Question Types)

The answers can be found in Part VI.

For each of the questions below, decide which question type it belongs to. For extra credit, list what you should look for in the passage that would normally precede the question.

1. Which of the following, if true, gives the most support to the recommendations above?

2. If the statements above are true, which of the following can properly be inferred on the basis of them?

3. The answer to which of the following questions would be most useful in evaluating the significance of the counter-claimant's charge?
4. The argument in the passage depends on which of the following assumptions?
5. Which of the following statements, if true, provides the best evidence that the CEO's reasoning is flawed?
6. Which of the following, if true, best reconciles the seeming discrepancy described above?
7. The bolded phrase plays which of the following roles in the argument?
8. Which of the following most closely parallels the reasoning used in the argument above?

Summary

Critical Reasoning is made up of short passages. Each of these passages is followed by one or two questions, for a total of roughly 11 questions.

The test writers have said that no formal logic is required to answer these questions, but in fact some knowledge of the rudiments of GMAT logic *will* increase your score.

There are three parts to an argument. Conclusion Premises Assumptions

Critical Reasoning is **not** like reading comprehension. You should never skim; each word is important. Most of the reading comprehension techniques we have shown you are inappropriate for critical reasoning.

Always read the question first because it will contain clues that will help you to find the answer as you read the passage. As you eliminate answer choices, cross them off in your scratch booklet.

In Critical Reasoning, the most important POE technique is eliminating answers that are outside the scope of the argument.

There are eight question types. Each type has its own strategy. **Assumption questions** Assumptions are unstated premises that support the conclusion. Look for a flaw in the argument that is fixed by the assumption. **Strengthen-the-argument questions** Look for an answer choice with information that supports the conclusion. **Weaken-the-argument questions** These questions ask you to find the answer choice that points out flaws in the reasoning of passages. **Inference questions** Like reading comprehension inference questions, these questions do not actually want you to infer. Unlike most critical reasoning questions, these questions typically concern the *premises*, not the conclusion. **Resolve/explain questions** This type of question asks you to pick an answer choice that explains an apparent contradiction between two incompatible facts. **Evaluate-the-argument questions** This type of question asks you to pick an answer choice that would help to evaluate an unspoken assumption about the argument.

Identify-the-reasoning questions This type of question asks you to pick an answer choice that identifies the purpose of a word or phrase or the type of reasoning used in an argument. **Parallel-the-reasoning questions** This type of question asks you to find an argument in one of the answer choices that mimics the method of reasoning used in the original argument. Most of these questions can be answered by simplifying (if A, then B).

In assumption questions, weaken-the-argument questions, and strengthen-the-argument questions, there are three types of assumptions for which you should be on the lookout. These are (in order of frequency): Causal assumptions—Ask yourself whether there might be an alternate cause. Assumptions of analogy—Ask yourself whether the two situations are analogous. Statistical assumptions—Ask yourself whether the statistics are representative.

Part IV

How to Crack the Integrated Reasoning GMAT

18 Integrated Reasoning: Basics

19 Integrated Reasoning: Strategies

20 Integrated Reasoning: Drills

Chapter 18

Integrated Reasoning: Basics

In June 2012 the Next Generation GMAT will be rolled out and we want you to be prepared. Here's an overview of the new Integrated Reasoning, followed by a chapter with some specific strategies, and then some practice. Get ready for the New GMAT.

For 2012, the GMAT gains a new section called the Integrated Reasoning section. If you are taking your GMAT on or after June 5, 2012, you'll need to prepare for the Integrated Reasoning section because it will be part of your test! We've prepared some resources to help you get ready. This chapter reviews the basics of the new section, including a run down on all four new question types. We've also included a chapter that

explains some strategies that will help you handle these new questions. Finally, this book includes two complete Integrated Reasoning sections with explanations so that you can practice.

There's one caveat, however, before we get started. At the time this chapter was written, GMAC had released many—but not all—of the details about the new section. So, you'll also want to check out our website www.PrincetonReview.com for the most up to date information about the new Integrated Reasoning section. As we learn more, we'll post what we find out to help you better prepare.

No More Issue Essay

GMAC has not only decided that there will only be one essay on the GMAT, they've also decided that there will only be one type of essay. The Argument essay stays and the Issue essay is history when the new test launches.

MEET THE INTEGRATED REASONING SECTION

The Integrated Reasoning section is 30 minutes long and takes the place of one of the GMAT essays. You'll see it as the second section of your test. Officially, there are only 12 questions, which sounds pretty great. However, most of those questions have multiple parts. So, for example, a Table Analysis question—one of the new question types we'll discuss—usually has four statements that you need to evaluate. So, your answer to the question really consists of four separate responses. For the entire section, you'll actually need to select approximately 30 different responses.

Integrated Reasoning Is Not Adaptive

Unlike the Quantitative and Verbal sections, the Integrated Reasoning section is not adaptive. So, you won't see harder questions if you keep answering questions correctly. That's good news because it means that you'll more easily be able to focus your attention on the current question rather than worrying whether you got the previous question right!

Test writers refer to non-adaptive sections as linear. Pacing for a linear section is

different from the pacing that we reviewed for the adaptive Quantitative and Verbal sections. As of this writing, GMAC has not released any information about how the Integrated Reasoning section is scored. As soon as we know that, we'll have specific pacing advice posted on our website. So, be sure to check out www.princetonreview.com and the online tools that come with this book.

Even without knowing the specifics of how the Integrated Reasoning section is scored, we can still offer two general pacing guidelines.

Pacing Guidelines

Work the easier questions first. As you'll see, many Integrated Reasoning questions call for more than one response per question. Work the easier questions first.

Don't get stubborn. With so many questions to answer in only 30 minutes, the Integrated Reasoning section can seem very fast paced. Spending too much time on one question means that you may not get to see all of the questions. Sometimes it's best to guess and move on.

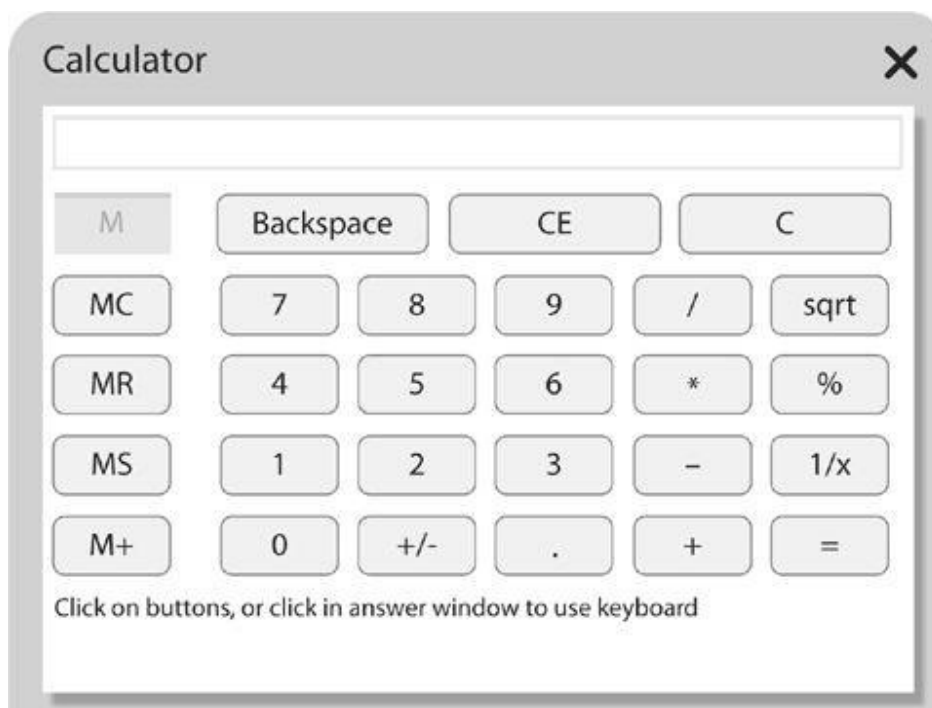
There's a Calculator

There's an onscreen calculator available for the Integrated Reasoning section. The calculator is not available, however, for the Quantitative section. For the Quantitative section, you still need to perform any necessary calculations by hand.

The calculator for the Integrated Reasoning section is relatively basic. There are buttons to perform the four standard operations: addition, subtraction, multiplication, and division. In addition, buttons to take a square root, find a percent, and take a reciprocal round out the available functions. There are also buttons to store and recall a value in the calculator's memory.

To use the calculator, you'll need to open it by clicking on the 'calculator' button in the upper left corner of your screen. The calculator will generally open in the middle of your screen but you can move it around so that you can see the text of the problem or the numbers on any charts or graphs that are part of the question. The calculator is available for all Integrated Reasoning questions. You can enter a number into the calculator either by clicking on the onscreen number buttons or by typing the number using the keyboard.

Here's what the calculator looks like:



For the most part, the keys on the onscreen calculator work like you might expect. However, a few keys may not work as expected. Oddly enough, that's particularly true if you are used to using a more sophisticated calculator. So, here are few tips about using some of the calculator keys:



MC is the memory clear key. Use this key to wipe out any values that you have stored in the calculator's memory.



MR is the memory recall key. Use this key to return any value that you have stored in the memory to the calculation area. For example, if you want to divide the number currently on your screen by the number in the memory, you would enter the key sequence / MR =.



MS is the memory store key. Use this key to store the number currently on the screen in the calculator's memory.



M+ is the memory addition key. Use this key to add the current onscreen number to the number in the calculator's memory. For example, if 2 is stored in the calculator's memory and 3 is on screen, then clicking M+ will result in 5 being stored in the calculator's memory.

Backspace

Backspace is used to clear the last digit entered. Use this key to correct mistakes when entering numbers without clearing the entire number. For example, if you entered 23 but meant to enter 25, click backspace then enter 5.

CE

CE is the clear entry button. Use this button to correct a mistake when entering a longer calculation without starting over. For example, suppose you entered $2*3+5$ but you meant to enter $2*3+9$. If you click on CE right after you enter 5, your screen will show 6, the result of $2*3$, and you can now enter $+9=$ to finish your intended calculation.

C

C is the clear key. Use this key when you want to start a calculation over. In our previous example, if you click C after you enter 5, the intermediate result, 6, is not retained.

sqrt

sqrt is the square root key. Click this key after you enter the number for which you want to take the square root. For example, if you enter 4 sqrt, the result 2 will display on your screen.

%

% is the key used to take a percentage without entering a decimal. For example, if you want to take 20% of 400, enter $400*20\%$. The result 80 will now show on your screen. Note that you do not need to enter = after you click %.

1/x

1/x is used to take a reciprocal. Click this key after you enter the number for which you want to take the reciprocal. For example, the keystrokes 2 followed by 1/x produces the result 0.5 on your screen. Again, note that you do not need to enter = after you click 1/x.

Calculator Practice Tip

When you practice for the Integrated Reasoning section, use a calculator similar to the calculator provided by GMAC. If you are doing online practice, use the onscreen calculator.

If you are working problems from this book,

use a basic calculator
rather than that fancy calculator
that you might still
have from your high school
or college math classes.

Be sure that you thoroughly understand the way the keys for the onscreen calculator work so as to avoid errors and wasted time when you take your GMAT.

THE QUESTION TYPES

There are four question types in the Integrated Reasoning section. These question types are mostly used to test the same type of content that is tested in the Quantitative section. So, expect to calculate percents and averages. You'll also be asked to make a lot of inferences based on the data presented in the various charts, graphs, and tables that accompany the questions. So, the format of these questions may take some getting used to but the content will probably seem familiar.

Let's take a more detailed look at each of the new question types.

Table Analysis

Table Analysis questions present data in a table. If you've ever seen a spreadsheet—and really, who hasn't?—you'll feel right at home. Most tables will have 5 to 10 columns and anywhere from 6 to 25 rows. You'll be able to sort the data in the table by each column heading. The sort function is fairly basic, however. If you're used to how you can sort first by a column such as state and then a column such as city to produce an alphabetical list of cities by state, you can't do that sort of sorting for these questions. You can only sort by one column at a time.

Here's what a table analysis question looks like:

Sort By Select... 1

National Park		Visitors			Area	
Name	State	Number	% change	Rank	Acres	Rank
Grand Canyon	AZ	4,388,386	0.9	2	1,217,403	11
Yosemite	CA	3,901,408	4.4	3	791,266	16
Yellowstone	WY	3,640,185	10.5	4	2,219,791	8
Rocky Mtn.	CO	2,955,821	-4.7	5	265,828	26
Zion	UT	2,665,972	-2.5	8	145,598	35
Acadia	ME	2,504,208	12.4	9	47,390	47
Bryce	UT	1,285,492	5.7	15	35,835	50
Arches	UT	1,014,405	1.8	19	76,519	42
Badlands	SD	977,778	4.7	22	242,756	28
Mesa Verde	CO	559,712	1.7	30	52,122	46
Canyonlands	UT	435,908	-0.1	36	337,598	23

Each column of the table can be 2 sorted in ascending order by clicking on the word "Select" above the table and choosing, from the drop-down menu, the heading of the column on which you want the table to be sorted.

Consider each of the following 3 statements about these National Parks. For each statement indicate whether the statement is true or false based on the information provided in the table.

True False 5

- The park that experienced the greatest percent increase in visitors from 2009 to 2010 also had the least total acreage.
- The park with the median rank by the number of visitors is larger than only one other park by acreage.
- Exactly 20% of the parks with ranks less than 40 by acreage and showing positive growth in visitors were in Utah (UT).
- The total number of visitor at Arches in 2009 was less than 1,000,000.

The table above gives information for 2010 on total visitors and total acreage for 11 US National Parks. In addition to the numbers of total visitors and total acreage for each National Park, the table also provides the percent increase or decrease over the total visitors for 2009 and the rank of the National Park for total visitors and total acreage in 2010. 4

Click [here](#) to view a larger image of the above table.

Answers for this Question

We'll discuss how you can solve this Table Analysis question—including which strategies you can apply—in our second chapter devoted to the Integrated Reasoning section.

One thing you won't see on your screen when you take the Integrated Reasoning section are the circled numbers. We've added those so we can talk about different parts of a Table Analysis question. Here's what each circled number represents:

1

This is the Sort By drop-down box. When opened, you'll see all the different ways that you can sort the data in the table. For this table, for example, the possibilities are National Park Name, National Park State, Visitors Number, Visitors % change, Visitors Rank, Area Acreage, and Area Rank. You can always sort by every column.

2

These are the standard directions for a Table Analysis question. These directions are the same for every Table Analysis question. So, once you've read these directions once, you don't really need to bother reading them again.

3

These lines are additional directions. These directions are slightly tailored to the question. However, they'll always tell you to base your answers on the information in the table. These directions will also always tell you which type of choice you are making for each statement: true / false, yes / no, agree / disagree, etc. Again, you can probably get by without reading these most of the time.

4

These lines explain the table. Mostly, this information will recap the column headings from the table. Occasionally, you can learn some additional information by reading this explanatory text. For example, the explanatory text for this table states that the Visitors Number column is for 2010 and that % change column shows the change from 2009 to 2010.

5

These statements are the questions. Typically, there are four statements and you need to evaluate and select an answer for each. If you try to move to the next question without selecting a response for one or more statements, a pop up window will open informing you that you have not selected an answer for all statements. You cannot leave any part of the question blank.

If you read through the statements, you may have noticed that the questions asked you to do things such as calculate a percentage or find a median. That's typical for Table Analysis questions. You've probably also realized just how helpful the sorting function can be in answering some questions.

Read What You Need When You Need It

You may not need to read

the explanatory information about the table (number 4) to evaluate the statements. You should study the column headings first. If you understand those, go straight to the statements. You can always go back and read the explanatory information if you need to.

Graphics Interpretation

Now, let's take a look at the Graphics Interpretation question. For this question type, you are given one chart, graph, or image and asked to answer three questions based on that information. The questions are statements that include one drop-down box. You select your answer from the drop-down box to complete the statement.

Here's an example of a Graphics Interpretation question:

1

Year	Company A	Company B	Company C
2008	500	600	550
2009	550	500	650
2010	600	400	450

2

The graph at the left is a bar chart showing the total number of employees for each of three small companies on December 31st for each of the three years shown. The legend shows which color represents which company. Use the drop-down menus to fill in the blanks in each of the following statements based on the information given by the graph.

3

had greatest change in the number of employees for one year.

Company A's average number of employees for the 3 years is that of Company C.

Company B's percent decrease in the number of employees from 2009 to 2010 is .

Click [here](#) to view a larger image of the above table.

Want to See What's in the Drop-Downs?

We'll be discussing how to answer this question in the strategy chapter. We'll expand the drop-down boxes there!

As with the Table Analysis questions, we've added the circled numbers so we can point out the different things that you'll see on your screen for a Graphics Interpretation question. Here's what each circled number represents:

1

The chart, graph, or image is always in the upper left of the screen. As shown here, the chart will take up a good deal of the screen. It will certainly be large enough that you can clearly extract information from it. You can expect to see a variety of different

types of charts or graphs including scatter plots, bar charts, line graphs, and circle (or pie) charts. For the most part, you'll see fairly standard types of graphs, however. Be sure to check out any labels on the axes as well as any sort of included legend.

2

These lines are an explanation of the graph or chart. Mostly, you'll be told what the chart represents as well as what individual lines, bars, or sectors may represent. Sometimes, you'll be given some additional information such as when measurements were made. For example, here you are told that the bars show the numbers of employees for each firm on December 31st of the year in question. This information is typically extraneous to answering the questions. The explanatory information always ends with the same line about selecting your answers from the drop-down menu.

3

These are the questions. Graphics Interpretation questions typically include three statements. Each statement is typically a single sentence with one drop-down menu. Each drop-down menu typically includes three to five answer choices. Choose that answer choice that makes the statement true.

Graphics Analysis questions mostly ask you to find relationships and trends for the data. You can also be asked to calculate percentage increases or decreases, averages, and medians.

Two-Part Analysis

Next up is the Two-Part Analysis question. In many ways, the two part analysis question is most similar to a standard math question. You'll typically be presented with a word problem that essentially has two variables in it. You'll need to pick an answer for each variable that makes some condition in the problem true.

Here's an example of a Two-Part Analysis question:

Two families buy new refrigerators using installment plans. Family A makes an initial payment of \$750. Family B makes an initial payment of \$1200. Both families make five additional payments to pay off the balance. Both families pay the same amount for their refrigerators including all taxes, fees and finance charges. **1**

In the table below, identify a monthly payment, in dollars, for Family A and a monthly payment, in dollars, for Family B that are consistent with the installment plan described above. Make only one selection in each column. **2**

Family A	Family B	Monthly payment (in dollars)
<input type="radio"/>	<input type="radio"/>	50
<input type="radio"/>	<input type="radio"/>	80
<input type="radio"/>	<input type="radio"/>	120 3
<input type="radio"/>	<input type="radio"/>	160
<input type="radio"/>	<input type="radio"/>	250
<input type="radio"/>	<input type="radio"/>	300

Click [here](#) to view a larger image of the above table.

What's the Answer?

Be sure to read our second chapter on the Integrated Reasoning section to find out!

As you might have surmised, we have once again added the circled numbers so we can describe the different parts of the question. Here's what each circled number represents:

1

This first block of text is the actual problem. Here, you'll find the description of the two variables in the problem. You'll also find the condition that needs to be made true. As with any word problem, make sure that you read the information carefully. For these problems, you'll also want to make sure that you are clear about which information goes with the first variable and which information goes with the second.

2

This part of the problem tells you how to pick your answers. Mostly this part will

tell you to pick a value for column A and a value for column B based on the conditions of the problem. This part is mostly boilerplate text that is slightly varied from problem to problem.

3

These are the answer choices. Two Part Analysis questions generally have six answer choices. You choose only one answer choice for each column. It is possible that the same number is the answer for both columns. So, if that's what your calculations indicate, go ahead and choose the same number for both columns.

Most Two-Part Analysis questions can be solved using math that is no more sophisticated than simple arithmetic. There is one exception to that, however. While most Two-Part Analysis questions are math problems, you may see one that looks like a Critical Reasoning question. For these, you'll be give an argument and you'll need to do something like pick one answer that strengthens and one answer that weakens the argument.

Multi-Source Reasoning

Finally, we come to the Multi-Source Reasoning question. Multi-Source Reasoning questions present information on tabs. The information can be text, charts, graphs, or a combination. In other words, GMAC can put almost anything on the tabs! The layout looks a little bit like Reading Comprehension because the tabbed information is on the left side of your screen while the right side shows the questions.

Here's an example of a Multi-Source Reasoning question:

Text #1
Graph #1
Graph #2

1

The graph below shows the CO₂ emissions per capita for five selected countries from 1980 to 2005.

CO₂ Emissions Per Capita for 5 Countries

Year	United States	Canada	Norway	China	India
1980	21	17.5	8.5	1.5	0.5
1985	19	15.5	8.5	2	0.5
1990	19.5	16.5	7.5	2.5	0.5
1995	19.5	15.5	7.5	3	0.5
2000	20.5	17.5	8.5	3	0.5
2005	19.5	17.5	10	4.5	0.5

2

Consider each of the following statements. Does the information in the graphs and text support the inference as stated? **3**

Yes No **4**

- Yes No 40% of the countries showed an increase in per capita CO₂ emissions for each 5 year period.
- Yes No The United States emitted more CO₂ in 2005 than did China.
- Yes No CO₂ emissions per capita in India increased between 2005 and 2010.
- Yes No China's CO₂ emissions per capita increased at a greater rate than did those of India between 2000 and 2005.

Click [here](#) to view a larger image of the above table.

What's on those Other Tabs?

We'll show you the other tabs and the answers to these questions in our other chapter on the Integrated Reasoning section.

Like we've done for the other three new question types, we've added circled numbers to indicate the different parts of the question. Here's what each circled number represents:

1

The tabs appear across the top left of the screen. Some questions have two tabs and some, as in this example, have three. The tabs typically give you some sort of indication about what's on the tab. The currently selected tab is white while the unselected tabs are grey. GMAC can put almost anything on each tab including graphs, tables, charts, text, or some combination. It's a good idea to take a few seconds and get your bearings before attempting the questions. Make sure you know what is on each tab and how the information on one tab relates to information on the other tab or tabs.

2

The information for each tab appears on the left of the screen. In this case, the information is a graph. When you see a chart or graph, be sure to check out the axes. You'll also want to look for a legend or other information to help explain the information shown by the graph or chart. For tables, check out the column headings so as to better understand the table. Finally, don't neglect to read any supplied headings for the chart, graph, or table. Sometimes, that's all you need for the chart to make sense.

3

These are the basic instructions for how to respond to the statements. These instructions help to explain how you need to evaluate each statement. Here, for example, you need to determine whether the statements are valid inferences. In other cases, you may be asked to evaluate the statements for a different choice such as true or false.

4

These are the actual questions. You need to pick a response for each statement. If you fail to respond to one or more statements, you won't be able to advance to the next question in the section. In other words, these statements work just like the statements for the Table Analysis question type.



Practice Makes Perfect

Practice some Integrated Reasoning questions with your Online Companion Tools. Just register your book at www.PrincetonReview.com/cracking.

Multi-Source Reasoning questions usually come in sets. Each set typically consists of three separate questions. Two of those questions are typically in the statement

style as shown in the example above. It's also possible to get a standard multiple choice question as part of the set. For a standard multiple choice question, there are five answer choices and you select one response.

You may need information from more than one tab to respond to a statement or multiple choice question. Don't forget to think about the information on the other tabs while evaluating the statements. That's why it's important to take a few moments and get familiar with what's on each tab before starting work on the questions.

Strategies and More Questions

Now, that you understand the basics of the new question types, it's time to start thinking about the best ways to solve these questions. You can find strategies and more practice questions in chapters 19 and 20.

Summary

The Integrated Reasoning section is 30 minutes long and contains 12 questions, each with multiple parts. This section is not adaptive and you may use an onscreen calculator.

Work the easier questions first, then tackle the tougher ones. Sometimes your best bet is simply to guess and move along.

There are four new question types. Be sure that you familiarize yourself with these: Table Analysis Graphics Interpretation Two-Part Analysis Multi-Source Reasoning

Check out these new question types on www.mba.com and practice with your online companion tools, found at www.PrincetonReview.com/cracking.

Chapter 19 Integrated Reasoning: Strategies

GMAC has devised four new question types for the Integrated Reasoning section. As with any section on a standardized test, doing well requires a blend of content knowledge and strategy. Test takers who approach the Integrated Reasoning section with a firm grasp of strategy will do better than those who haven't thought about strategies for the section.

We'll be looking at two types of strategies in this chapter. Some strategies apply to most or all of the question types that you'll see. Other strategies will apply to specific questions types. We'll start by reviewing strategies and pointers for the section and then move on to examine some methods for the individual question types.

GENERAL STRATEGIES

Some strategies apply to the entire section and you'll use these methods on almost every question. The more consistently you apply these pointers, the better you'll do and the more efficiently you'll use your time.

Get Your Bearings

Before you can use a chart, graph, or table to answer questions, you need to understand the information on it. So, before you evaluate any statements or answer any questions, take a few moments to review the charts, graphs, and tables.

For charts and graphs, make sure you look at the axes. You'll want to take note of what each axis measures and the units used to make the measurements. You'll also want to read any headings or titles because those can provide valuable insight into the purpose of the graph. There may be a legend. If there is, take a moment to identify the different items that the chart or graph compares. For tables, make sure that you look at each column heading. This sort of review is essential before you start working on evaluating the statements or answering the questions that go with Table Analysis and Graphics Interpretation questions.

For Multi-Source Reasoning questions, you need to review the information that is on each tab. It's also a good idea to look for connections between the charts on one tab and those on the others. One way that you can do so is to think about what quantities you'd be able to calculate if you used the information from two charts. For example, if one chart shows the number of cars per day that several factories produce and another chart shows the number of days those factories were active in a year, you know that you could calculate the total number of cars each factory produced that year.

What Do the Questions Look Like?

If you aren't sure what the Integrated Reasoning questions look like, you should read [Chapter 18](#),

Integrated Reasoning:
Basics. We introduce the
four new question types
there.

Read What You Need When You Need

Both Table Analysis and Graphics Interpretation questions include a blurb of text that explains the table or chart. While GMAC includes this information to help you to understand the table or chart, you may not need to take the time to read it.

Most of the charts and tables are understandable without the explanatory text. So, if your review of the chart or table doesn't turn up any unusual quantities or units that need further explanation, you're most likely ready to get to work on the actual questions. You can also be guided by the questions. If something about the question or statement isn't making sense, then you can always go back and read the explanatory information at that time.

Valid Inferences

Both Table Analysis and Multi-Source Reasoning items include statement style questions. (Reread [Chapter 18](#) to see examples of statement style questions.) In some cases, you'll be asked to decide whether the statement is true or false. But, in other cases, you'll be asked whether the information supplied supports the inference as stated and asked to respond yes or no. That's a little different from asking whether the statement is true or false. After all, there's the possibility that there is insufficient information to conclude whether the statement is true or false. If that's the case, you need to pick "no" as your answer.

It's also important to remember that a valid inference is something that you know to be true. The way you know something is true is that you have evidence you can point to. GMAC knows, however, that most people think "interpret" or "read into" when they hear the word "infer." So, some statements provided on Table Analysis and Multi-Source Reasoning questions attempt to read into the information on the chart or table to come up with a conclusion. For example, there may be a clear trend on a chart showing that a company has increased its sales for every year between 2000 and 2008. The statement may try to get you to conclude that the company also increased its sales in 2009 even though 2009 is not shown on the chart. That's not a valid inference! Be careful that you don't mix up "true" and "very likely" when evaluating what can be inferred from the data.

What's an Inference?

An inference is a statement that you can prove true using supplied facts or other evidence.

TABLE ANALYSIS

Table Analysis questions always include one table to display data. You'll be asked to evaluate four statements. You may be asked whether the statements are true or false based on the data in the table. You may also be asked whether the statements represent valid inferences based on the table.

While you won't be called upon to provide numerical answers as part of Table Analysis question, you may need to perform some calculations to evaluate the statements. For example, you may be asked to verify that a certain percentage of the items in the table have a certain characteristic.

The Sort Function

As mentioned in our chapter covering the basics of the Integrated Reasoning section, the sort function allows you to sort the data in the table by any column. However, the sort function will only sort by one column at a time. So, forget all those fancy multiple column sorts that you can do with Excel.

To see how the sort function works for Table Analysis questions, let's look at a very simple table. This table is really too simple for a GMAT question but it will help us to illustrate how the sort function works.

When you first see the table, it is typically sorted by one key statistic from the table. All numerical sorts are always smallest to largest. This table, for example, is sorted by Median Income (2009) and represents the original sort for this table.

City	State	Median Income (2009)
Rochester	NY	\$30,553
Philadelphia	PA	\$37,045
Salt Lake City	UT	\$45,754
New York	NY	\$50,033

Now, here's what you'll see if you sort by state.

City	State	Median Income (2009)
Rochester	NY	\$30,553
New York	NY	\$50,033
Philadelphia	PA	\$37,045
Salt Lake City	UT	\$45,754

If you sort next by City, you might expect that Rochester and New York would exchange positions. That's particularly true if you are used to the way that Excel lets you sort by multiple columns.

However, what you'll really get is an alphabetical listing by City. Here's what the sort by City looks like.

City	State	Median Income (2009)
New York	NY	\$50,033
Philadelphia	PA	\$37,045
Rochester	NY	\$30,553
Salt Lake City	UT	\$45,754

Question Order

In general, you should just evaluate the statements in order for Table Analysis questions. Of course, if you get stuck on one statement, skip over it, evaluate the other statements and come back to the one that gave you trouble.

To Sort or Not To Sort

While the sort feature can be a huge help when answering some questions, you may not need to use it to answer every question. In some cases, you may only need to find one piece of information on the table. In other cases, the table may not have that many rows. Table Analysis questions can have as few as six rows of data. It may be

faster to simply scan the table for the information that you need.

On the other hand, remember that sorting the table only takes a few seconds. If you think sorting will help, do it! One thing you shouldn't do, however, is spend time trying to organize the statements so that you do as little sorting as possible. You're actually likely to waste more time trying to come up with the perfect order in which to evaluate the statements than you would if you wind up sorting the same way twice in evaluating the statements.

Let's look at a sample Table Analysis question. Here's the question that we discussed in Chapter 18.

Sort By

Select...
▼

National Park		Visitors			Area	
Name	State	Number	% change	Rank	Acres	Rank
Grand Canyon	AZ	4,388,386	0.9	2	1,217,403	11
Yosemite	CA	3,901,408	4.4	3	791,266	16
Yellowstone	WY	3,640,185	10.5	4	2,219,791	8
Rocky Mtn.	CO	2,955,821	4.7	5	265,828	26
Zion	UT	2,665,972	-2.5	8	145,598	35
Acadia	ME	2,504,208	12.4	9	47,390	47
Bryce	UT	1,285,492	5.7	15	35,835	50
Arches	UT	1,014,405	1.8	19	76,519	42
Badlands	SD	977,778	4.7	22	242,756	28
Mesa Verde	CO	559,712	1.7	30	52,122	46
Canyonlands	UT	435,908	-0.1	36	337,598	23

The table above gives information for 2010 on total visitors and total acreage for 11 US National Parks. In addition to the numbers of total visitors and total acreage for each National Park, the table also provides the percent increase or decrease over the total visitors for 2009 and the rank of the National Park for total visitors and total acreage in 2010.

Each column of the table can be sorted in ascending order by clicking on the word "Select" above the table and choosing, from the drop-down menu, the heading of the column on which you want the table to be sorted.

Consider each of the following statements about these National Parks. For each statement indicate whether the statement is true or false, based on the information provided in the table.

True False

- The park that experienced the greatest percent increase in visitors from 2009 to 2010 also had the least total acreage.
- The park with the median rank by the number of visitors is larger than only one other park by acreage.
- Exactly 20% of the parks with ranks less than 40 by acreage and showing positive growth in visitors were in Utah (UT).
- The total number of visitors at Arches in 2009 was less than 1,000,000.

Get Your Bearings

Step one for any Table Analysis question is to review the information presented by the table.

Here's How To Crack It:

As with any Table Analysis question, the first step is to make sure that you take a moment to understand the information presented by the table. While it might be tempting to jump straight to the statements, you'll be able to evaluate the statements more efficiently when you first take a moment to understand the information on the table. Looking at the column headings can also help you to decide whether you need to read the explanatory information under the table.

The first two columns of this table—National Park Name and National Park State—are self-explanatory. More importantly, however, the first column—National Park Name—tells you that this table provides information about national parks. Next, you get information about visitors to the national parks included in the table. The third column heading—Visitors Number—is pretty clear. However, you don't know the time period for the visitation numbers. The next column—Visitors % Change—shows increases or decreases from some previous time period. Again, you don't know the time period just by looking at the table. Do the time periods matter? Probably not. You'll probably learn the time period from the statements. If the statements seem to indicate that the time periods matter, you can read the explanatory text at that time.

The next column—Visitors Rank—is potentially more confusing, however. Does the rank refer to the number of visitors or the percent change? That's an important distinction for understanding the information in the table. There are two ways to figure out what's being ranked. You could scan the table looking for evidence. Of course, that could be time consuming. Or, you could scan the explanatory text beneath the table. *If you don't understand one of the column headings shown in the table, that's when you want to read the explanatory text.* The explanation indicates that the rank refers to the total number of visitors. As a bonus, you now also know that the visitation numbers are for 2010.

Step 2

Decide the best way to sort the table. For some statements, you may be able to sort in more than one way. Sort by the column with the larger

numbers or more complex data.

The last two column headings—Area Acres and Area Rank—are also pretty clear. Note that the inclusion of Area Rank means that you won't need to deal with the larger number in the Area Acres column if all you need to do is compare the size of one park to another. The same is also true of the inclusion of the Visitors Rank column. The inclusion of these columns makes it much easier to make some types of comparisons about the parks in the table. That's definitely something to make note of as you finish reviewing the information presented by the chart.

We'll just evaluate the statements in order. First, we'll evaluate:

The park that experienced the greatest percent increase in visitors from 2009 to 2010 also had the least total acreage.

This statement is typical of the sorts of statements that you are called upon to evaluate for Table Analysis questions. Note that there are two possible sorts that you could perform to evaluate this question. First, you could sort by Visitors % Change. But, you could also sort by Area Acres. So, what's the best? Sort by only one of those columns? Sort by both? Sort by neither?

With 11 rows of data, you'll probably find it safer to sort by at least one of the columns. But, which one? Well, note that the table provides you with ranking information for the areas of the parks. The smaller numbers used to rank the parks by area make it easier to identify the smallest park by area without sorting.

However, you might reasonably be worried about missing which park had the greatest percent increase by visitors. So, sort by Visitors % Change. Here's what the sorted table looks like:

National Park		Visitors			Area	
Name	State	Number	% Change	Rank	Acres	Rank
Zion	UT	2,556,972	-2.5	8	145,598	35
Canyonlands	UT	435,908	-0.1	36	337,598	23
Grand Canyon	AZ	4,388,386	0.9	2	1,217,403	11
Mesa Verde	CO	559,712	1.7	30	52,122	46
Arches	UT	1,014,405	1.8	19	76,519	42
Yosemite	CA	3,901,408	4.4	3	791,266	16
Rocky Mtn.	CO	2,955,821	4.7	5	265,828	26
Badlands	SD	977,778	4.7	22	242,756	28
Bryce	UT	1,285,492	5.7	15	35,835	50
Yellowstone	WY	3,640,185	10.5	4	2,219,791	8
Acadia	ME	2,504,208	12.4	9	47,390	47

Now, it's clear that Acadia had the greatest percent increase in the number of visitors from 2009 to 2010. Acadia was ranked 47th in terms of overall acreage. You could sort the chart by Area Acres or by Area Rank at this point to finish evaluating the statement. However, since you know Acadia's rank for acreage, it's probably slightly faster to simply scan to see if any park had a higher rank for area. In this case, Bryce was ranked 50th, so this first statement is false.

Now, let's take a look at the second statement, which states:

The park with the median rank by the number of visitors is larger than only one other park by acreage.

Again, you may be considering several different ways to sort the chart. So, start by asking yourself "What's hardest to see right now?" Remember that your chart will still be sorted as shown above, which is the sort that you did to evaluate the first statement. This sort makes it pretty hard to see which park had the median rank for visitors, so it makes sense to sort by Visitors Rank.

Medians, Modes, Percents

Medians, modes, and percents are all frequently used in Integrated Reasoning questions. If you need a review, be sure to read through [Chapters 10](#) and [12](#).

Here's what the sorted chart looks like:

National Park		Visitors			Area	
Name	State	Number	% Change	Rank	Acres	Rank
Grand Canyon	AZ	4,388,386	0.9	2	1,217,403	11
Yosemite	CA	3,901,408	4.4	3	791,266	16
Yellowstone	WY	3,640,185	10.5	4	2,219,791	8
Rocky Mtn.	CO	2,955,821	4.7	5	265,828	26
Zion	UT	2,665,972	-2.5	8	145,598	35
Acadia	ME	2,504,208	12.4	9	47,390	47
Bryce	UT	1,285,492	5.7	15	35,835	50
Arches	UT	1,014,405	1.8	19	76,519	42
Badlands	SD	977,778	4.7	22	242,756	28
Mesa Verde	CO	559,712	1.7	30	52,122	46
Canyonlands	UT	435,908	-0.1	36	337,598	23

With the table sorted by Visitors Rank, it's now fairly easy to find the park with the median rank. To find a median, you start by putting the items on a list into numerical order, which we just did by sorting the list. Then, you can just choose the middle number. In this case, Acadia is the park in the middle position since there are 5 parks ranked before it and 5 parks ranked after it.

Note that you could have also sorted the list by Visitors Number. Since data is always sorted from least to greatest, Canyonlands would have been the first row of the table and Grand Canyon would have been the last row. But, Acadia still would have been in the middle. We chose to sort by Visitors Rank because that term was mentioned in the question and it's easier to work with smaller numbers.

Use Your Noteboards

For more complicated statements, you may want to make a list of the items that satisfy a condition in the statement.

Having identified Acadia as the park with the median rank, you now need to decide whether to sort the table again. Since the table provides ranks for the total acreage of the parks on the list, you likely don't need to sort again. Acadia is 47th by acreage.

One park, Bryce with a rank of 50, is smaller. So, Acadia, the median park by visitation, is larger than only one other park on the list. The second statement is true.

Note, however, that if the table had not provided ranks for the parks by total area, then you most likely would have wanted to sort by Area Acres. After all, it's a lot easier to see that only one number is greater than 47 than to see that only one number is smaller than 47,390. Remember that sorting only takes a few seconds and you should sort whenever you think doing so will help you to accurately find what you need on the table.

Now, let's evaluate the third statement:

Exactly 20% of the parks with ranks less than 40 by acreage and showing positive growth in visitors were in Utah (UT).

This statement provides a few more challenges when it comes to deciding how to sort the data. Again, be guided by what you most need to see. The current sort makes it very difficult to quickly determine how many parks are ranked less than 40 by acreage. So, first, sort by Area Rank.

Here's what the sorted table looks like:

National Park		Visitors			Area	
Name	State	Number	% Change	Rank	Acres	Rank
Yellowstone	WY	3,640,185	10.5	4	2,219,791	8
Grand Canyon	AZ	4,388,386	0.9	2	1,217,403	11
Yosemite	CA	3,901,408	-4.4	3	791,266	16
Canyonlands	UT	435,908	-0.1	36	337,598	23
Rocky Mtn.	CO	2,955,821	4.7	5	265,828	26
Badlands	SD	977,778	4.7	22	242,756	28
Zion	UT	2,665,972	-2.5	8	145,598	35
Arches	UT	1,014,405	1.8	19	76,519	42
Mesa Verde	CO	559,712	1.7	30	52,122	46
Acadia	ME	2,504,208	12.4	9	47,390	47
Bryce	UT	1,285,492	5.7	15	35,835	50

Calculations Required

Expect to do some calculations such as computing an average or a percent change to evaluate one or two of the statements in a Table Analysis question.

With the table data sorted by Area Rank, it's now easy to see that there are seven parks—Yellowstone, Grand Canyon, Yosemite, Canyonlands, Rocky Mtn., Badlands, and Zion—with ranks less than 40 by acreage. Of those seven parks, you next need to identify the ones that had positive growth in visitors. Note that you can do so without resorting the table. Five of parks with ranks less than 40 also have positive growth. Those five are Yellowstone, Grand Canyon, Yosemite, Rocky Mtn., and Badlands.

Calculator Time!

Don't forget that you can use the onscreen calculator to perform messy calculations such as dividing through by 101.8!

Finally, you need to determine how many of those five parks are also in Utah. Again, there's no need to resort the table. None of the five parks we just listed are in Utah. So, the actual percentage of parks that have ranks less than 40 by acreage and also showed positive growth is 0%. The third statement is false.

Note that some Table Analysis statements may ask you to use two or three of the criteria to find a very specific subset of the data. The statement we just evaluated is an example of such a statement. Of course, you can only sort by one criteria at a time. The key to evaluating these statements is typically to find the most important criteria to sort by. Once you have narrowed the list down by doing one sort, you can probably find the specific items that match all the criteria without doing any additional sorting.

Now, it's time to finish the question by evaluating the fourth statement. The fourth statement claims:

The total number of visitors at Arches in 2009 was less than 1,000,000.

Because this statement involves only a single data point, you don't really need to worry about doing any sorting. Even the most involved GMAT tables will have fewer than 30 rows of data. So, it will never be an issue to quickly scan the table, no matter how it is currently sorted, to find one data point. Just use the current sort which has Arches in the 8th row.

Next, you need some information about Arches to evaluate the statement. The table shows that Arches had 1,014,405 visitors in 2010. The table also shows that the number of visitors in 2010 was 1.8% greater than it was in 2009. To find the number of visitors in 2009, use the percent change formula:

$$\% \text{ change} = \frac{\text{difference}}{\text{original}} \times 100$$

Next, put the numbers that you know into the formula to get:

$$1.8 = \frac{(1,014,405 - x)}{x} \times 100$$

We've called the 2009 number that we're trying to find x . A little rearranging gives:

$$101.8x = 101,440,500$$

Finally, just divide through by 101.8 to find that x , the 2009 visitation at Arches, was 996,469 rounded to the nearest integer. So, statement four is true.

Here's what your answers should look like just before you click next to move onto the next question in the Integrated Reasoning section:

Sort By

Select...
▼

National Park		Visitors			Area	
Name	State	Number	% change	Rank	Acres	Rank
Grand Canyon	AZ	4,388,386	0.9	2	1,217,403	11
Yosemite	CA	3,901,408	4.4	3	791,266	16
Yellowstone	WY	3,640,185	10.5	4	2,219,791	8
Rocky Mtn.	CO	2,955,821	-4.7	5	265,828	26
Zion	UT	2,665,972	-2.5	8	145,598	35
Acadia	ME	2,504,208	12.4	9	47,390	47
Bryce	UT	1,285,492	5.7	15	35,835	50
Arches	UT	1,014,405	1.8	19	76,519	42
Badlands	SD	977,778	-4.7	22	242,756	28
Mesa Verde	CO	559,712	-1.7	30	52,122	46
Canyonlands	UT	435,908	-0.1	36	337,598	23

The table above gives information for 2010 on total visitors and total acreage for 11 US National Parks. In addition to the numbers of total visitors and total acreage for each National Park, the table also provides the percent increase or decrease over the total visitors for 2009 and the rank of the National Park for total visitors and total acreage in 2010.

Each column of the table can be sorted in ascending order by clicking on the word "Select" above the table and choosing, from the drop-down menu, the heading of the column on which you want the table to be sorted.

Consider each of the following statements about these National Parks. For each statement indicate whether the statement is true or false, based on the information provided in the table.

True False

- The park that experienced the greatest percent increase in visitors from 2009 to 2010 also had the least total acreage.
- The park with the median rank by the number of visitors is larger than only one other park by acreage.
- Exactly 20% of the parks with ranks less than 40 by acreage and showing positive growth in visitors were in Utah (UT).
- The total number of visitors at Arches in 2009 was less than 1,000,000.

GRAPHICS INTERPRETATION

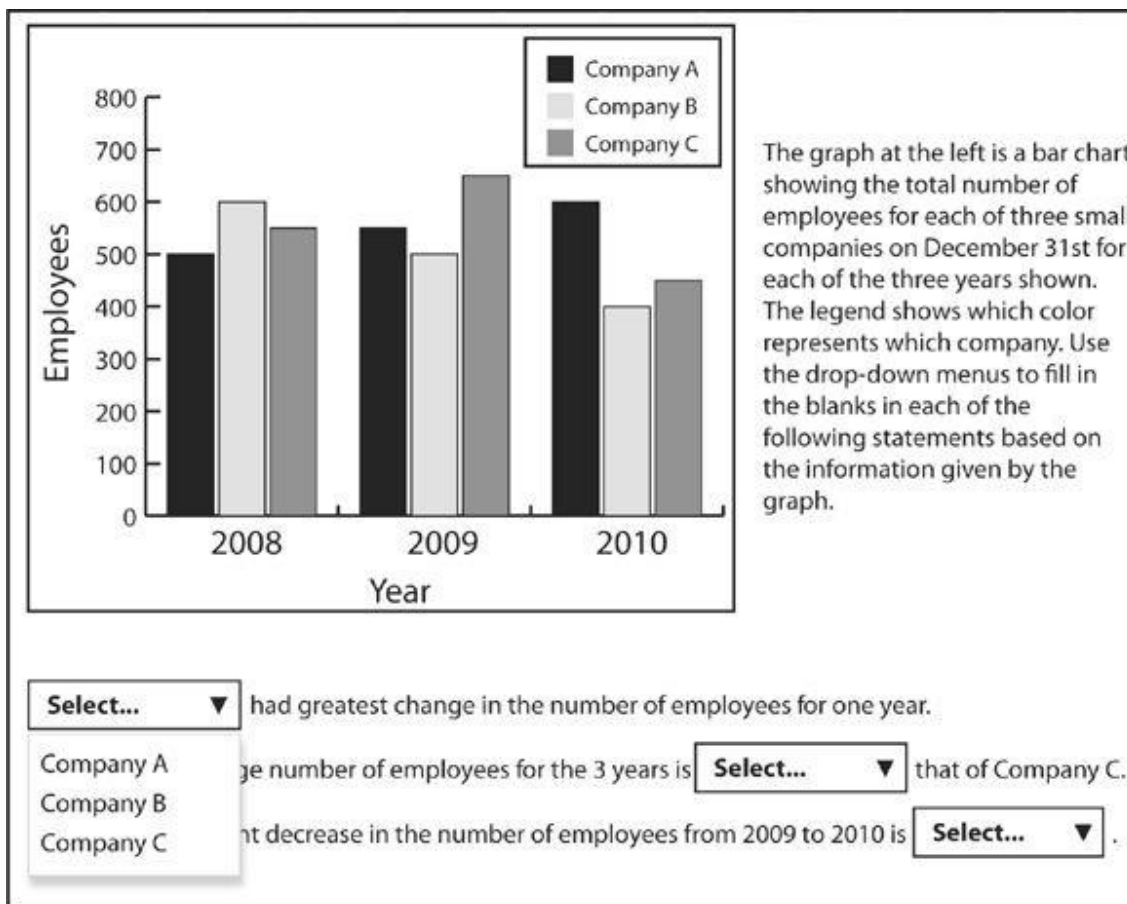
Graphics Interpretation questions provide you with one chart, graph, or image. Each chart is followed by three statements. The statements each contain one dropdown list from which you choose one answer. Your job is to pick the answer that makes the statement true. Each drop-down list typically contains between three to five answer choices.

You'll find a few sentences of explanatory text to the right of the chart or graph. As with Table Analysis questions, you may not need to read this explanatory information. Just as with Table Analysis questions, you can be guided by how well you understand the chart or graph. If you understand the chart or graph, then you probably don't need to read the explanatory text.

So, what should you look for when you review the chart or graph? Start by looking at any labels on the axes. Are quantities being measured in common, easily understood units? You should also look to see if the chart or graph has any titles that help to explain the data it shows. Finally, see if there's any sort of legend that helps to differentiate different types of data.

Let's take a look at the sample Graphics Interpretation question that we discussed in [Chapter 18](#).





Here's How To Crack It:

Before we get started discussing this question, note that we've expanded the drop down list for the first statement. When the question first appears on the screen, none of the drop-downs are expanded. Here, we just wanted to show what the expanded drop-downs look like in the context of a question.

The first step in working any Graphics Interpretation question is to review the chart or graph. In this case, there's a bar chart. The vertical axis shows employees in hundreds, which seems fairly easy to understand. The horizontal axis shows results for three years. The different colored bars are explained by the legend—there are three companies. So, this chart seems fairly straightforward. It shows the number of employees for three companies for three different years.

With everything on the chart so clearly marked, there's little reason to read the explanatory text to the right of the chart. Note that the only piece of information that the explanatory text really adds is that the number of employees for each company was tallied on December 31st of each year. That's the sort of detail that often turns out to be irrelevant in answering the questions. Remember that you can always go back and read

the explanatory text if it seems like you need to know something that wasn't clearly reflected on the chart or graph.

Let's take a look at the questions. As with Table Analysis questions, it's best to just evaluate the statements in order. If one of them gives you trouble or seems particularly time-consuming, you can always skip over it and evaluate the other statements first. Of course, you'll need to pick an answer for all three statements before you can move to the next question in the Integrated Reasoning section.

Here's the first statement again:

Select... ▼ had greatest change in the number of employees for one year.

- Company A
- Company B
- Company C

Avoid Common Errors

Be careful when you read the chart. Are you looking at the right item? It's also a good idea to write down the data before performing any calculations with the data.

For this statement, the task is to determine which company had the greatest overall changes in employees in any one year period. You'll probably find it helpful to write down the changes on your notepad. You may even want to construct a rough table to keep track of the changes. In that way, you can easily spot the largest overall change.

Here's a table that shows the changes for each company:

	2008 to 2009	2009 to 2010
Company A	50	50
Company B	-100	-100
Company C	100	-200

For this statement, it's important to note that the question asked for the greatest change. So, you need to include overall decreases in looking for the greatest change. Employment at Company C declined by 200 between 2009 and 2010. The correct answer to statement one is "Company C".

Here's the second statement showing the possible answers:

Company A's average number of employees for the 3 years is **Select...** that of Company C.

greater than
less than
the same as

To evaluate this statement, you need to calculate the average number of employees for Companies A and C. Questions that ask you to perform calculations such as finding an average are fairly common for Graphics Interpretation questions. Just be sure to read the information from the chart carefully. Common errors for questions such as this one usually involve reading the information for the wrong company or mixing the information for two companies.

For Company A, the total number of employees for each year was 500, 550, and 600. To find the average, take the sum of the three numbers to get 1,650. Now, just divide by 3 because you want the average over three years. So, the average number of employees for Company A is 550.

For Company C, the total number of employees for each year was 550, 650, and 450. The average number of employees per year for Company C is also 550. So, the correct answer for the second statement is 'the same as'. Now, here's the third statement showing the possible answers:

Company B's percent decrease in the number of employees from 2009 to 2010 is **Select...**

10%
17%
20%
33%
40%

To evaluate this statement, you need to find the number of employees for Company B in both 2009 and 2010. In 2009, Company B had 500 employees. In 2010, the company's number of employees had declined to 400. To find the percent decrease, use the percent change formula:

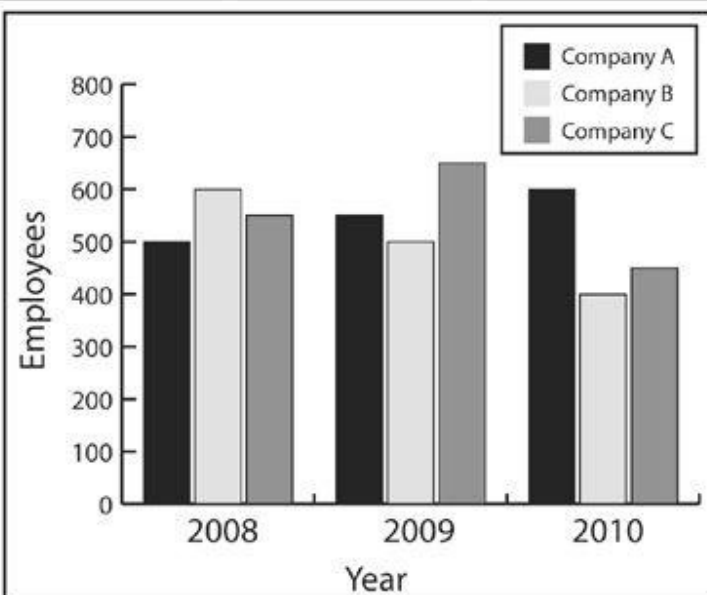
$$\% \text{ change} = \frac{\text{difference}}{\text{original}} \times 100$$

The difference in this case is $500 - 400 = 100$. For the original, use the 2009 number, 500. So, with the numbers, here's how the formula is evaluated:

$$\% \text{ change} = \frac{100}{500} \times 100 = 20\%$$

The answer for the third statement is 20%.

Here's what your answers should look like just before you click next to move on to the next question in the Integrated Reasoning section:



The graph at the left is a bar chart showing the total number of employees for each of three small companies on December 31st for each of the three years shown. The legend shows which color represents which company. Use the drop-down menus to fill in the blanks in each of the following statements based on the information given by the graph.

Year	Company A	Company B	Company C
2008	500	600	550
2009	550	500	650
2010	600	400	450

Company C ▼ had greatest change in the number of employees for one year.

Company A's average number of employees for the 3 years is **the same as** ▼ that of Company C.

Company B's percent decrease in the number of employees from 2009 to 2010 is **20%** ▼ .

TWO-PART ANALYSIS

Most two-part analysis questions will remind you of the word problems that are part of the Quantitative section of the GMAT. The only difference is that you'll need to pick two answers rather than one! It's likely that you'll need to do some calculations to solve most Two-Part Analysis questions. For the most part, the math you'll need to do will be fairly straightforward arithmetic. You may find that it's faster to do the calculations without the calculator. However, remember that the calculator is available. Just remember to set up your calculations before entering them into the calculator.

For most Two-Part Analysis questions, the two answers that you need to pick are related or linked in some way. When that's the case, you may be able to identify one part

as easier to solve than the other. If so, do the easier part first. It's also important to remember that working with the answer choices is often easier for these questions. While some Two-Part Analysis questions can be solved algebraically, it's very often faster to just test out the answer choices. In other words, you'll be able to use a form of PITA (Plugging In The Answers, discussed in our Algebra Chapter) to solve most of these questions. Let's take a look at how to solve the question we saw in [Chapter 18](#).

Two families buy new refrigerators using installment plans. Family A makes an initial payment of \$750. Family B makes an initial payment of \$1200. Both families make five additional payments to pay off the balance. Both families pay the same amount for their refrigerators including all taxes, fees and finance charges.

In the table below, identify a monthly payment, in dollars, for Family A and a monthly payment, in dollars, for Family B that are consistent with the installment plan described above. Make only one selection in each column.

Family A	Family B	Monthly payment (in dollars)
<input type="radio"/>	<input type="radio"/>	50
<input type="radio"/>	<input type="radio"/>	80
<input type="radio"/>	<input type="radio"/>	120
<input type="radio"/>	<input type="radio"/>	160
<input type="radio"/>	<input type="radio"/>	250
<input type="radio"/>	<input type="radio"/>	300

Here's How to Crack It

For this problem, one of the first things to notice is that there is a connection between the payments that each family makes. Since Family B's initial payment is \$450 more than that of Family A, Family A's monthly payment is larger than that of Family B. That can help when you start testing the answer choices. Moreover, you can also see that the answer for Family A cannot be either \$50 or \$80. If Family A's monthly payment were \$80, then they would have only paid an additional \$400 after 5 months. That's not even enough to make Family A's total payment equal to Family B's initial payment. Of course, Family B makes monthly payments, too.

You can set the problem up just like you would a PITA question with one change. So that you can keep track of your process of elimination, you'll write the answer choices down twice leaving some space between the answers to show any quantities that you

needed to calculate. Of course, you'll label your answer choices just like with any other PITA question. For this problem, you can label your columns of numbers as "A's payment" and "B's payment." Here's what your initial setup should look like:

A's payment		B's payment	
50		50	
80		80	
120		120	
160		160	
250		250	
300		300	

Note that we've already crossed off 50 and 80 as possible payments for Family A. As discussed, these answers are too small for A's payment. As with any other PITA question, it makes sense to start with a number in the middle. We'll start with \$160 for Family A's payment.

If Family A's payment is \$160, what can you find? The problem states that Family A makes 5 payments, so the total of those 5 payments is 800. Moreover, the problem also states that Family A made an initial payment of \$750. So, if Family A made payments of \$160, then the refrigerator cost $\$750 + \$800 = \$1,550$. That's what goes into the next column for Family A.

What about Family B? If Family A makes payments of \$160, then Family B's payments must be less than that amount. So, Family B could make payments of \$50, \$80 or \$120. For each of those numbers, you calculate how much Family B would have paid for the refrigerator. Here's what your table should look like at this step:

A's payment	A's Total	B's payment	B's Total
50		50	\$1450
80		80	\$1600
120		120	\$1800
160	\$1550	160	
250		250	
300		300	

So, how do you know if you've found the correct answers? Remember that the problem states that both families pay the same amount for their refrigerators. Since Family B cannot pay \$1,550 for their refrigerator, you can eliminate 160 as an answer for Family A.

It's not that clear whether Family A's payment needs to be larger or smaller. So, just pick a direction and try it. Let's try \$250 for Family A's payment. If Family A's payment is \$250, then their refrigerator costs $\$750 + (5 \times \$250) = \$2,000$. For Family B, none of the answers we've already worked out make their refrigerator cost \$2,000.

However, we can also check what happens if Family B makes monthly payments of \$160. In that case, Family B's refrigerator costs $\$1,200 + (5 \times \$160) = \$2,000$. So, the answers are 250 for Family A and 160 for Family B.

Here's what your completed table looks like:

A's payment	A's Total	B's payment	B's Total
50		50	\$1,450
80		80	\$1,600
120		120	\$1,800
160	\$1,550	160	\$2,000
250	\$2,000	250	
300		300	

Here's what your answers should look like just before you click next to move on to the next question in the Integrated Reasoning section:

Two families buy new refrigerators using installment plans. Family A makes an initial payment of \$750. Family B makes an initial payment of \$1200. Both families make five additional payments to pay off the balance. Both families pay the same amount for their refrigerators including all taxes, fees and finance charges.

In the table below, identify a monthly payment, in dollars, for Family A and a monthly payment, in dollars, for Family B that are consistent with the installment plan described above. Make only one selection in each column.

Family A	Family B	Monthly payment (in dollars)
<input type="radio"/>	<input type="radio"/>	50
<input type="radio"/>	<input type="radio"/>	80
<input type="radio"/>	<input type="radio"/>	120
<input type="radio"/>	<input checked="" type="radio"/>	160
<input checked="" type="radio"/>	<input type="radio"/>	250
<input type="radio"/>	<input type="radio"/>	300

Check Your Answers

Always double check your answers for a Two Part Analysis question. Flipping

your answers is a very common mistake for these questions. Make sure you have the correct answer for each column.

We used a form of Plugging In the Answers (PITA) to solve the previous question. You can use that approach for most of the Two-Part Analysis questions that you see. Here's a recap of the steps.

PITA for Two-Part Analysis Questions

1. Write down the answer choices on your notepad. Make two columns leaving some space between.

2. Decide which variable is easier to work with. For example, you might be able to eliminate some answers for one variable because those answers are too big or too small.

3. Write a label over each column of numbers. Label the first column as the easier variable to work with.

4. Starting with an answer in the middle for the first column, work the steps of the problem. For the second column, remember that you may only need to test the answers that are bigger or smaller than the number you worked with in the first column.

5. Check for a match between the first and second column that makes a condition in the problem true.

For some Two-Part Analysis questions, however, you won't be able to use PITA. For the problem we just discussed, the two monthly payments were linked because both families needed to pay the same amount for a refrigerator. For some Two-Part Analysis questions, however, the variables are either unlinked or, at least, less linked.

Let's look at an example:

Jack divides \$30,000 between two investments. He invests 35% of the money in Investment A which pays 4% simple interest annually for 5 years. He invests the remainder of the money in Investment B which pays 2% interest compounded semi-annually for 4 years.

In the table below, identify the total interest earned, in dollars, for Investment A and the total interest earned, rounded to the nearest dollar, for Investment B that are consistent with the investments described above. Make only one selection in each column.

Investment A	Investment B	Interest Earned (in dollars)
<input type="radio"/>	<input type="radio"/>	392
<input type="radio"/>	<input type="radio"/>	870
<input type="radio"/>	<input type="radio"/>	1560
<input type="radio"/>	<input type="radio"/>	1616
<input type="radio"/>	<input type="radio"/>	2100
<input type="radio"/>	<input type="radio"/>	3347

Here's How to Crack It

For this question, note that there's no common condition that needs to be satisfied. Rather, there are two independent calculations. That's how you know that you can't use PITA to solve this question.

The solution to this question starts with calculating how Jack divides the \$30,000 between the two investments. Start by calculating 35% of \$30,000. Remember that you can just use the onscreen calculator: $30,000 \times 0.35 = 10,500$. So, \$10,500 is invested in Investment A and the rest, or \$19,500, is invested in Investment B.

Next, it's time to calculate the interest earned on each investment. Investment A earns simple interest at a rate of 4% per year for 5 years. To find simple interest, you multiply the principle amount, \$10,500, by the interest rate, 0.04, by the time period, 5 years. Here's what the calculation looks like:

$$\$10,500 \times 0.04 \times 5 = \$2,100$$

The onscreen calculator makes doing the calculation an easy, one-step operation. Just make sure that you use the right numbers from the problem!

For Investment B, the interest is compounded semi-annually. That means that every six months the interest is added to the principle so that interest can be earned on the combined amount. There are several ways to calculate compound interest. One of the

easiest is to divide the yearly interest rate by the compounding period. For this problem, the investment pays 2% per year but the interest is compounded twice per year.

So, that's 1% every six months. In four years, there are 8 compounding periods. So, to find the account balance at the end of 4 years, you'd calculate the interest for the first six months by multiplying by 0.01. Then, you'd add that amount to the principle and repeat the calculation. Keep calculating until you've done all 8 compounding periods. Of course, since you are multiplying each time, there's a shorter way. Here's what the overall calculation looks like.

$$\$19,500 \times (1.01)^8 = \$21,115.71$$

Now, to find the interest just subtract \$19,500 from the account balance. The interest earned is \$1,616 rounded to the nearest dollar.

Here's what your answers should look like just before you click next to move onto the next question in the Integrated Reasoning section:

Jack divides \$30,000 between two investments. He invests 35% of the money in Investment A which pays 4% simple interest annually for 5 years. He invests the remainder of the money in Investment B which pays 2% interest compounded semi-annually for 4 years.

In the table below, identify the total interest earned, in dollars, for Investment A and the total interest earned, rounded to the nearest dollar, for Investment B that are consistent with the investments described above. Make only one selection in each column.

Investment A	Investment B	Interest Earned (in dollars)
<input type="radio"/>	<input type="radio"/>	392
<input type="radio"/>	<input type="radio"/>	870
<input type="radio"/>	<input type="radio"/>	1560
<input type="radio"/>	<input checked="" type="radio"/>	1616
<input checked="" type="radio"/>	<input type="radio"/>	2100
<input type="radio"/>	<input type="radio"/>	3347

MULTI-SOURCE REASONING

For Multi-Source Reasoning questions, you'll be given a variety of information

that can include text, charts, tables, and graphs. The information is arranged on 2 or 3 tabs. Multi-Source Reasoning questions typically come in sets. So, you'll probably get two sets of statement style questions and perhaps one standard multiple choice question.

When a new Multi-Source question appears on your screen, you should take a minute to review the information on each tab. As usual, you'll want to check out things like the axes on graphs and any headings for the charts. But, for Multi-Source Reasoning questions, you also want to see how the information on one tab relates to the information on the other tabs.

Let's look at the example that we saw in the previous Integrated Reasoning chapter. This time, we'll take a look at the information on all three tabs. We'll also discuss how to evaluate statements and answer questions.

Text #1

Graph #1

Graph #2

The population of a country affects its ability to compete in the global economy. On the one hand, a large population can be a source of inexpensive labor that can attract investment. On the other hand, large populations can also create resource allocation problems, especially for items such as food, clean water and health care.

Increased wealth sometimes results in reduced population growth. The table below compares the 2005 populations and 2005 population growth rates for the United States, Canada, Norway, India and China.

Country	Population	Rate of Growth
United States	295,753,000	0.9%
Canada	32,312,000	1.0%
Norway	4,623,000	0.7%
India	1,095,000,000	1.4%
China	1,304,000,000	0.6%

Consider each of the following statements. Does the information in the graphs and text support the inference as stated?

	Yes	No	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	40% of the countries showed an increase in per capita CO ₂ emissions for each 5 year period.
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	The United States emitted more CO ₂ in 2005 than did China.
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	CO ₂ emissions per capita in India increased between 2005 and 2010.
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	China's CO ₂ emissions per capita increased at a greater rate than did those of India between 2000 and 2005.

Here's How to Crack It

We'll review the information one tab at a time before we start evaluating the statements. The first tab, Text #1, provides some background information about the ways in which a country's population can affect its participation in the global economy. This tab also presents a table with population and growth rates for five countries. Notice that you need to read the included information on this tab to determine that the table displays data from 2005. Unlike the other question types that we've discussed, you should always read any text that's included on a tab in a Multi-Source Reasoning question.

Make Connections

As you review the information
on each tab, try to
find ways that it relates
to the information on the
other tabs.

Now, here's the information for the second tab:

Text #1

Graph #1

Graph #2

The graph below shows the CO₂ emissions per capita for five selected countries from 1980 to 2005.

CO₂ Emissions Per Capita for 5 Countries

Year	United States	Canada	Norway	China	India
1980	21	17	8.5	1.5	0.5
1985	19	15.5	8.5	1.8	0.6
1990	19.5	16	7.5	2.2	0.7
1995	19.5	15.5	7.5	2.8	0.8
2000	20.5	17.5	8.5	2.5	0.9
2005	19.5	17.5	10	4.5	1.2

Consider each of the following statements. Does the information in the graphs and text support the inference as stated?

Yes	No	
<input type="radio"/>	<input type="radio"/>	40% of the countries showed an increase in per capita CO ₂ emissions for each 5 year period.
<input type="radio"/>	<input type="radio"/>	The United States emitted more CO ₂ in 2005 than did China.
<input type="radio"/>	<input type="radio"/>	CO ₂ emissions per capita in India increased between 2005 and 2010.
<input type="radio"/>	<input type="radio"/>	China's CO ₂ emissions per capita increased at a greater rate than did those of India between 2000 and 2005.

This tab shows CO₂ emissions for five countries over a 25 year period. Notice that the countries on this tab are the same as the countries on the first tab. It's also important to note that the CO₂ emissions on this tab are per capita emissions. Since the first tab provided information about populations for 2005, it would be possible to calculate approximate total CO₂ emissions for these five countries for 2005. While you don't necessarily need to consider all the calculations you could perform, thinking about what you could calculate is an excellent way to notice connections between the data provided on the tabs.

Next, let's take a look at the information on the third tab:

Text #1
Graph #1
Graph #2

The graph below shows the Gross Domestic Product per Capita for India and China from 1990 to 2005.

Year	India	China
1990	~350	~300
1995	~350	~600
2000	~450	~950
2005	~750	~1750

Consider each of the following statements. Does the information in the graphs and text support the inference as stated?

Yes	No	
<input type="radio"/>	<input type="radio"/>	40% of the countries showed an increase in per capita CO ₂ emissions for each 5 year period.
<input type="radio"/>	<input type="radio"/>	The United States emitted more CO ₂ in 2005 than did China.
<input type="radio"/>	<input type="radio"/>	CO ₂ emissions per capita in India increased between 2005 and 2010.
<input type="radio"/>	<input type="radio"/>	China's CO ₂ emissions per capita increased at a greater rate than did those of India between 2000 and 2005.

This tab provides GDP information about two of the countries, India and China, discussed on the first two tabs. The information on this tab is provided for a subset of the timespan from the second tab. The second tab showed the 25 year range from 1980 to 2005 while this information is only for the 15 year timespan from 1990 to 2005. The GDP information is provided as per capita information. Again, that means that the information on the first tab could be used to calculate the overall GDP for India and China. Of course, that calculation can only be completed for 2005.

Now, that we've reviewed the information on each tab, it's time to start evaluating the statements. But first, we need to consider the directions carefully. The directions state that you are supposed to consider "Does the information in the graphs and text support the inference as stated?" Remember our discussion of valid inferences. An inference is a statement that you know to be true because you can back it up with proof.

There are really three cases to consider when evaluating these statements. If the graphs and other information on the tabs are sufficient to show that the statement is true, answer "yes." If the graphs and other information on the tabs are sufficient to show that the statement is false, answer "no". But, what if there is simply insufficient information to conclusively show that the statement is either true or false? In that case, you answer

“no” because the information did not support the inference. In other words, the task here is a little different than simply evaluating whether the statements are true or false.

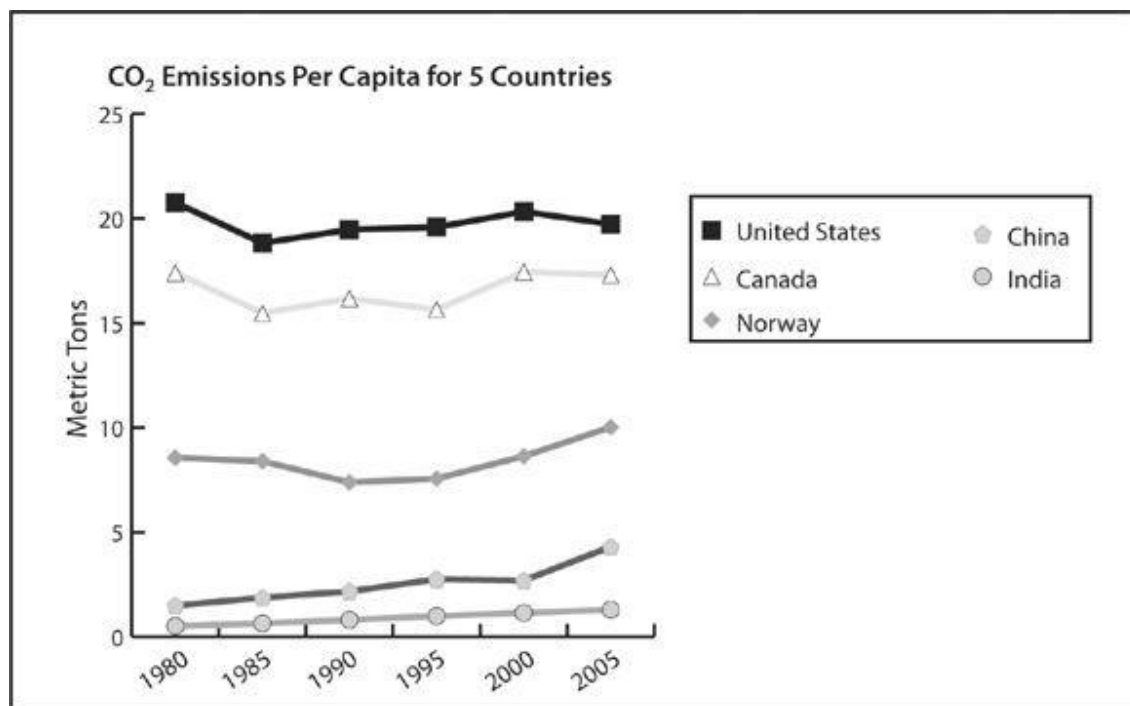
After all, GMAC could have made the answer choices True and False rather than Yes and No.

Remember, however, that most GMAC statements won't try to trick you that way. But, it is important to remember that you need proof to claim that something can be inferred. You will see statements that try to get you to read into or interpret the information. Such activities do not lead to valid inferences!

Let's take a look at the first statement:

40% of the countries showed an increase in per capita CO² emissions for each five year period.

The first step in evaluating a statement for a Multi-Source Reasoning question is to determine which tab or tabs contain the information that you need. For this statement, the second tab contains information about per capita CO² emissions so select that tab. Next, start checking out the trend lines on the graph. We've reprinted the chart from the second tab below.



The trend lines for the United States, Canada, and Norway clearly show both increases and decreases between five year periods. So, none of those countries fit the requirements of the statement. The trend line for China needs to be examined carefully. China's CO² emissions per capita increase for four out of the five five-year periods shown. However, China's emissions decreased slightly between 1995 and 2000. So, China also does not fit the requirements of the statement. Only India's trend line shows

an increase for every five-year period depicted on the graph. But, that means that only 1 out of 5 or 20% of the countries showed an increase in CO² emissions for each five year period. So, the answer to the first statement is no.

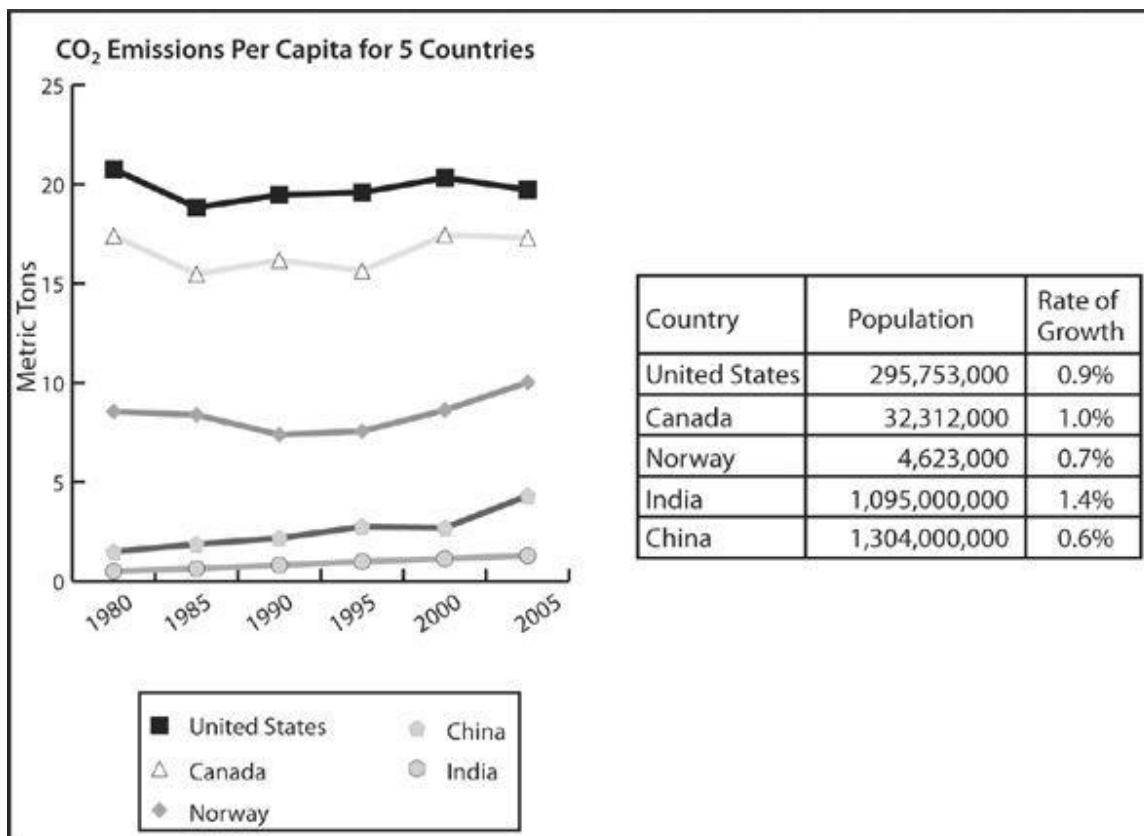
Next, let's take a look at the second statement:

The United States emitted more CO² in 2005 than did China.

Evaluating this statement is a little trickier than evaluating the first statement. First, be careful of the wording. The statement is about total CO² emissions rather than the per capita emissions that are shown by the chart on the second tab. So, while the emissions chart does show that per capita emissions for the US were higher than those for China in 2005, you cannot base your answer only on that piece of information. Remember that the test-writers will try to get you to make hasty conclusions so always check out the wording of the statement carefully.

Since none of the provided charts allows you to simply look up the information for this statement, you need to determine if you have sufficient information to evaluate the statement. To go from per capita CO² emissions in 2005 to total CO² emissions in 2005, you need to know the populations for China and the United States in 2005. That information is provided by the table on the first tab. As discussed above, if there had been insufficient information, you could have clicked "no" right away for your answer.

Since there is sufficient information, however, you'll need to calculate the total 2005 CO² emissions for both China and the United States. To do so, multiply the per capita emissions for each country from the chart on the second tab by the population for that country from the table on the first tab. We've duplicated the relevant information from the first two tabs below.



Of course, you won't be able to split the view on your computer screen this way. So, you'll need to write down some of the relevant information on your notebooks. You should use your notebooks to take notes whenever you need information from two different tabs. Simply trying to remember the numbers can cause errors and waste time. For example, to evaluate this statement, you might jot down the 2005 per capita CO² emissions for the United States and China. Then, go to the first tab to get the population numbers for each country.

Use Your Noteboards

If the information you need is on two different tabs, use your notebooks to keep track of the information from one of the tabs.

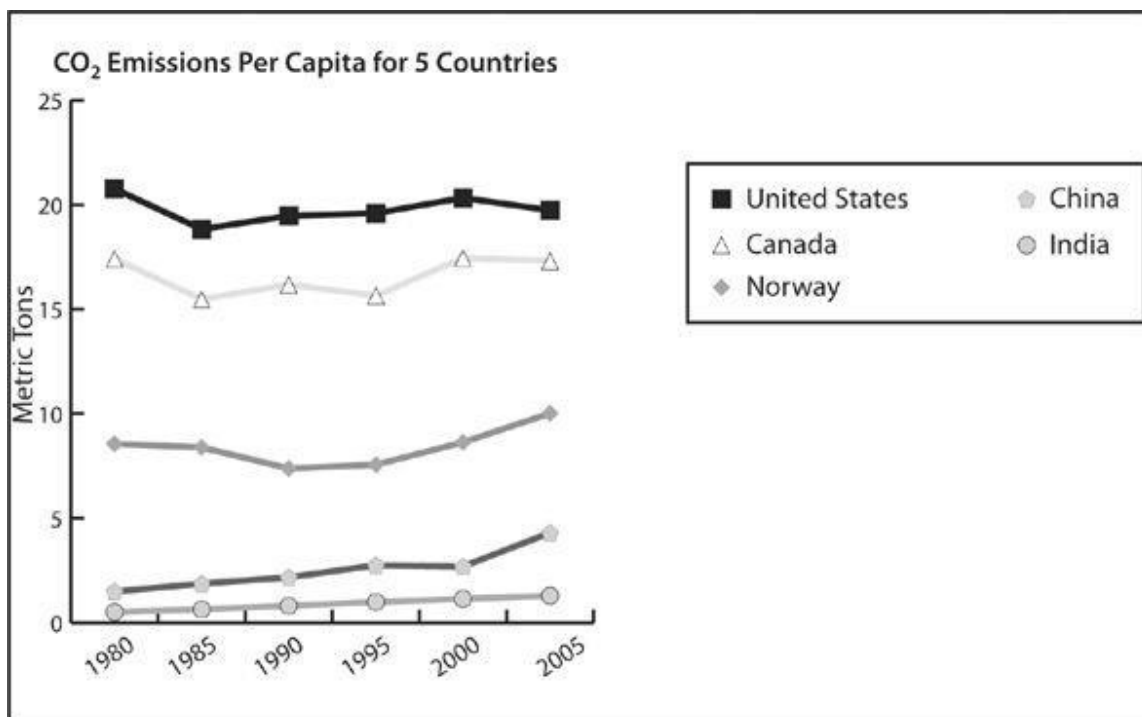
For the US, per capita CO² emissions in 2005 were approximately 20 metric tons. The US population in 2005 was 295,753,000. So, the total 2005 CO² emissions for the United States was $20 \times 295,753,000 = 5,915,060,000$ metric tons. For China, the per capita CO² emissions are approximately 4.8 and the population was 1,304,000,000. So,

China's total CO² emissions for 2005 were $4.8 \times 1,304,000,000 = 6,259,200,000$, greater than those of the United States. Therefore, the answer to the second statement is no.

It's time to tackle the third statement:

CO² emissions per capita in India increased between 2005 and 2010.

In contrast with the second statement, evaluating this statement is certainly less time consuming. However, as we'll see, you'll need to remember what is necessary for a valid inference. The necessary information is displayed on the graph on the second tab. Again, we've duplicated the necessary information below.

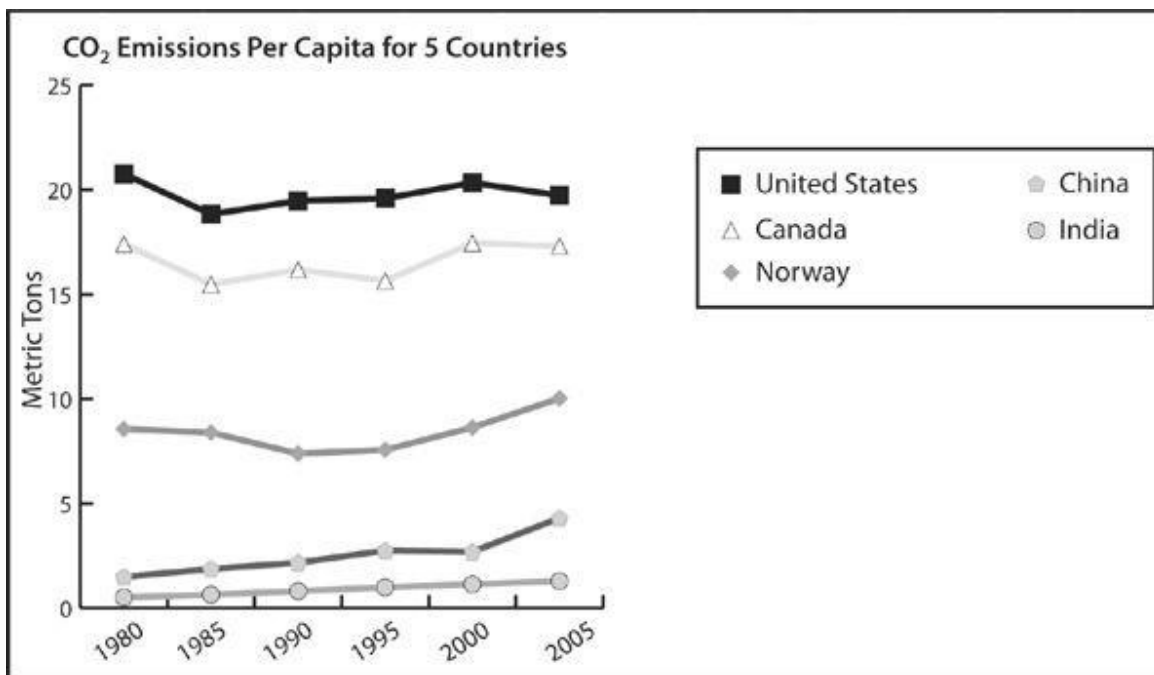


Now, it's time to be careful. Notice that the chart only displays data up to 2005. While India's per capita CO² emissions have shown a steady increase over the 25 year period shown on the chart, that's not sufficient for a valid inference. Since the chart does not display the actual numbers for 2010, the answer to the third statement is "no."

Finally, we'll evaluate the fourth statement:

China's CO² emissions per capita increased at a greater rate than did those of India between 2000 and 2005.

As with all the other statements, start by assessing which graph or graphs contain the information you need. Since this statement is about per capita CO² emissions, you once again need the chart on the second tab. Again, we've printed the relevant chart below for reference.



To evaluate this statement compare the slopes of the trend lines for China and India. China's trend line shows a sharp increase between 2000 and 2005 while India's shows a more moderate increase. Therefore, the answer to fourth statement is "yes."

Here's what your answers should look like just before you click next to move on to the next question in the Integrated Reasoning section:

Text #1	Graph #1	Graph #2																																																										
<p>The graph below shows the CO₂ emissions per capita for five selected countries from 1980 to 2005.</p>	<p>CO₂ Emissions Per Capita for 5 Countries</p> <table border="1" style="margin-top: 10px; border-collapse: collapse; width: 100%;"> <caption>Approximate CO₂ Emissions per Capita (Metric Tons)</caption> <thead> <tr> <th>Year</th> <th>United States</th> <th>Canada</th> <th>Norway</th> <th>China</th> <th>India</th> </tr> </thead> <tbody> <tr> <td>1980</td> <td>21</td> <td>17.5</td> <td>8.5</td> <td>1.5</td> <td>0.5</td> </tr> <tr> <td>1985</td> <td>19</td> <td>15.5</td> <td>8.5</td> <td>2</td> <td>0.8</td> </tr> <tr> <td>1990</td> <td>19.5</td> <td>16.5</td> <td>7.5</td> <td>2.5</td> <td>1</td> </tr> <tr> <td>1995</td> <td>19.5</td> <td>15.5</td> <td>7.5</td> <td>3</td> <td>1.2</td> </tr> <tr> <td>2000</td> <td>20.5</td> <td>17.5</td> <td>8.5</td> <td>3</td> <td>1.5</td> </tr> <tr> <td>2005</td> <td>19.5</td> <td>17.5</td> <td>10</td> <td>4.5</td> <td>1.8</td> </tr> </tbody> </table>	Year	United States	Canada	Norway	China	India	1980	21	17.5	8.5	1.5	0.5	1985	19	15.5	8.5	2	0.8	1990	19.5	16.5	7.5	2.5	1	1995	19.5	15.5	7.5	3	1.2	2000	20.5	17.5	8.5	3	1.5	2005	19.5	17.5	10	4.5	1.8		<p>Consider each of the following statements. Does the information in the graphs and text support the inference as stated?</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%; text-align: left;">Yes</th> <th style="width: 10%; text-align: left;">No</th> <th></th> </tr> </thead> <tbody> <tr> <td style="text-align: center;"><input type="radio"/></td> <td style="text-align: center;"><input checked="" type="radio"/></td> <td>40% of the countries showed an increase in per capita CO₂ emissions for each 5 year period.</td> </tr> <tr> <td style="text-align: center;"><input type="radio"/></td> <td style="text-align: center;"><input checked="" type="radio"/></td> <td>The United States emitted more CO₂ in 2005 than did China.</td> </tr> <tr> <td style="text-align: center;"><input type="radio"/></td> <td style="text-align: center;"><input checked="" type="radio"/></td> <td>CO₂ emissions per capita in India increased between 2005 and 2010.</td> </tr> <tr> <td style="text-align: center;"><input checked="" type="radio"/></td> <td style="text-align: center;"><input type="radio"/></td> <td>China's CO₂ emissions per capita increased at a greater rate than did those of India between 2000 and 2005.</td> </tr> </tbody> </table>	Yes	No		<input type="radio"/>	<input checked="" type="radio"/>	40% of the countries showed an increase in per capita CO ₂ emissions for each 5 year period.	<input type="radio"/>	<input checked="" type="radio"/>	The United States emitted more CO ₂ in 2005 than did China.	<input type="radio"/>	<input checked="" type="radio"/>	CO ₂ emissions per capita in India increased between 2005 and 2010.	<input checked="" type="radio"/>	<input type="radio"/>	China's CO ₂ emissions per capita increased at a greater rate than did those of India between 2000 and 2005.
Year	United States	Canada	Norway	China	India																																																							
1980	21	17.5	8.5	1.5	0.5																																																							
1985	19	15.5	8.5	2	0.8																																																							
1990	19.5	16.5	7.5	2.5	1																																																							
1995	19.5	15.5	7.5	3	1.2																																																							
2000	20.5	17.5	8.5	3	1.5																																																							
2005	19.5	17.5	10	4.5	1.8																																																							
Yes	No																																																											
<input type="radio"/>	<input checked="" type="radio"/>	40% of the countries showed an increase in per capita CO ₂ emissions for each 5 year period.																																																										
<input type="radio"/>	<input checked="" type="radio"/>	The United States emitted more CO ₂ in 2005 than did China.																																																										
<input type="radio"/>	<input checked="" type="radio"/>	CO ₂ emissions per capita in India increased between 2005 and 2010.																																																										
<input checked="" type="radio"/>	<input type="radio"/>	China's CO ₂ emissions per capita increased at a greater rate than did those of India between 2000 and 2005.																																																										

As mentioned, Multi-Source Reasoning questions usually come in sets. Typically, you'll get two statement style questions and one multiple choice style question. The questions on the right change but the tabbed information on the left stays the same.

Let's take a look at a multiple choice question for the tabbed information that we just used to evaluate a statement style question.

Text #1
Graph #1
Graph #2

The graph below shows the Gross Domestic Product per Capita for India and China from 1990 to 2005.

GDP per Capita for India and China

Year	India (Dollars)	China (Dollars)
1990	~380	~300
1995	~400	~600
2000	~450	~950
2005	~750	~1750

For 2005, China's Gross Domestic Product was approximately how much more than that of India, in dollars?

- 2,282,000,000
- 1,460,000,000
- 938,000,000
- 821,000,000
- 784,000,000

Here's How to Crack It

As with any other Multi-Source Reasoning question, your first step is to determine which chart or charts contain the relevant data. For this question, you certainly need the bar chart on the third tab because that chart shows information about GDP. The bar chart is shown above. However, the bar chart displays data about GDP per capita and the question asks about overall Gross Domestic Product. So, you'll also need the 2005 population numbers from the table on tab one. We've reproduced the relevant table below.

Country	Population	Rate of Growth
United States	295,753,000	0.9%
Canada	32,312,000	1.0%
Norway	4,623,000	0.7%
India	1,095,000,000	1.4%
China	1,304,000,000	0.6%

To answer the question, you need to multiply each countries GDP per capita from 2005 by its population from 2005. Then, subtract India's GDP from that of China.

Based on the bar chart, China's 2005 per capita GDP was approximately \$1,750. Since China's population in 2005 was 1,304,000,000, China's 2005 GDP was approximately $\$1,750 \times 1,304,000,000 = \$2,282,000,000,000$. (Remember that you can use the onscreen calculator to perform the calculation.) For India, the 2005 per capita GDP was approximately \$750 while India's population was 1,095,000,000. That means that India's GDP was approximately $\$750 \times 1,095,000,000 = \$821,250,000,000$. Now, just subtract to find that China's 2005 GDP was approximately \$1,460,750,000 more than that of India. That's closest to Answer Choice B.

Time to Practice

Take some Integrated Reasoning drills head-on in the next chapter. You've got the basics and strategies down, now you're ready to try some questions.

Complex Calculations and the Memory Keys

The problem just discussed featured several longer calculations. Your calculator probably has parentheses which makes entering such a calculation a one step operation. Is there a way to do this calculation in one step using the onscreen calculator which doesn't have parentheses? Sure, use the memory keys!

Enter the following keystrokes:

$$1750 * 1304000000 = \text{MS}$$

$$750 * 1095000000 = \text{+/-} \quad \text{M+} \quad \text{MR}$$

These keystrokes will minimize the number of times you need to enter the large numbers which helps to avoid errors.

Summary

Before you jump into the Integrated Reasoning questions, get your bearings and peruse each tab or piece of information.

On Table Analysis questions, know that you can only sort by one column at a time. If you think that sorting will help, go for it. But don't waste time devising the perfect order to evaluate statements.

On Graphics Interpretation questions, start by looking for labels on the axes and finding the legend if there is one.

On Two-Part Analysis questions, do some algebra or PITA to get to the right answer. Careful that you select the right button in the right column when answering these questions.

On Multi-Source Reasoning questions, take a minute to review the information on each tab before you jump in. Think about how the information on one tab relates to the information on other tabs.

Chapter 20 Integrated Reasoning: Drills

Click [here](#) to download a PDF of Integrated Reasoning: Drills.

PRACTICE INTEGRATED REASONING: SECTION 1

12 Items

372

Time limit: 30 minutes

This section is a full practice Integrated Reasoning section. Please note that some questions are laid out slightly differently in this book versus what you'll see on the GMAT. Many of the new question formats are interactive. Hence, only approximations can be printed. Specifically,

Table Analysis questions are shown with a main sort and several alternate sorts. You may not need every sort.

Graphics Interpretation questions include drop down boxes. In this book, the box is shown as a fill-in blank and the answers printed below the blank.

For Multi-Source Reasoning questions, we've printed what's on each tab consecutively on the page.

For some questions, you'll see (A), (B), (C), etc. next to answer choices. These are included only to make it easier to check your work. These do not appear on the real GMAT.

We've included answers to this section starting on [this page](#).

At the time this book was printed, GMAC had not released the scoring scale for the Integrated Reasoning section. We'll make a scoring grid available in your online tools as soon as possible so that you can compute your score on the section.

Item 1:

Subway Station	Riders	% Change	Connecting Subway Lines
Times Square/42nd St.	58,422,597	0.6%	11
Grand Central/42nd St.	41,903,210	-0.2%	5
34th St./Herald Square	37,769,752	2.2%	7
14th St./Union Square	34,730,692	1.4%	7
34th St./Penn Station (Red Lines)	26,892,243	-1.1%	3
34th St./Penn Station (Blue Lines)	24,265,016	0.3%	3
59th St./Columbus Cir.	20,711,058	1.4%	5
Lexington Ave/59th St	19,553,597	3.3%	6
86th St. (Green Lines)	19,147,021	1.4%	3

The table above gives information for the year 2010 on the ridership in 9 subway stations in New York City. The subway stations were chosen for inclusion in the table because they were the busiest stations in 2010, based on the number of passengers entering the station. In addition to annual ridership (number of passengers) for each station in 2010, the table also gives the percent increase or decrease in ridership from 2009 to 2010 and the number of subway lines that connect to the station.

Each column of the table can be sorted in ascending order by clicking on the word

“Select” above the table and choosing, from the drop-down menu, the heading of the column on which you want the table to be sorted.

Alternate Sort 1: % Change

Subway Station	Riders	% Change	Connecting Subway Lines
34th St./Penn Station (Red Lines)	26,892,243	-1.1%	3
Grand Central/42nd St.	41,903,210	-0.2%	5
34th St./Penn Station (Blue Lines)	24,265,016	0.3%	3
Times Square/42nd St	58,422,597	0.6%	11
14th St./Union Square	34,730,692	1.4%	7
59th St./Columbus Cir.	20,711,058	1.4%	5
86th St. (Green Lines)	19,147,021	1.4%	3
34th St./Herald Square	37,769,752	2.2%	7
Lexington Ave/59th St	19,553,597	3.3%	6

Alternate Sort 2: *Connecting Subway Lines*

Subway Station	Riders	% Change	Connecting Subway Lines
34th St./Penn Station (Red Lines)	26,892,243	-1.1%	3
34th St./Penn Station (Blue Lines)	24,265,016	0.3%	3
86th St. (Green Lines)	19,147,021	1.4%	3
Grand Central/42nd St.	41,903,210	-0.2%	3
59th St./Columbus Cir.	20,711,058	1.4%	5
Lexington Ave/59th St	19,553,597	3.3%	6
14th St./Union Square	34,730,692	1.4%	7
34th St./Herald Square	37,769,752	2.2%	7
Times Square/42nd St	58,422,597	0.6%	11

Consider each of the following statements about this Presidential election data. For each statement indicate whether the statement is true or false, based on the information provided in the table.

- True False Question 1-1 The station with the median rank based on annual ridership is also the station with the greatest decrease in annual ridership from 2009 to 2010. Question 1-2
- The annual ridership in 2009 for the station with the

greatest percentage increase. **Question 1-3** The ratio of the average 2010 ridership of those stations having Connecting Subway Lines equal to the mode and of those stations having Connecting Subway Lines equal to the median is approximately 4 to 3. **Question 1-4** The station with the highest percent increase in riders from 2009 to 2010 had the lowest annual ridership in 2010. **Item 2:**

Frank researched 45 doctors in his local area and found that 8 of them graduated from medical school with honors, but that the services of only 3 of those 8 doctors are covered by his medical plan. On the other hand, he found that 27 doctors whose services are covered by his medical plan graduated from medical school without honors.

In the table below, identify the total number of doctors whose services are not covered by Frank’s medical plan, and identify the number of doctors who both graduated from medical school without honors and whose services are not covered by Frank’s health plan.

Services Not Covered by Medical Plan	Graduated Without Honors and Services Not Covered by Medical Plan	Total Number
(A) <input type="radio"/>	<input type="radio"/>	10
(B) <input type="radio"/>	<input type="radio"/>	15
(C) <input type="radio"/>	<input type="radio"/>	18
(D) <input type="radio"/>	<input type="radio"/>	30
(E) <input type="radio"/>	<input type="radio"/>	37
(F) <input type="radio"/>	<input type="radio"/>	40

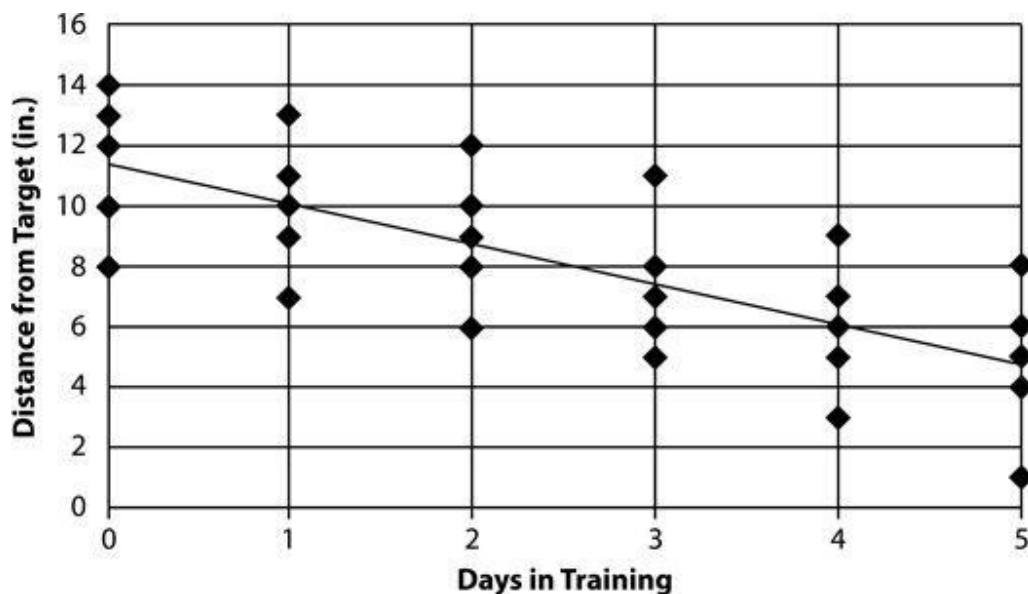
Item 3:

A flower market sells orchids for \$1.35 and dahlias for \$1.80. Faustino spends \$18.00 on orchids and dahlias.

In the table below, choose the number of orchids and the number of lilies that are consistent with the amount spent by Faustino. Make only one selection in each column.

	Orchids	Dahlias	Number Purchased
(A)	<input type="radio"/>	<input type="radio"/>	0
(B)	<input type="radio"/>	<input type="radio"/>	2
(C)	<input type="radio"/>	<input type="radio"/>	4
(D)	<input type="radio"/>	<input type="radio"/>	5
(E)	<input type="radio"/>	<input type="radio"/>	6
(F)	<input type="radio"/>	<input type="radio"/>	8

Item 4:



At a certain archery school, each of five students fired a single shot at the end of each day of training, as well as one shot before the first day of training. The graph above

is a scatterplot, in which each of the 30 points represents the distance from the target that each student hit and the number of days the student had been in training at the time the shot was fired. The solid line is the regression line. Use the drop-down menus to fill in the blanks in each of the following statements based on the information given by the graph.

Question 4-1:

The slope of the regression line is closest to _____.

(A) -2.6

(B) -1.4

(C) -0.8

(D) 1.2

(E) 2.9

Question 4-2:

The number of students within 11 in. of the target was _____ after day 2 of training than before any training.

(A) 50% less

(B) 25% less

(C) 50% greater

(D) 100% greater

(E) 200% greater

Question 4-3:

The relationship between the number of days in training and the distance from the target is _____.

(A) positive

(B) negative

(C) zero

Item 5:

The earliest known evidence of seafaring by human ancestors dates to approximately 130,000 years in the past. However, in 2010, archaeologists discovered stone tools on the coast of a Mediterranean island that date to the Paleolithic age (about 2.6 million years in the past). Because more than 40 miles of open sea separate the island from Greece, the archaeologists theorized that some human ancestors developed nautical skills millions of years earlier than previously discovered.

Question 5-1:

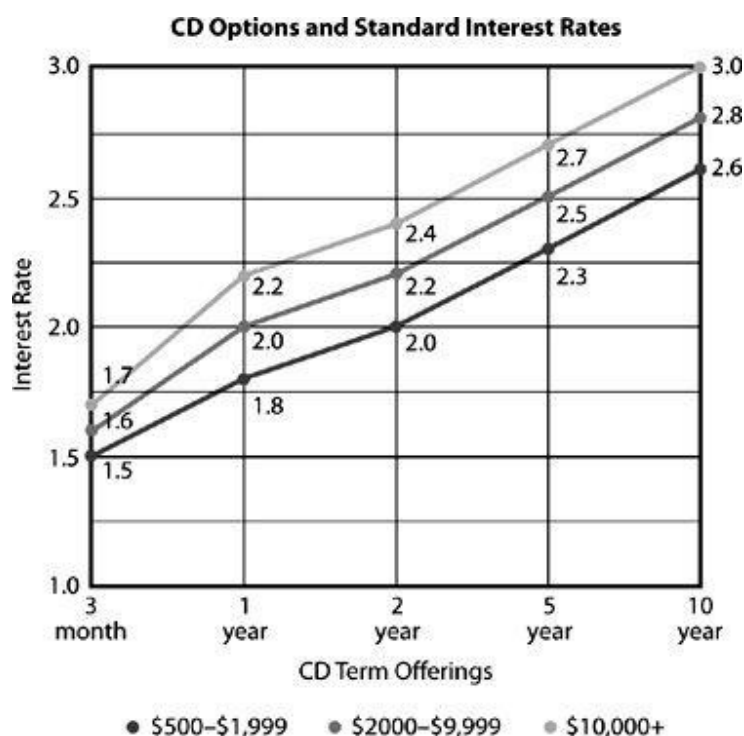
In the table below, identify which statement, if true, most strengthens the argument above, and which statement, if true, most seriously weakens the argument above.

Strengthen	Weaken	Statement	(A)	<input type="radio"/>	<input type="radio"/>	In the
same area of the island, archaeologists discovered pieces of ancient						
harpoons and spears used for fishing. (B)						
			<input type="radio"/>	<input type="radio"/>		The stone tools

resemble those made and used by **Homo erectus** and **Homo heidelbergensis**, human ancestors in the Paleolithic era who lived on the mainland of Greece. (C) The stone tools were probably used primarily for skinning animals. (D) It would be impossible to construct a seaworthy boat solely from the tools discovered by the archaeologists. (E) Approximately 5 million years ago, during the Messinian Salinity Crisis of the late Miocene era, the Mediterranean Sea dried up. (F) The stone tools were likely used for purposes other than construction of boats or rafts. Data for Items 6, 7, and 8:

CD Offerings Memo

This table provides the standard interest rates offered by Central Bank for CDs, listed according to term offering and purchase amount. The interest rates listed are annual rates, compounded yearly, to be paid when the CD comes to term. No bonuses or other adjustments are included.



CD Offerings Memo

General memo to employees of Central Bank:

January 15th

In order to improve and stabilize our bank's investment opportunities, we are seeking to shift the balance of our customers' CD accounts towards those with longer maturity terms. We have begun testing two incentive programs. All CDs purchased with terms of at least 5 years now receive, as a bonus, an additional 0.1% interest during the first year to be added to the standard rate. Preferred customers (those who have previously bought CDs of any term length in amounts of \$10,000 or more) will, when they purchase a 5-year or 10-year CD of \$10,000 or more, instead receive a bonus of 0.2% during the first year. Other CDs continue at the standard rates.

We have also instituted a new system of early withdrawal penalties, applicable to all new CDs. The penalties are as follows: For any CD, early withdrawal less than a year after the CD is purchased results in a loss of all interest. For 2-year CDs, early withdrawal after the first year results in the loss of one year of interest. For 5-year and 10-year CDs, withdrawal after the first year results in the loss of two years of interest and of any accrued bonus interest.

Item 6:

Determine whether each of the following investments will earn at least \$250 of interest in its first year.

Yes No

- (A) \$11,000 invested by a new customer in a 1-year CD
- (B) \$9,500 invested by a preferred customer in a 5-year CD
- (C) \$9,500 invested by a new customer in a 10-year CD
- (D) \$10,000 invested by a preferred customer in a 2-year CD

Item 7:

Determine whether each of these transactions will, according to the new rules and rates described, yield a total interest payment of between \$500 and \$600?

Yes No

- (A) A new customer's \$20,000 1-year CD comes to term.
- (B) A new customer's \$4,000 5-year CD comes to term.
- (C) A preferred customer's \$10,000 2-year CD comes to term.
- (D) A preferred customer's 5-year \$20,000 CD is withdrawn at the end of the 3rd year.

Item 8:

Consider each of the following statements. Does the information in the memo and the table support the inference as stated?

Yes No

- (A) Prior to the policy changes described, there were no penalties for early CD withdrawals.
- (B) Certain bank policies are designed to reward preferred customers for their loyalty.
- (C) If the bank accomplishes its stated intentions, it will likely pay a higher average interest rate to customers than if it does not.
- (D) Part of the purpose of the policy changes is to increase the proportion of CD investments that result in early withdrawal.

Item 9:

Year of Election	President	Political Party	Popular Vote (millions)	% of Popular Vote	Electoral Vote	% of Electoral Vote
1960	John Kennedy	Democratic	34.2	49.72%	303	56.40%
1964	Lyndon Johnson	Democratic	43.1	61.05%	486	90.30%
1968	Richard Nixon	Republican	31.8	43.42%	301	55.90%
1972	Richard Nixon	Republican	47.2	60.67%	520	96.70%
1976	James Carter	Democratic	40.8	50.08%	297	55.20%
1980	Ronald Reagan	Republican	43.9	50.75%	489	90.90%
1984	Ronald Reagan	Republican	54.5	58.77%	525	97.60%
1988	George Bush	Republican	48.9	53.37%	426	79.20%
1992	William Clinton	Democratic	44.9	43.01%	370	68.80%
1996	William Clinton	Democratic	47.4	49.23%	379	70.40%
2000	George W. Bush	Republican	50.5	47.87%	271	50.40%
2004	George W. Bush	Republican	62.0	50.73%	286	53.20%
2008	Barack Obama	Democratic	69.5	52.87%	365	67.80%

The table above gives information about the voting patterns in United States presidential elections from 1960 to 2008. In addition to giving the name and the political party of the President elected in each year, the table provides the total popular vote and electoral vote that the winner received in that election, as well as the percentage of the total vote that each figure represents.

Each column of the table can be sorted in ascending order by clicking on the word “Select” above the table and choosing, from the drop-down menu, the heading of the column on which you want the table to be sorted.

Alternate Sort 1: *Electoral Vote*

Year of Election	President	Political Party	Popular Vote (millions)	% of Popular Vote	Electoral Vote	% of Electoral Vote
2000	George W. Bush	Republican	50.5	47.87%	271	50.40%
2004	George W. Bush	Republican	62.0	50.73%	286	53.20%
1976	James Carter	Democratic	40.8	50.08%	297	55.20%
1968	Richard Nixon	Republican	31.8	43.42%	301	55.90%
1960	John Kennedy	Democratic	34.2	49.72%	303	56.40%
2008	Barack Obama	Democratic	69.5	52.87%	365	67.80%
1992	William Clinton	Democratic	44.9	43.01%	370	68.80%
1996	William Clinton	Democratic	47.4	49.23%	379	70.40%
1988	George Bush	Republican	48.9	53.37%	426	79.20%
1964	Lyndon Johnson	Democratic	43.1	61.05%	486	90.30%
1980	Ronald Reagan	Republican	43.9	50.75%	489	90.90%
1972	Richard Nixon	Republican	47.2	60.67%	520	96.70%
1984	Ronald Reagan	Republican	54.4	58.77%	525	97.60%

Alternate Sort 2: *Percent of Popular Vote*

Year of Election	President	Political Party	Popular Vote (millions)	% of Popular Vote	Electoral Vote	% of Electoral Vote
1992	William Clinton	Democratic	44.9	43.01%	370	68.80%
1968	Richard Nixon	Republican	31.8	43.42%	301	55.90%
2000	George W. Bush	Republican	50.5	47.87%	271	50.40%
1996	William Clinton	Democratic	47.4	49.23%	379	70.40%
1960	John Kennedy	Democratic	34.2	49.72%	303	56.40%
1976	James Carter	Democratic	40.8	50.08%	297	55.20%
2004	George W. Bush	Republican	62.0	50.73%	286	53.20%
1980	Ronald Reagan	Republican	43.9	50.75%	489	90.90%
2008	Barack Obama	Democratic	69.5	52.87%	365	67.80%
1988	George Bush	Republican	48.9	53.37%	426	79.20%
1984	Ronald Reagan	Republican	54.4	58.77%	525	97.60%
1972	Richard Nixon	Republican	47.2	60.67%	520	96.70%
1964	Lyndon Johnson	Democratic	43.1	61.05%	486	90.30%

Consider each of the following statements. Does the information contained in the two emails and the memorandum support the inference as stated?

True **False** **Question 9-1** **The President who received the median number of electoral votes also received the median number of popular votes.** **Question 9-2** **Of those Presidents elected for two terms, William Clinton had the smallest percent increase in popular vote between the two years.** **Question 9-3** **The average (arithmetic mean) number of electoral votes received by Democratic presidents was greater than the average number of electoral votes received by Republican presidents.** **Question 9-4** **The**

same President was elected in the two election years in which the winner's percentage of the popular vote and percent age of the electoral vote were most nearly equal. Data for Items 10, 11 and 12:

Memo #1 Memo #2 Email #1

MEMORANDUM

To: Regional Office Managers
From: Chief Operations Officer
RE: Travel planning

Once again, our annual management retreat will be held in Bloomsbury. In preparation for this year's retreat, all Regional Office Managers (ROMs) will be responsible for arranging the travel reservations for all Level 2 managers within his or her Region. You may delegate that task should you wish.

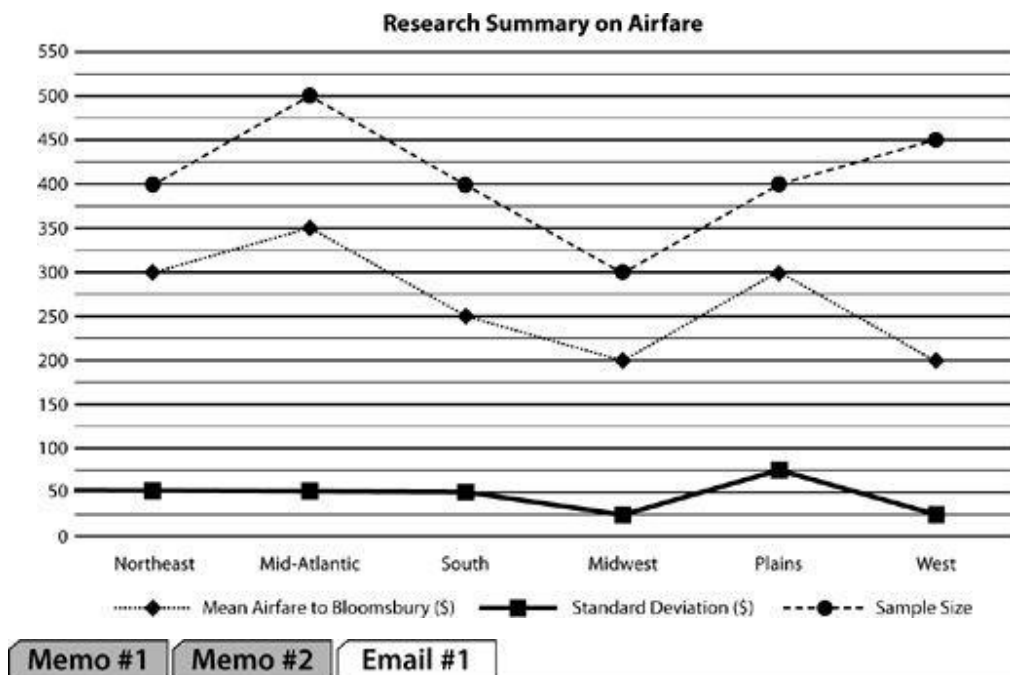
ROMs will receive a research memorandum from the Logistics Division providing the average airfare from the 6 Regions to Bloomsbury. While ROMs should use that average airfare as a guide, we anticipate that there may be some variation in ticket prices based upon the specifics of travel arrangements. As such, Regional offices will be reimbursed for the full cost of any plane ticket priced within 1 (one) standard deviation of the average airfare from its region to Bloomsbury, inclusive. For any ticket priced more than 1 (one) standard deviation above the mean, regional offices will be reimbursed up to the average airfare from your region to Bloomsbury. For any ticket priced more than 1 (one) standard deviation below the average, in addition to full reimbursement of the ticket cost, regional offices will receive a "Budget Bonus" of 50% of the difference between the ticket price and the average airfare from your region to Bloomsbury.

Memo #1 Memo #2 Email #1

MEMORANDUM

To: Regional Office Managers
From: Logistics Division
RE: Airfare Research

The attached chart lists the average (arithmetic mean) airfare from the listed Regions to Bloomsbury. The mean airfare was calculated based upon taking a normally distributed sample of airfares. The standard deviation and size of each sample is also listed in the chart.



Email from Marco Roland, Human Resources Manager, West Region to Marisa Cortland, Regional Office Manager, West Region

Dear Marisa,

Tickets have been purchased for all of the Level 2 Managers in the West Region. Below is a summary

Airfare	Number of Tickets Purchased
\$150	18
\$210	4
\$230	8

Best,
Marco

Item 10:

Consider each of the following statements. Does the information contained in the two memoranda and the email support the stated inference?

Yes No

- (A) The management retreat is held at Bloomsbury most years.
- (B) No region had a lower average (arithmetic mean) airfare to Bloomsbury than the Midwest.
- (C) Only Level 2 managers will attend the management retreat.
- (D) The Regional Office Manager need not make the reservations personally.

Item 11:

Consider each of the following statements. Based upon the information contained in the two memoranda and the email, determine whether each statement is true or false as stated.

Yes No

- (A) The West Region will receive a “Budget Bonus” of \$450.
- (B) In the Mid-Atlantic sample, more than 20 tickets were priced over \$450.
- (C) In the Northeast sample, more than 50 tickets were priced under \$250.
- (D) In the sample, the ticket price two standard deviations below the mean for the Midwest was less than that for Plains.

Item 12:

If one of the tickets purchased by the West Region's Level 2 managers were selected at random, what is the probability that it will be fully reimbursed?

(A) $\frac{4}{15}$

(B) $\frac{9}{15}$

(C) $\frac{11}{15}$

(D) $\frac{12}{15}$

(E) $\frac{14}{15}$

PRACTICE INTEGRATED REASONING: SECTION 2

12 Items

Time limit: 30 minutes

This section is a full practice Integrated Reasoning section. Please note that some questions are laid out slightly differently in this book versus what you'll see on the GMAT. Many of the new question formats are interactive. Hence, only approximations can be printed. Specifically,

Table Analysis questions are shown with a main sort and several alternate sorts. You may not need every sort.

Graphics Interpretation questions include drop down boxes. In this book, the box is shown as a fill-in blank and the answers printed below the blank.

For Multi-Source Reasoning questions, we've printed what's on each tab

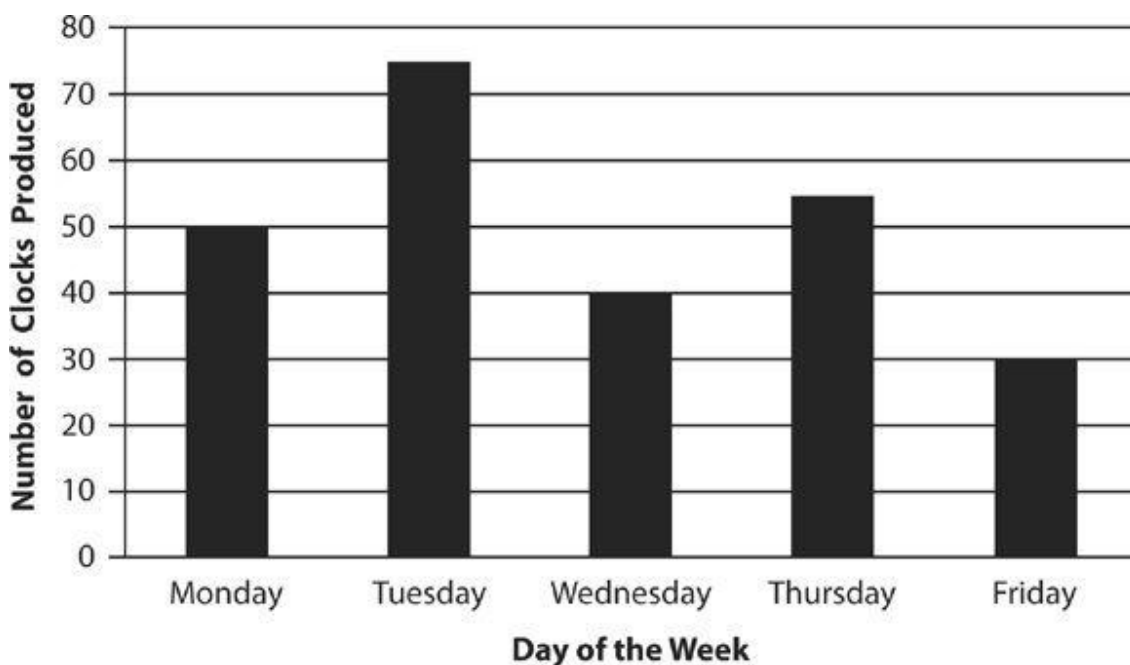
consecutively on the page.

For some questions, you'll see (A), (B), (C), etc. next answer choices.

We've included answers to this section starting on [this page](#).

At the time this book was printed, GMAC had not released the scoring scale for the Integrated Reasoning section. We'll make a scoring grid available in your online tools as soon as possible so that you can compute your score on the section.

Item 1:



The graph above gives the daily output in a particular five day work week at a certain clock factory. Use the drop-down menus to fill in the blanks in each of the following statements based on the information given by the graph.

Question 1-1:

The ratio of the number of clocks produced on Tuesday to that on Wednesday is approximately.

- (A) 15 to 8

(B) 12 to 7

(C) 10 to 9

(D) 8 to 11

(E) 5 to 13

Question 1-2:

The number of clocks produced on Monday and Wednesday combined is approximately of the number of clocks produced over the entire week.

(A) 16%

(B) 20%

(C) 28%

(D) 36%

(E) 45%

Question 1-3:

The number of clocks produced on Monday is more than the number produced on Friday.

(A) 5

(B) 10

(C) 15

(D) 20

(E) 25

Item 2:

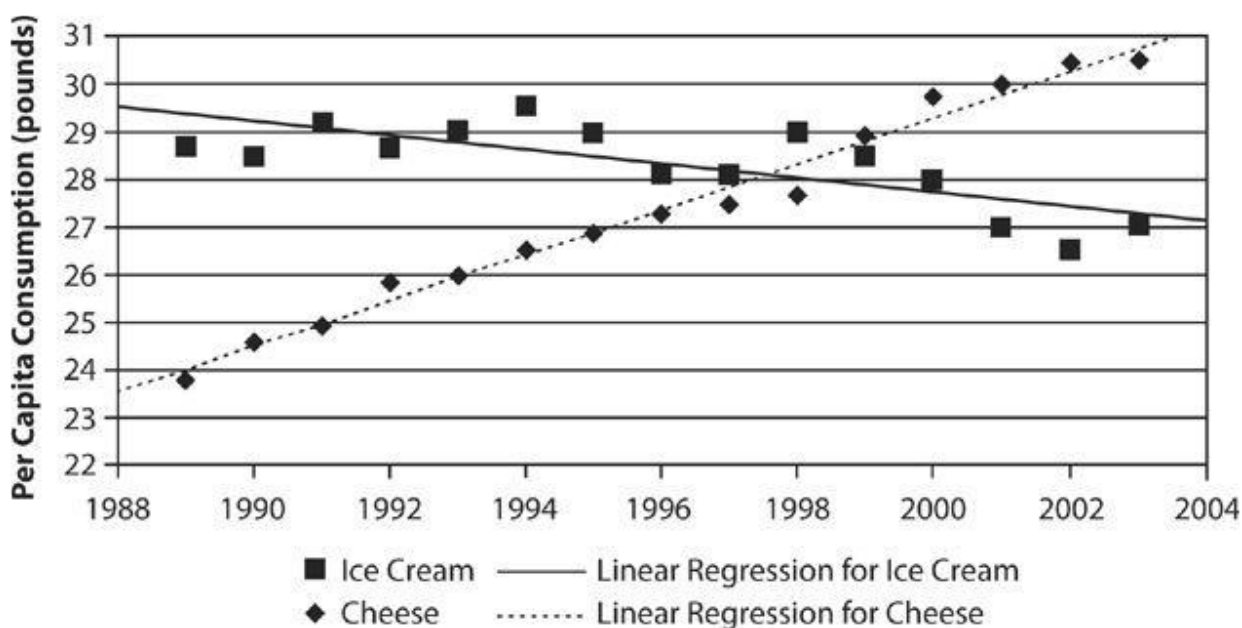
Company X: Our company's computer technology is out of date. We will be unable to compete effectively in the modern economy if we are not using current computer technology. We have decided to purchase throughout the company new computers that run Portals 8, the newest version of the world's best-selling operating system.

Technology Consultant: We agree that Company X needs to purchase new computers, but instead of installing Portals 8, Company X should purchase GreenCap, our consulting firm's proprietary operating system. The initial purchase of a GreenCap operating system costs substantially less than does Portals 8, and it provides the same functionality with current computer technology. With the money it would save, Company X would be better able to compete effectively in the modern economy.

In the table below, identify which statement, if true, most weakens A's argument, and which statement, if true, most weakens B's argument.

	Company X	Technology Consultant	Statement
(A)	<input type="radio"/>	<input type="radio"/>	GreenCap makes more efficient use of computer resources than does Portals 8.
(B)	<input type="radio"/>	<input type="radio"/>	GreenCap is not the most cutting-edge software available on the market.
(C)	<input type="radio"/>	<input type="radio"/>	Although Portals 8 was released this year, GreenCap has been available for three years.
(D)	<input type="radio"/>	<input type="radio"/>	GreenCap requires purchase of an annual maintenance agreement, making it more expensive overall than Portals 8.
(E)	<input type="radio"/>	<input type="radio"/>	Portals 8 is available in several different versions with different price levels, depending on the proposed use of the operating system.
(F)	<input type="radio"/>	<input type="radio"/>	Portals 8, which

was newly released, contains bugs and design flaws that would impair Company X’s ability to compete in the modern economy. **Item 3:**



The graph above is a scatter plot with 30 points, each representing the per capita consumption, in pounds, in the United States of a particular dairy product during the years 1989 through 2003. The solid line is a regression line for the points representing the per capita consumption of ice cream (and other frozen dairy products). The dashed line is a regression line for the points representing the per capita consumption of cheese. Use the drop-down menus to fill in the blanks in each of the following statements based on the information given by the graph.

Question 3-1:

Based on the line of regression, the expected per capita consumption of ice cream in 2015 would be approximately _____ pounds.

(A) 21

(B) 26

(C) 31

(D) 36

(E) 41

Question 3-2:

For the year with the lowest total per capita consumption of both ice cream and cheese combined, the ratio of per capita ice cream consumption to per capita cheese consumption was approximately _____.

(A) 2 to 3

(B) 3 to 2

(C) 6 to 5

(D) 5 to 6

Question 3-3:

The slope of the regression line for ice cream is _____ the slope of the regression line for cheese.

(A) greater than

(B) less than

(C) equal to

Item 4:

XM Representative: The federal committee thoroughly reviews all of the geo-engineering industry’s planned projects and approves only those that meet your guidelines for safety and environmental impact. Since less than two percent of XM projects have ever been rejected, the costly and time-consuming review should be waived so that our latest project can be quickly passed and implemented.

Committee Member: Your request fails to consider that the decisions of our board affect not only the corporation involved, but also the entire field. If we fail to review your project, we also fail to observe innovations in geo-engineering that may need guidelines drafted for the safety of subsequent projects throughout the industry.

In the table below, please identify the additional evidence that most strengthens and the additional evidence that most weakens the committee member’s response to the XM representative.

	Most Strengthens	Most Weakens	Additional Evidence
(A)	<input type="radio"/>	<input type="radio"/>	XM’s latest project is nearly identical to a previous project by XM that had successfully passed the committee review process
(B)	<input type="radio"/>	<input type="radio"/>	The geo-engineering corporation CL, which is XM’s biggest competitor, has had less than one percent of its projects rejected by the committee
(C)	<input type="radio"/>	<input type="radio"/>	Once a geo-engineering innovation has been passed by the committee, the same innovation is automatically approved in all subsequent projects, without further review.
(D)	<input type="radio"/>	<input type="radio"/>	Many of XM’s geo-engineering projects are peer-reviewed within the industry before they are submitted to the federal committee.
(E)	<input type="radio"/>	<input type="radio"/>	Geo-engineering is a hazardous field that deserves careful monitoring.
(F)	<input type="radio"/>	<input type="radio"/>	The federal committee has had to reverse some of its decisions on past projects.

Item 5:

A group of entomologists estimates that the population of Insect Species X is decreasing at a constant rate of 10% per year, while the population of Insect Species Y is decreasing at a constant rate of 15% per year. Based on these estimates, in four years, the two species will have equal populations, rounded to the nearest million.

In the table below, identify a number for the current population of Insect Species X, in millions, and a number for the current population of Insect Species Y, in millions, that could be consistent with the entomologists' estimates.

	Insect Species X		Insect Species Y		Current Populations (in millions)						
(A)	<input type="radio"/>	<input type="radio"/>	450	(B)	<input type="radio"/>	<input type="radio"/>	525	(C)	<input type="radio"/>	<input type="radio"/>	565
(D)	<input type="radio"/>	<input type="radio"/>	600	(E)	<input type="radio"/>	<input type="radio"/>	625	(F)	<input type="radio"/>	<input type="radio"/>	770

Data for Items 6, 7 and 8:

Email #1 Email #2 Memo #1

Email from Marketing Director to Marketing Researcher on October 4, 2011.

As you know, our revenue growth rate has declined for the past three quarters. To address this, I suggest that we initiate a massive advertising buy. On three separate occasions, in 1978, 1987, and 1993, we have responded to falling revenues by increasing our advertising expenditures by 30%. On all three occasions, within one quarter, our revenues began to increase again. Therefore, if we increase the number of advertisements targeted at our top consumers by 30%, we will once again increase our revenues.

Since our top consumers are females aged 15 – 25, compile a list of the top two television programs watched by that group. Also research the prices for a 30-second commercial for each television program.

Email #1 Email #2 Memo #1

Email from Marketing Researcher to Marketing Director on October 10, 2011.

We've hit a slight complication in our research. While we've had no problem determining the top two programs and advertising prices for each, we've realized that there is a fair amount of overlap between the viewers of the two programs. We've found that 80% of the audience for Hart Attack also watches Blonde Fury.

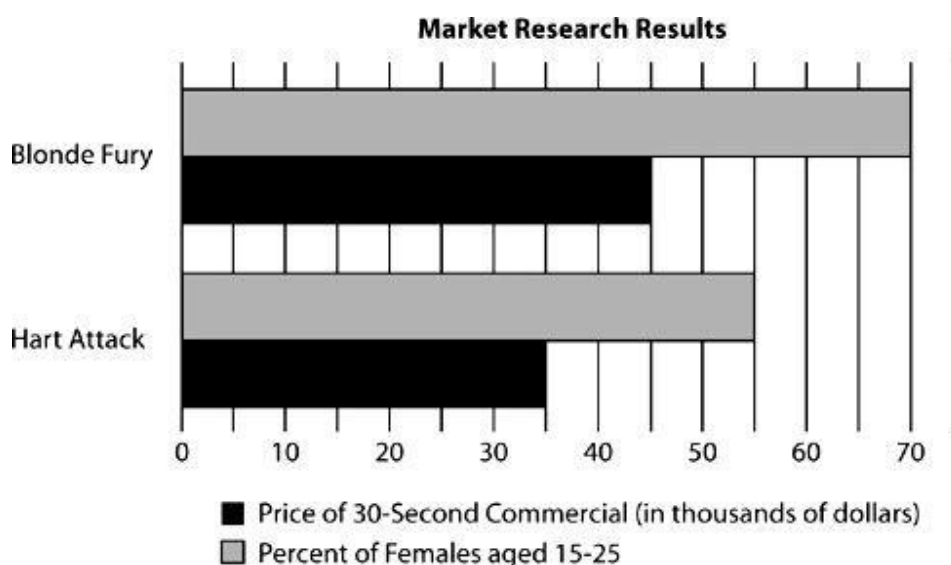
I'll send you the chart summarizing the audience size and advertising prices tomorrow.

Email #1 Email #2 Memo #1

MEMORANDUM

TO: Marketing Director
 FROM: Marketing Researcher
 DATE: October 11, 2011
 RE: Market Research Results

The attached chart presents the results from our research on the top 2 television programs for Females aged 15-25.



Item 6:

Consider each of the following statements. Does the information in the memo and the table support the inference as stated?

Yes No

(A) Yes No More females aged 15-25 watch Blonde Fury than do any other group.

(B) Yes No Advertisements are more expensive during higher rated programs.

(C) Hart Attack has a higher ratio of viewers per dollar spent on advertising than *Blonde Fury*.

(D) Females aged 15-25 make up the majority of the company's customers.

Item 7:

If there are 20,000,000 females aged 15-25, then how many females aged 15-25 (in millions) watch neither *Blonde Fury* nor *Hart Attack*?

(A) 1.4

(B) 4.0

(C) 5.6

(D) 9.6

(E) 11.2

Item 8:

Consider each of the following statements. Based upon the information contained in the two emails and the memoranda, determine whether each statement is an assumption made by the Marketing Director.

Yes No

(A) It is possible for a strategy that succeeded in the past to succeed again.

(B) The previous increases in revenues were attributable at least in part to the effect of increased advertising

(C) Increasing the number of advertisements has a similar effect on revenues as increasing the amount of money spent on advertising expenditures.

(D) Television advertisements remain as effective at reaching a targeted audience as they were in the past.

Item 9:

Name	Population 2010	Population 2050	% of Population Foreign-Born
Andorra	84,000	75,000	77.25
Australia	22,729,000	29,013,000	19.93
Barbados	273,000	282,000	9.31
Brazil	190,733,000	260,692,000	0.34
Canada	34,611,000	41,136,000	18.76
China	1,399,725,000	1,303,723,000	0.29
Egypt	80,942,000	137,873,000	0.22
France	65,822,000	69,768,000	10.18
India	1,210,193,000	1,656,554,000	0.52
Indonesia	237,556,000	313,021,000	0.07
Kazakhstan	16,518,000	15,100,000	16.88
Laos	6,230,000	10,069,000	0.42
Nauru	10,000	12,000	38.45
Portugal	10,637,000	9,933,000	7.2
Republic of the Congo	4,043,000	9,599,000	7.2
Russia	142,914,000	109,187,000	8.48
Suriname	525,000	617,000	1.11
United Kingdom	62,436,000	71,154,000	8.98
United States	312,399,000	439,010,000	21.81

The table above gives 2010 population based on UN estimates and 2050 populations based on UN projections for 19 selected countries. The table also gives the UN estimates of the percentage of the population that is foreign-born for each country in 2010.

Each column of the table can be sorted in ascending order by clicking on the word “Select” above the table and choosing, from the drop-down menu, the heading of the

column on which you want the table to be sorted.

Alternate Sort 1: *Population 2010*

Name	Population 2010	Population 2050	% of Population
Nauru	10,000	12,000	38.45
Andorra	84,000	75,000	77.25
Barbados	273,000	282,000	9.31
Suriname	525,000	617,000	1.11
Republinc of the Congo	4,043,000	9,599,000	7.2
Laos	6,230,000	10,069,000	0.42
Portugal	10,637,000	9,993,000	7.2
Kazakhstan	16,518,000	15,100,000	16.88
Australia	22,729,000	29,013,000	19.93
Canada	34,611,000	41,136,000	18.76
United Kingdom	62,436,000	71,154,000	8.98
France	65,822,000	69,768,000	10.18
Egypt	80,942,000	137,873,000	0.22
Russia	142,914,000	109,187,000	8.48
Brazil	190,733,000	260,692,000	0.34
Indonesia	237,556,000	313,021,000	0.07
United States	312,399,000	439,010,000	21.81
India	1,210,193,000	1,656,554,000	0.52
China	1,399,725,000	1,303,723,000	0.29

Consider each of the following statements about these countries. For each statement indicate whether the statement is supported based on the information provided in the table.

- Supported** **Unsupported** **Question 9-1** **Of the countries with a population of greater than 150 million in 2010, the one with the median number of foreign-born inhabitants is China. Question 9-2**
- The total population of Laos is projected to be about 8 million in 2030. Question 9-3** **Andorra has the highest rank in terms of number of foreign-born inhabitants. Question 9-4**
- Russia is projected to have the highest percent decrease in population from 2010 to 2050. Data for Items 10, 11, and 12:**

The following emails come from the Public Relations division of a large non-profit organization.

Email #1 Email #2 Email #3

Hello Gloria!

We have to choose a caterer for the upcoming gala. Two under consideration are DoxySource and BrightRight. Although DoxySource has delivered satisfactory service in the past, our First Annual Sponsors Gala promises to be the largest event we have ever hosted, and BrightRight is known for large event planning and production. However, I'd like more information before switching from a tried and true contractor. Also, I'd like to consider how to justify any over-budget costs from using BrightRight, if that comes up. I am committed to using only one provider. Please work up a comparison of costs of services and rentals for BrightRight and DoxySource. We require: tables, audio, food, and a punch fountain or fountains (a dessert fountain would be a lovely addition). Our budget is \$6,000.00, and we plan for a maximum of 400 people.

Thanks!
Evelyn Schott
Gala Coordinator

Email #1 Email #2 Email #3

Hello Evelyn,
I've broken out the data in the following chart:

	DoxySource		BrightRight	
	Description	Price	Description	Price
AUDIO	200 Watt P.A. System (up to 40 people)	\$65.00	Party Sound System	\$650.00
	500 Watt P.A. System (up to 120 people)	\$90.00	Marquee Sound System	\$850.00
CATERING	Choice of appetizers (shrimp or spring roll)	\$2.00 per piece	The Classic Western BBQ	\$14.00 per person
	Choice of entree (chicken or beef w/ rice)	\$6.25 per piece	The Greek Feast	\$17.50 per person
	Choice of dessert (cupcakes or lemon bars)	\$3.40 per piece	The Far East Extravaganza	\$19.50 per person
TABLES	Trestle Table (seats 8)	\$15.50	Classroom (seats 8)	\$20.00
	Circular Table (seats 7)	\$17.00	Bistro/High-top (seats 6)	\$22.00
FOUNTAINS	Chocolate Fountain (supplies not included)	\$105.00	Chocolate Fountain (supplies included)	\$500.00
	Punch Fountain (7 gallons, provided, serves approx. 70)	\$47.00	Punch Fountain, waterfall tier (40 gallons, provided)	\$350.00

BrightRight offers packages that are generally more elegant and comprehensive, and more expensive. For instance, we can choose a single full meal set, such as “The Greek Feast,” for the entire gala. Using Doxy Source, while more economical and flexible in the catering, does mean more hands-on involvement on our end.

The biggest price difference comes in the audio systems. BrightRight, which consistently hosts events with attendance of several hundreds, offers complex systems that include lights and sound effects, in addition to high-definition audio reproduction. DoxySource offers two standard, large public address systems. I am not sure whether the Gala will need all the flash and sizzle of the high-end sound system; but the projected attendance is above the recommended usage for DoxySource’s P.A. systems. Due to electrical concerns, we can only have one P.A. system at the gala.

Gloria Welch
Administrative Assistant, Public Relations

Item 10:

Based on the information in the communications above, and assuming the maximum number of guests, which of the following must be true?

Yes No

(A) If the coordinator uses DoxySource and orders one appetizer, one entrée and one dessert per person, then the table costs will be approximately 16.6% of the food costs.

- (B) If the large punch fountain from BrightRight is sufficient for 400 guests, then using smaller fountains from DoxySource to serve the same number of guests would cost at least 20% less per gallon.
- (C) If BrightRight is used, the project will go over its present budget by at least 15%.
- (D) If the coordinator uses DoxySource, she can add the chocolate fountain without a budget increase assuming chocolate fountains supplies cost \$0.50 per guest.

Item 11:

Suppose the Gala Coordinator uses DoxySource, for the maximum number of guests. If she wants to use at least one of each type of table, then the lowest total cost for tables would be:

- (A) \$775.00
- (B) \$778.44
- (C) \$792.00
- (D) \$873.21
- (E) \$971.43

Item 12:

Which of the following statements can be most reasonably inferred from the messages between the Gala Coordinator and the Administrative Assistant?

Yes No

(A) The Gala Coordinator is willing to ask for a budgetary increase, if necessary.

(B) If the Gala Coordinator wants to ensure that the Gala has audio equipment appropriate to the size of the Gala, she must contract with BrightRight.

(C) According to the Administrative Assistant, audio costs are not the only determining factor in choosing one event planning service over another.

(D) Fountains are an optional element of the gala.

Part V

How to Crack the Analytical Writing Assessment

21 Analytical Writing Assessment

Chapter 21

Analytical Writing Assessment

Writing a coherent essay in 30 minutes might seem daunting, but in this chapter, you will learn techniques of pre-construction and pre-structuring that will make the process easy. You will also learn how the essay is scored and the *key factor* the readers are told to look for. (*Hint*: It isn't originality.)

The very first thing you will be asked to do on the GMAT is to write an essay using a word-processing program. You will have 30 minutes for your essay. You will not be given the essay topic in advance, nor will you be given a choice of topics. However, there is a complete list of all the possible writing assessment topics available for you to review on the GMAC website. Simply go to www.mba.com/mba/TaketheGMAT,

select the link for the Analytical Writing Assessment section, and follow the directions to download a list of current topics. Oh, and just in case you are wondering, it's free!

Old GMAT vs New GMAT

If you are taking your GMAT before June 4, 2012, your test will have two essays: Analysis of an Issue and Analysis of an Argument. This chapter does not discuss the Issue essay.

Why Have an Essay on the GMAT?

The business schools themselves asked for the essay. Recent studies have indicated that success in business (and in business school) actually depends more on verbal skills than has been traditionally thought.

The business schools have also had to contend with a huge increase in the number of applicants from overseas. Admissions officers at the business schools were finding that the application essays they received from outside the United States did not always accurately reflect the abilities of the students who were supposed to have written them. To put it more bluntly, some of these applicants were paying native English speakers to write their essays for them.

The GMAT Analytical Writing Assessment (AWA) is thus at least partly a check on the writing ability of foreign applicants who now make up more than one-third of all applicants to American business schools.

At the business schools' request, all schools to which you apply now receive, in addition to your AWA score, a copy of the actual essay you wrote.

How Do the Schools Use the Analytical Writing Assessment?

If you are a citizen of a non-English-speaking country, you can expect the schools to look quite closely at both the score you receive on the essay you write and the essay itself. If you are a native English speaker with reasonable Verbal scores and English grades in college, then the AWA is not likely to be a crucial part of your package.

On the other hand, if your verbal skills are *not* adequately reflected by your grades in college, or in the other sections of the GMAT, then a strong performance on the

AWA could be extremely helpful.

How Is the Essay Scored?

When you get your GMAT score back from GMAC, you will also receive a separate score for the AWA. Your essay is read by two readers, each of whom will assign your writing a grade from 0 to 6, in half-point increments (6 being the highest score possible). If the two scores are within a point of each other, they will be averaged. If there is more than a one-point spread, the essay will be read by a third reader, and scores will be adjusted to reflect the third scorer's evaluation.

The essay readers use the "holistic" scoring method to grade essays; your writing will be judged not on small details but rather on its overall impact. The readers are supposed to ignore small errors of grammar and spelling. Considering that these readers are going to have to plow through more than 600,000 essays each year, this is probably just as well.

Who Are These Readers Anyway?

We'll put this in the form of a multiple-choice question:

Your essay will be read by:

- (A) captains of industry
- (B) leading business school professors
- (C) college TAs working part time

If you guessed C, you're doing just fine. Each essay will be read by part-time employees of the testing company, mostly culled from graduate school programs.

Admissions Insight No. 11: Financial Aid, Part 1

The perception is that there is no financial aid available for business school. While this is generally true in the case of grants (money you don't

have to pay back), it is not true about government-subsidized student loans. Right now, about 70 percent of graduate students receive some form of aid.

How Much Time Do They Devote to Each Essay?

The graders get two minutes, tops. They work in eight-hour marathon sessions (nine to five, with an hour off for lunch), and are each required to read 30 essays per hour. Obviously, these poor graders do not have time for an in-depth reading of your essay. They probably aren't going to notice how carefully you thought out your ideas or how clever your analysis was. Under pressure to meet their quota, they are simply going to be giving it a fast skim. By the time your reader gets to your essay, she will probably have already seen more than a hundred essays—and no matter how ingenious you were in coming up with original ideas, she's already seen them.

So How Do You Score High on the AWA Essays?

On the face of it, you might think it would be pretty difficult to impress these jaded readers, but it turns out that there are some very specific ways to persuade them of your superior writing skills.

What GMAC Doesn't Want You to Know

In a 1982 internal study, two researchers from one of the big testing companies analyzed a group of essays written by actual test takers and the grades that those essays received. The most successful essays had one thing in common. Which of the following characteristics do you think it was?

- good organization
- proper diction
- noteworthy ideas
- good vocabulary
- sentence variety
- length

number of paragraphs

What Your Essay Needs in Order to Look Like a Successful Essay

Those researchers discovered that the essays that received the highest grades from the essay graders had one single factor in common: length.

To ace the AWA, you need to take one simple step: *Write as much as you possibly can*. Each essay should include at least four indented paragraphs.

Admissions Insight No. 12: Financial Aid, Part 2

The best kind of student loans: low-cost Stafford loans (which don't have to be repaid until the student has graduated or left the program and which generally have much lower rates than regular, unsecured loans). Graduate students can borrow up to \$20,500 per year in Stafford loans (of which at least \$12,000 must be unsubsidized, so you'll pay interest from the start). If necessary, borrow the rest through private educational loans.

How Does the Word-Processing Program Work?

The test makers have created a simple word-processing program to allow students to compose their essays on the screen.

Practice Test 1 Time Remaining 74:58
1 of 37

The following appeared as part of a medical advertisement in a magazine.

"A new medical test that allows the early detection of a particular disease will prevent the deaths of people all over the world who would otherwise die from the disease. The test has been extremely effective in allowing doctors to diagnose the disease six months to a year before it would have been spotted by conventional means."

Discuss how logically convincing you find this argument. In explaining your point of view, be sure to evaluate the line of reasoning and the use of evidence in the argument. For example, it may be necessary to consider what questionable assumptions underlie the thinking and what other explanations or counterexamples might weaken the argument's conclusion. You can also discuss what kind of evidence would strengthen or refute the argument, what changes in the argument would make it more logically persuasive, and what, if anything, would enable you to better evaluate its conclusion.

Cut Copy Paste Undo Redo

The argument that this new medical test |

Help End Exam Next →

The question always appears at the top of your screen. Below it, in a box, will be your writing area (where you can see a partially completed sentence). When you click inside the box with your mouse, a winking cursor will appear, indicating that you can begin typing. The program supports the use of many of the normal computer keys, plus the following shortcuts:

Cut: Ctrl + X and Alt + T

Copy: Ctrl + C and Alt + C

Paste: Ctrl + V and Alt + A

Undo: Ctrl + Z and Alt + U

Redo: Ctrl + Y and Alt + R

You can also use the icons above the writing area to copy and paste words, sentences, or paragraphs and to undo and redo actions.

Obviously, this small box is not big enough to display your entire essay.

However, you can see your entire essay by using the scroll bar, the up and down arrows, or the Page Up and Page Down keys.

Does Spelling Count?

Officially, no. Essay readers are supposed to ignore minor errors of spelling and grammar. However, the readers wouldn't be human (so to speak) if they weren't influenced favorably by an essay that had no obvious misspelled words or unwieldy constructions. Unfortunately, there is no spell-check function in the word-processing program.

What Will the Essay Topic Look Like?

There's only one type of essay topic: Analysis of an Argument. Here's an example:

Analysis of an Argument

The following appeared as part of a medical advertisement in a magazine.

“A new medical test that allows the early detection of a particular disease will prevent the deaths of people all over the world who would otherwise die from the disease. The test has been extremely effective in allowing doctors to diagnose the disease six months to a year before it would have been spotted by conventional means.”

Discuss how logically convincing you find this argument. In explaining your point of view, be sure to evaluate the line of reasoning and the use of evidence in the argument. For example, it may be necessary to consider what questionable assumptions underlie the thinking and what other explanations or counterexamples might weaken the argument's conclusion. You can also discuss what kind of evidence would strengthen or refute the argument, what changes in the argument would make it more logically persuasive, and what, if anything, would enable you to better evaluate its conclusion.

THE AWA: BASIC PRINCIPLES

You might think that there is really no way to prepare for the AWA (other than by practicing writing over a long period of time and by practicing your typing skills). After all, you won't find out the topic of the essay they'll ask you to write until you get there, and there is no way to plan your essay in advance.

However, it turns out there are some very specific ways to prepare for the GMAT essay. Let's take a look.

Create a Template

When a builder builds a house, the first thing he does is construct a frame. The frame supports the entire house. After the frame is completed, he can nail the walls and windows to the frame. We're going to show you how to build the frame for the perfect GMAT essay. Of course, you won't know the exact topic of the essay until you get there (just as the builder may not know what color his client is going to paint the living room), but you will have an all-purpose frame on which to construct a great essay no matter what the topic is.

We call this frame the *template*.

Admissions Insight No. 13: Financial Aid, Part 3

To get student loans, you will probably have to fill out both the FAFSA form (available at www.fafsa.ed.gov) and the PROFILE form (available at www.collegeboard.com).

For simple and straightforward advice about making your way through all of that financial aid paperwork, visit PrincetonReview.com.

Preconstruction

Just as a builder can construct the windows of a house in his workshop weeks before he arrives to install them, so too can you pre-build certain elements of your essay.

We call this *preconstruction*.

In the rest of this chapter, we'll show you how to prepare *ahead of time* to write essays on two topics you won't see until they appear on your screen.

ANALYSIS OF AN ARGUMENT

The Analysis of an Argument essay must initially be approached just like a logical argument in the Critical Reasoning section.

An Analysis of an Argument topic requires the following steps:

Step 1:

Read the topic and separate out the conclusion from the premises.

Step 2:

Because they're asking you to critique (i.e., weaken) the argument, concentrate on identifying its assumptions.

Brainstorm as many different assumptions as you can think of. It helps to write or type these out.

Step 3:

Look at the premises. Do they actually help to prove the conclusion?

Step 4:

Choose a template that allows you to attack the assumptions and premises in an organized way.

Step 5:

At the end of the essay, take a moment to illustrate how these same assumptions could be used to make the argument more compelling.

Step 6:

Read over the essay and do some editing.

Opinions Vs. Arguments

The most common mistake our students make is offer an opinion on the topic

presented in the argument. For the Analysis of an Argument essay, you need to analyze the reasoning rather than explain why you agree or disagree.

What the Readers Look For

An Analysis of an Argument topic presents you with an argument. Your job is to critique the argument’s line of reasoning and the evidence supporting it and suggest ways in which the argument could be strengthened. You aren’t required to know more about the subject than would any normal person—but you must be able to spot logical weaknesses. This should start to remind you of Critical Reasoning.

The essay readers will look for four things as they skim through your Analysis of an Argument essay at the speed of light. According to GMAC, “an outstanding argument essay...

- clearly identifies and insightfully analyzes important features of the argument;
- develops ideas cogently, organizes them logically, and connects them smoothly with clear transitions;
- effectively supports the main points of the critique; and
- demonstrates superior control of language, including diction, syntactic variety, and the conventions of standard written English. There may be minor flaws.”

To put it more simply, the readers look for good organization, good analysis based on a cursory understanding of the rules of logic, and reasonable use of the English language.

Critical Reasoning in Essay Form

In any GMAT argument, the first thing to do is to separate the conclusion from the premises.

Let’s see how this works with an actual essay topic. Check out the Analysis of an Argument topic you saw before.

Topic:

The following appeared as part of a medical advertisement in a magazine.

“A new medical test that allows the early detection of a particular disease will prevent the deaths of people all over the world who would otherwise die from the disease. The test has been extremely effective in allowing doctors to diagnose the disease six months to a year before it would have been spotted by conventional means.”

Discuss how logically convincing you find this argument. In explaining your point of view, be sure to evaluate the line of reasoning and the use of evidence in the argument. For example, it may be necessary to consider what questionable assumptions underlie the thinking and what other explanations or counterexamples might weaken the argument’s conclusion. You can also discuss what kind of evidence would strengthen or refute the argument, what changes in the argument would make it more logically persuasive, and what, if anything, would enable you to better evaluate its conclusion.

The conclusion in this argument comes in the first line:

A new medical test that allows the early detection of a particular disease will prevent the deaths of people all over the world who would otherwise die from that disease.

The premises are the evidence in support of this conclusion.

The test has been extremely effective in allowing doctors to diagnose the disease six months to a year before it would have been spotted by conventional means.

The assumptions are the *unspoken* premises of the argument—without which the argument would fall apart. Remember that assumptions are often causal, analogical, or statistical. What are some assumptions of *this* argument? Let’s brainstorm.

Brainstorming for Assumptions

You can often find assumptions by looking for a gap in the reasoning:

Medical test → **early detection**: According to the conclusion, the medical test leads to the early detection of the disease. There doesn’t seem to be a gap here.

Early detection → **nonfatal**: In turn, the early detection of the disease allows patients to survive the disease. Well, hold on a minute. Is this necessarily true? Let’s brainstorm:

First of all, do we know that early detection will necessarily lead to survival? We don’t even know if this disease is *curable*. Early detection of an incurable disease is not going to help someone survive it.

Second, will the test be widely available and cheap enough for general use? If the test is expensive or only available in certain parts of the world, people will continue to

die from the disease.

Will doctors and patients interpret the tests correctly? The test may be fine, but if doctors misinterpret the results or if patients ignore the need for treatment, then the test will not save lives.

The Use of the Evidence

Okay, we've uncovered some assumptions. Now, the essay graders also want to know what we thought of the argument's "use of evidence." In other words, did the premises help to prove the conclusion? Well, in fact, no, they didn't. The premise here (the fact that the test can *spot* the disease six months to a year earlier than conventional tests) does not really help to prove the conclusion that the test will save *lives*.

B-School Lingo

three Cs: the primary forces considered in marketing—Customer, Competition, Company

Source: *Best 294 Business Schools*

Organizing the Analysis of an Argument Essay

We're ready to put this into a ready-made template. In any Analysis of an Argument essay, the template structure will be pretty straightforward: You're simply going to reiterate the argument, attack the argument in three different ways (one to a paragraph), summarize what you've said, and mention how the argument could be strengthened. From an organizational standpoint, this is pretty easy. Try to minimize your use of the word "I." *Your* opinion is not really the point in an Analysis of an Argument essay.

A Sample Template

Of course, you will want to develop your *own* template for the Analysis of an Argument essay, but to get you started, here's one possible structure:

The argument that (restatement of the conclusion) is not entirely logically convincing, because it ignores certain crucial assumptions.

First, the argument assumes that

Second, the argument never addresses

Finally, the argument omits

Thus, the argument is not completely sound. The evidence in support of the conclusion

Ultimately, the argument might have been strengthened by

How Would Our Brainstorming Fit Into the Template?

Here's how the assumptions we came up with for this argument would have fit into the template:

The argument that *the new medical test will prevent deaths that would have occurred in the past* is not entirely logically persuasive, because it ignores certain crucial assumptions.

First, the argument assumes that *early detection of the disease will lead to a reduced mortality rate. There are a number of reasons this might not be true. For example, the disease might be incurable (etc.).*

Second, the argument never addresses *the point that the existence of this new test, even if totally effective, is not the same as the widespread use of the test (etc.).*

Finally, *even supposing the ability of early detection to save lives and the widespread use of the test, the argument still depends on the doctors' correct interpretation of the test and the patients' willingness to undergo treatment. (etc.)*

Thus, the argument is not completely sound. The evidence in support of the conclusion (*further information about the test itself*) does little to prove the conclusion—that *the test will save lives—because it does not address the assumptions already raised.* Ultimately, the argument might have been strengthened by *making it plain that the disease responds to early treatment, that the test will be widely available around the world, and that doctors and patients will make proper use of the test.*

The Analysis of an Argument Essay in Six Steps

Step 1: Read the topic.
Isolate the
conclusion and
premises.

Step 2: Identify its
assumptions.
Brainstorm for
five minutes.

Step 3: Look at the assumptions. Do they help to prove the conclusion?

Step 4: Choose a template that allows you to attack the assumptions in an organized way.

Step 5: Illustrate how these same assumptions could be used to make the argument more compelling.

Step 6: Do some editing to correct spelling or grammar mistakes.

Customizing Your Analysis of an Argument Template

Your organizational structure may vary in some ways, but it will always include the following elements:

The *first paragraph* should sum up the argument's conclusion.

In the *second, third, and fourth paragraphs*, you should attack the argument and the supporting evidence.

In the *last paragraph*, you should summarize what you've said and state how the argument could be strengthened. Here are some alternate ways of organizing your essay.

Variation 1:

1st paragraph: Restate the argument. 2nd paragraph: Discuss the link (or lack of one) between the conclusion and the evidence presented in support of it. 3rd paragraph: Show three holes in the reasoning of the argument. 4th paragraph: Show how each of the three holes could be plugged up by explicitly stating the missing assumptions. Variation 2:

1st paragraph: Restate the argument and say it has three flaws. 2nd paragraph: Point out a flaw and show how it could be plugged up by explicitly stating the missing assumption. 3rd paragraph: Point out a second flaw and show how it could be plugged up by explicitly stating the missing assumption. 4th paragraph: Point out a third flaw and show how it could be plugged up by explicitly stating the missing assumption. 5th paragraph: Summarize and conclude that because of these three flaws, the argument is weak. Analysis of an Argument: Final Thoughts

You've separated the conclusion from the premises. You've brainstormed for the gaps that weaken the argument. You've noted how the premises support (or don't support) the conclusion. Now it's time to write your essay. Start typing, indenting each of the four or five paragraphs. Use all the tools you've learned in this chapter. Remember to keep an eye on the time.

If you have a minute at the end, read over your essay and do any editing that's necessary.

PRECONSTRUCTION

The readers will look for evidence of your facility with standard written English. This is where preconstruction comes in. It's amazing how a little elementary preparation can enhance an essay. We'll look at three tricks that almost instantly improve the appearance of a person's writing:

- structure words
- sentence variety
- the impressive book reference

Structure Words

In our Reading Comprehension chapter, we brought up a problem that most students encounter when they get to the Reading Comprehension section: There isn't enough time to read the passages carefully and answer all the questions. To get around this problem, we showed you some ways to spot the overall organization of a dense reading passage in order to understand the main idea and to find specific points quickly.

When you think about it, the essay readers face almost the identical problem: They have less than two minutes to read your essay and figure out if it's any good. There's no time to appreciate the finer points of your argument. All they want to know is whether it's well organized and reasonably lucid—and to find out, they will look for the *same* structural clues you have learned to look for in the reading comprehension passages. Let's mention them again:

If you have three points to make in a paragraph, it helps to point this out ahead of time:

There are three reasons why I believe that the Grand Canyon should be preserved for all eternity. First ... Second ... Third...

If you want to clue the reader in to the fact that you are about to support the main idea with examples or illustrations, the following words are useful:

for example
to illustrate
for instance
because

To add yet another example or argument in support of your main idea, you can use one of the following words to indicate your intention:

furthermore
in addition
similarly
just as
also
moreover

To indicate that the idea you're about to bring up is important, special, or

surprising in some way, you can use one of these words:

surely
truly
undoubtedly
clearly
certainly
indeed
as a matter of fact
in fact
most important

To signal that you're about to reach a conclusion, you might use one of these words:

therefore
in summary
consequently
hence
in conclusion
in short

Key to Analysis of an Argument

Critique the weaknesses in the argument clearly.

The Appearance of Depth

You may have noticed that much of the structure we have discussed thus far has involved contrasting viewpoints. Nothing will give your writing the *appearance* of depth faster than learning to use this technique. The idea is to set up your main idea by first introducing its opposite.

It is a favorite ploy of incoming presidents to blame the federal bureaucracy for the high cost of government, but I believe that bureaucratic waste is only a small part of the problem.

How It Works

Here's a paragraph that consists of a main point and two supporting arguments:

I believe he is wrong. He doesn't know the facts. He isn't thinking clearly.

Watch how a few structure words can make this paragraph classier and clearer at the same time:

*I believe he is wrong. **For one thing**, he doesn't know the facts. **For another**, he isn't thinking clearly.*

*I believe he is wrong. **Obviously**, he doesn't know the facts. **Moreover**, he isn't thinking clearly.*

*I believe he is wrong **because, first**, he doesn't know the facts, and **second**, he isn't thinking clearly.*

***Certainly**, he doesn't know the facts, and he isn't thinking clearly **either**. **Consequently**, I believe he is wrong.*

You may have noticed that this sentence contained a "trigger word." In this case, the trigger word *but* tells us that what was expressed in the first half of the sentence is going to be contradicted in the second half. We discussed trigger words in the Reading Comprehension chapter of this book. Here they are again:

but however on the contrary although yet while despite in spite of
rather nevertheless instead By using these words, you can instantly give your writing the appearance of depth.

Example:

Main thought: *I believe that television programs should be censored.*

While many people believe in the sanctity of free speech, I believe that television programs should be censored.

Most people believe in the sanctity of free speech, but I believe that television programs should be censored.

In addition to trigger words, here are a few other words or phrases you can use to introduce the view you are eventually going to decide *against*:

admittedly true certainly granted obviously of course undoubtedly to be sure one cannot deny that it could be argued that Also, don't forget about yin-yang words, which can be used to point directly to two contrasting ideas:

on the one hand/on the other hand

the traditional view/the new view

Contrasting Paragraphs

Trigger words can be used to signal the opposing viewpoints of entire paragraphs. Suppose you saw an essay that began:

Many people believe that youth is wasted on the young. They point out that young people never seem to enjoy, or even think about, the great gifts they have been given but will not always have: Physical dexterity, good hearing, good vision. However...

What do you think is going to happen in the second paragraph? That's right, the author is now going to disagree with the *many people* of the first paragraph.

Setting up one paragraph in opposition to another lets the reader know what's going on right away. The organization of the essay is immediately evident.

Sentence Variety

Many people think good writing is a mysterious talent that you either have or don't have, like good rhythm. In fact, good writing has a kind of rhythm to it, but there is nothing mysterious about it. Good writing is a matter of mixing up the different kinds of raw materials that you have available to you—phrases, dependent and independent clauses—to build sentences that don't all sound the same.

The graders won't have time to savor your essay, but they will look for variety in your writing. Here's an example of a passage in which all the sentences sound alike:

Movies cost too much. Everyone agrees about that. Studios need to cut costs. No one is sure exactly how to do it. I have two simple solutions. They can cut costs by paying stars less. They can also cut costs by reducing overhead.

Why do all the sentences sound alike? Well, for one thing, they are all about the same length. For another thing, the sentences are all made up of independent clauses with the same exact setup: Subject, verb, and sometimes object. There are no dependent clauses, almost no phrases, no structure words, and, frankly, no variety at all.

Now let's take a look at the same passage, with some minor modifications.

Everyone agrees that movies cost too much. Clearly, studios need to cut costs, but no one is sure exactly how to do it. I have two simple solutions: They can cut costs by paying stars less and by reducing overhead.

In this version of the passage, we've combined some clauses and used conjunctions. This helped to add variety in both sentence structure and sentence length. We also threw in a few structure words as well. As you can see, simple techniques like these can make your writing appear stronger and more polished.

The AWA

Few people are rejected by a business school based on their writing score, so don't bother feeling intimidated. Think of it this way: The essays represent an *opportunity* if your Verbal score is low, or if English is your second language. For the rest of you, the essay is as good a way as any to warm up (and wake up) before the sections that count.

Summary

The GMAT AWA section consists of one essay, written in 30 minutes, using a basic word-processing program and the computer keyboard. The essay will be given scores that range from 0 to 6 in half-point increments.

Each essay will be evaluated by at least two underpaid, overworked college teaching assistants.

To score high on the AWA: Write as many words as possible. Use a prebuilt template to organize your thoughts. Use structure words, and vary your sentence structure and length to give the appearance of depth to your writing. If possible, refer to a well-known work of literature or nonfiction.

For the Analysis of an Argument topic:

Step 1:

Read the topic and separate out the conclusion from the premises.

Step 2:

Because they ask you to critique (i.e., weaken) the argument, concentrate on identifying its assumptions. Brainstorm as many different assumptions as you can think of and write them down.

Step 3:

Look at the premises. Do they actually help to prove the conclusion?

Step 4:

Choose a template that allows you to attack the assumptions and premises in an organized way.

Step 5:

At the end of the essay, take a moment to illustrate how these same assumptions could be used to make the argument more compelling.

Step 6:

Read over the essay and edit your work.

Part VI
Answer Key to Drills

DRILL 1 (AD/BCE)

1. BCE. From Statement (1) all we know is a value for y . There is no telling what the value of x will be.

2. BCE. From Statement (1) we know that $2y$ is an integer, but does that mean y must be an integer? Not necessarily. What if y were $\frac{1}{2}$?

3. AD. If we know from the question that there are 12 children in a room and Statement (1) tells us there are 3 girls, then we know there are 9 boys, and we can answer the question.

4. AD. Statement (1) gives us an equation that we *could* solve to get the value of x (not that we need to). If we can solve for x , then we can answer the question.

DRILL 2

1. 77

2. 79

3. 10

4. 16

5. choice B

6. Statement (1) gives us one unique value for x : $x = 2$. We're down to AD. Statement (2) on the other hand gives us two possible values for x : 2 or -2 . The correct answer is choice A.

DRILL 3

1. $80 + 40 = 120$

2. $55 \times 100 = 5,500$

3. $ab + ac - ad$

4. $c(ab + xy)$

5. $\frac{12y - 6y}{y} = \frac{y(6)}{y} = 6$, choice B

6. Statement (1) gives us a value for x , but we need $x + y + d$. Statement (1) is not sufficient. We're down to BCE. Statement (2) might not have seemed much more helpful, BUT using the distributive property, we can rewrite the original equation to read $a(x + y + z) = 15$. If a is 5, then $x + y + z$ must equal 3. The correct answer is choice B.

DRILL 4

1. $\frac{145}{24}$ or $6\frac{1}{24}$

2. $\frac{1}{5}$

3. $\frac{29}{3}$

4. 18

5. choice C

DRILL 5

1. 33.30

2. 266.175

3. 6.09

4. 800

5. choice C

6. You were probably very tempted by choice (C) since Statement (1) gives us a value for x and Statement (2) gives us a value for y . However, if x and y are reciprocals (meaning that when multiplied together, their product must equal 1), then Statement (1)

not only gives us a value for x ($\frac{2}{10}$ or $\frac{1}{5}$), but it also gives us a value for y : the

reciprocal of $\frac{1}{5}$, which is 5.0. We're down to AD. Statement (2) does exactly the same thing in reverse. The correct answer is choice D.

DRILL 6 (Angles and Lengths)

1. $x = 110^\circ$

2. $x = 50^\circ$ $y = 130^\circ$ $z = 130^\circ$

3. $x = 60^\circ$ $y = 120^\circ$ $z = 120^\circ$

4. $\frac{3}{4}$

5. choice D

6. Statement (1) by itself gives us a mystery angle y not related to angle x , so we're down to BCE. Statement (2) by itself relates angles x and y : together, they add up to 180 degrees. But by itself, Statement (2) is still not sufficient because we don't have either individual angles. We're down to C or E. However, when we put both statements together, we can answer the question: if $x + y = 180$, and $y = 40$, then x must equal 140. The correct answer is choice C.

DRILL 7 (Triangles)

1. $x = 8$

2. $x = 60$

3. $x = 5$

4. x must be less than 11 and greater than 3

5. $3\sqrt{2}$

6. $2\sqrt{3}$

7. choice B

8. Choice C. Statement (1) tell us that $y = 80$. Remember, however, that figures in data sufficiency problems are not necessarily drawn to scale. So, don't assume that angles x and y are equal! We are down to BCE. Statement (2) tells us that sides AB and BC are equal, so angles x and y are also equal. However, we don't know the degree measure of those angles, so cross off B. Combining the statements, we know that x and y are equal and that $y = 80$. So, $x = 80$. The correct answer is choice C.

DRILL 8 (Circles)

1. area = 25π , circumference = 10π

2. circumference = 12π

3. 60°

4. choice B

5. Statement (1) by itself would allow you to find the area of circle Q , but that's not what the question is asking; we want circle P . We're down to BCE. Statement (2) by itself gives us a way to compare the two circles, but gives us no specific dimension. We're down to C or E. Combining the statements gives us both a specific dimension and a way to compare the circles. The correct answer is choice C.

DRILL 9 (Data Sufficiency Parts and Wholes)

1. Choice C. Statement (1) tells us only how many people paid a deposit. This is not sufficient to answer the question, and we are down to BCE. Statement (2) tells us only what percent of the people who paid deposits actually showed up. Again, by itself,

this does not give us the number of people who attended, so we can eliminate B. But if we put the two statements together, we now know how many people paid deposits (70), and what percentage of those people actually attended (60%), which means we can figure out how many people attended.

2. Choice D. You might think you need both statements together, but in fact, either is sufficient by itself. Statement (1) tells us there are 7 ounces of pigment in a 12-ounce can. Because there are only two ingredients, this means the other ingredient must make up the rest, or 5 ounces. This is sufficient to figure out the ratio (7 : 5) and we are down to a fifty-fifty choice: A or D. Similarly, Statement (2) tells us there are 5 ounces of alcohol in a 12-ounce can. Because there are only two ingredients, this means the other ingredient must make up the rest, or 7 ounces. Again, this is sufficient to figure out the ratio, so the answer must be D.

3. Choice C. To answer this question, we need the total number of miles. Statement (1) does not give us any concrete figures—just a fraction, so it is not sufficient, and that narrows our options down to BCE. Statement (2) gives us a concrete number, but it is only for part of the distance, so we can eliminate B. However, if we combine the two

statements, we learn that those 12 miles must make up the remaining $\frac{2}{5}$ of the entire trip.

From this we can learn the entire distance of the trip by setting up the equation $\frac{2}{5} = \frac{12}{x}$.
The correct answer is C.

DRILL 10 (Strange Powers of Powers)

1. Choice C. Statement (1) might *seem* to be sufficient, but remember, if $x^2 = 4$, then x could be either 2 or -2 . The question asks for the one and only value of x . Statement (1) is not sufficient. Statement (2) by itself is not sufficient either, because the question is asking for the one and only value of x . But together, the two statements are sufficient because Statement (1) gets us down to two possibilities, 2 and -2 , and Statement (2) eliminates the positive number.

2. Choice B. If $x^2 = 4$, then x could be either 2 or -2 , so Statement (1) is not sufficient. You might not think Statement (2) is sufficient by itself, because it only gives us a value for y , not for x . However, the question is asking for the value of x times y . If $y = 0$, then we know the value of xy . Zero times anything equals zero.

3. Choice E. If $x^2 = 4$, then x could be either 2 or -2 , so Statement (1) is not

sufficient. If $y^2 = 9$, then y could be either 3 or -3 . The question is asking for the one and only value of x , so Statement (2) is not sufficient by itself either. You might think that putting the two statements together would help us arrive at an answer, but in fact, we don't know. If $x = 2$ and $y = 3$, then $xy = 6$, but what if either x or y was negative? Then xy could also equal -6 .

DRILL 11 (Yes or No)

1. Choice A. To answer this yes-or-no question, plug values into the statements. The only condition of the question itself is that x is positive. The only positive numbers

that will make Statement (1) true are positive fractions less than $\frac{1}{2}$. This means Statement (1) always answers this question "yes" and we are down to AD. Plugging

positive numbers into Statement (2), we could have $\frac{1}{2}$, which gives us a "yes," or 1, which gives us a "no." Therefore, the answer must be choice A.

2. Choice B. When we plug normal numbers 3 and 2 into Statement (1), x is positive. But if we plug in -3 and -2 , x is negative, so we are down to BCE. Now, when we plug normal numbers 3 and 2 into Statement (2), we get a "yes." But when we try to plug weird numbers into Statement (2), we realize that (y^2) must always be positive—which means that x must always be positive as well, giving us a definitive "yes."

3. Choice C. To answer this yes-or-no question, plug values into the statements. Let's begin with Statement (1) and let's begin with normal numbers. How about 2 and 3?

We get a "yes." Now, let's try some weird numbers. How about 2 and $\frac{1}{2}$? This time, we get a "no," which means we're down to BCE. Let's try Statement (2). Plugging in normal

numbers 2 and 3 again, we get a "yes." Plugging in weird numbers $3\frac{1}{2}$ and $1\frac{1}{2}$ we get a "no," and we're down to C or E. Now, to consider C, we must pick numbers that make both statements work at the same time. The regular numbers give us a "yes." But when we try to plug weird numbers into the two statements, we realize it can't be done. Only integers will make both statements true at the same time. The answer is choice C.

DRILL 12 (Spotting Critical Reasoning Question Types)

1. Strengthen-the-argument question. To find the correct answer, look for the gap in the argument, and try to close it.

2. Inference question. To find the correct answer, use scope and POE to rule out any answer choice that goes too far.

3. Evaluate-the-argument question. To find the correct answer, look for the unspoken assumptions in the passage.

4. Assumption question. To find the correct answer, look for the gap in the argument.

5. Weaken-the-argument question. To find the correct answer, look for the gap in the argument and try to widen it.

6. Resolve/explain question. To find the correct answer, look for the answer choice that allows both of the facts from the passage to be true at the same time.

7. Identify-the-reasoning question. To find the correct answer, identify the conclusion and the premises, and see how they relate to each other.

8. Parallel-the-reasoning question. To find the correct answer, simplify the argument (if A, then B), and look for an answer choice that matches.

INTEGRATED REASONING DRILLS:

Section 1

Item 1:

1-1. True

This question asks about the median, so first list the data in order of *Riders* and note the median (fifth) in the list: *34th St/Penn Station (Red Lines)*. Next, to find the station with the greatest decrease in passengers from 2009 to 2010, sort the data by % *Change* and note that the same station shows a percentage decrease of 1.1%, the greatest percentage decrease in the list.

The question, however, asks if the station had the greatest decrease in passengers, which is different from the greatest percent decrease in passengers. Confirm that the actual decrease in passengers was the greatest; since the only other station with a decrease from 2009 was *Grand Central/42nd St*, calculate the actual decrease for each station and compare them.

The 2010 ridership for *34th St/Penn Station (Red Lines)* is 26,892,243, which you can round to 27 million for this purpose. Since the decrease from 2009 to 2010 was 1.1%, the 2010 value is equal to 98.9% (100%-1.1%) of the 2009 value. So, to solve for the

2009 value, the formula would be $\frac{98.9}{100}x = 27,000,000$.

Solving for x gives a 2009 ridership at *34th St/Penn Station (Red Lines)* of about 27.3 million for an actual decrease of about 300,000 riders. Calculating the actual decrease for *Grand Central/42nd St* in the same manner gives a decrease of less than 100,000 riders, and so *34th St/Penn Station (Red Lines)* had the greatest decrease in riders, and the statement is true.

1-2. False

Sorting the table in order by *% Change* will make it easy to find the station with the greatest percentage increase in riders from 2009 to 2010, which was *Lexington Ave/59th St*, with a 3.3 percent increase.

The 2010 ridership for *Lexington Ave/59th St* is 19,553,557, which you can round to 19.6 million for this purpose. Since the increase from 2009 to 2010 was 3.3%, the 2010 value is equal to 103.3% (100%+3.3%) of the 2009 value. So, to solve for the 2009 value,

the formula would be $\frac{103.3}{100}x = 19,600,000$.

Solving for x gives a 2009 ridership at *Lexington Ave/59th St* of about 19.0 million. Since the statement indicated a ridership of 19.6 million (which is approximately equal to the 2010 ridership, not the 2009 ridership), the statement is false.

1-3. True

Sorting the table by *Connecting Subway Lines* will make it easy to see that the median of the list is 5 and that the mode of the list is 3. The onscreen calculator can be used to find that the average *Riders* of the two stations with 5 connecting subway lines is 31,307,134; that the average *Riders* of the three stations with 3 connecting subway lines is 23,434,760; and that the ratio between those two numbers is 1.33. Presented as a

fraction, 1.33 is approximately $\frac{4}{3}$, so the statement is true.

1-4. False

Sorting the table by *% Change* will make it easy to identify the station with the highest percent increase in riders from 2009 to 2010: *Lexington Ave/59th Street*. However, when the table is sorted by *Riders*, *Lexington Ave/59th Street* is 8th, not 9th (last), in annual ridership, and so the statement is false.

Item 2:

Services Not Covered by Medical Plan: B, 15

The problem divides the doctors into two categories: those whose services are, or are not, covered by Frank’s medical plan, and those who graduated from medical school with, or without, honors. The information can be summarized in a group grid as follows:

	Services Covered by Medical Plans	Services Not Covered by Medical Plan	Total
Graduated with Honors	3		8
Graduated Without Honors	27		
Total			45

The remaining data in the table can be completed by solving for the missing data elements. The total number of doctors whose services are covered by the medical plan is $27 + 3$, or 30, and so the number of doctors whose services are not covered by the medical plan is $45 - 30$, or 15. Here’s the group grid with that data filled in:

	Services Covered by Medical Plans	Services Not Covered by Medical Plan	Total
Graduated with Honors	3		8
Graduated Without Honors	27		
Total	30	15	45

Graduated Without Honors and Services Not Covered by Medical Plan: A, 10

To find the number of doctors who graduated with honors and whose services are not covered by Frank’s medical plan, continue the work from the first part of the question by solving for additional missing elements in the group grid.

In this case, the total number of doctors who graduated without honors is $45 - 8$, or 37. The number of doctors, then, who graduated without honors and whose services are not covered by Frank’s medical plan is $37 - 27$, or 10.

Here’s the completely filled-in group grid:

	Services Covered by Medical Plans	Services Not Covered by Medical Plan	Total
Graduated with Honors	3	5	8
Graduated Without Honors	27	10	37
Total	30	15	45

Item 3:

Orchids: Choice F, 8

Dahlia: Choice C, 4

The word problem can be expressed in the form of an equation in terms of the price of each flower: $1.35o + 1.8d = 18$. Generally, two distinct equations are required in order to solve for two different variables. Since you only have one equation with two variables, there are multiple solutions (different numbers of orchids and dahlias) that could satisfy the equation: the number of orchids in the solution will depend on the number of dahlias, and vice versa.

Since the number of orchids and the number of dahlias must both be integers, Plug In The Answers (PITA). Plug in each answer choice into the equation as the number of orchids and solve the equation for the number of dahlias, looking to see whether the result is also an answer choice.

Start with the first answer choice: 0, giving the equation $1.35(0) + 1.8d = 18$, which simplifies to $1.8d = 18$, and $d = 10$. Since 10 is not an available answer choice, 0 is not the correct answer for orchids.

Plugging in the second choice (2) for the number of orchids results in a solution of 8.5 dahlias. Since a whole number of dahlias is required, 2 is not the correct answer for orchids. Using the third choice (4), the solution to the equation is 7 dahlias, but again, 7 is not an available answer choice, so 4 is not the correct answer for orchids.

Plugging in the sixth choice, 8 orchids, to the equation gives $1.35(8) + 1.8d = 18$, which can be simplified to $1.8d = 7.20$, and when solved, $d = 4$. Since 4 is also an available response, 8 is the correct number of orchids and 4 is the correct number of dahlias, and no further testing of the answer choices is necessary.

Item 4

4-1. Choice B, -1.4

The regression line comes close to the points (0,12) and (5,5). Therefore, the

$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{12 - 5}{0 - 5} = \frac{7}{-5} = -1.4$$

approximate slope is

4-2. Choice D, 100% greater

After 0 days of training, only two students were able to get within 11 in. of the target. After two days of training, there were four students who were able to get with 11 in. of the target. There was definitely an increase, so eliminate A and B. Now, to get the

percent increase, you need to do $\frac{\text{diff}}{\text{orig}} \times 100 = \frac{4 - 2}{2} \times 100 = \frac{2}{2} \times 100 = 100$

4-3. Choice B, Negative

The regression line is decreasing. Therefore, as the number of days increase, the distance a student is able to get from the target decreases. This is a negative relationship.

Item 5:

Strengthen: Choice B

The stone tools resemble those made and used by *Homo erectus* and *Homo heidelbergensis*, human ancestors in the Paleolithic era who lived on the mainland of Greece.

Weaken: Choice E

Approximately 5 million years ago, during the Messinian Salinity Crisis of the late Miocene era, the Mediterranean Sea dried up.

Conclusion:

“... some human ancestors developed nautical skills millions of years earlier than previously discovered.”

Premises:

“... earliest ... evidence of seafaring by human ancestors dates to ... 130,000 years in the past ... Archaeologists discovered stone tools on ... a Mediterranean island that date to ... 2.6 million years in the past ...” and “40 miles of open sea separate the island from Greece.”

Assumption:

The only way the stone tools could have gotten to the island is if the human ancestors developed nautical skills and migrated to the island by boat or raft.

Based on the discovery of stone tools on an island that date to 2.6 million years ago, archaeologists hypothesize that human ancestors must have developed nautical skills and migrated to the island by boat. The argument assumes that the evidence is sufficient to support their hypothesis; that there is no alternative explanation that is supported by the data.

The answer that most strengthens the argument will strengthen the link between the premise (finding stone tools on the island) and the conclusion (the human ancestors developed nautical skills and migrated there), or will eliminate alternate explanations supported by the data.

The first answer choice is out of scope because the fact that tools *used for fishing*

were found in the same area does not directly relate to whether the human ancestors had developed *nautical skills*; they could have fished from land or from the sea.

The second answer choice strengthens the argument by confirming that the stone tools were the same as those used by the human ancestors who lived on the other side of the water, and therefore increases the likelihood that they must have migrated there by boat or raft.

The third answer choice is irrelevant, because the argument is not concerned with the uses of the stone tools.

The fourth answer choice is irrelevant, because the argument is not concerned with whether the stone tools were used to construct boats.

The fifth answer choice weakens the argument by providing an alternate explanation of the migration that does not involve nautical skills: the human ancestors could have migrated to the island while the Mediterranean Sea was dry.

The sixth answer choice is irrelevant, because the argument is not concerned with whether the stone tools were used to construct boats.

Item 6:

(A): No

No 1-year CDs qualify for bonuses, so this \$11,000 CD earns an interest rate of 2.2%. Use your calculator. 2.2% of \$11,000 is $(0.022 \times 11,000)$ \$242. Therefore this 1-year CD does not earn at least \$250.

(B): No

All 5-year CDs qualify for a 0.1% bonus, so this \$9,500 CD will earn 2.6% interest in its first year. Use your calculator. 2.6% of \$9,500 is \$247, so this CD does not earn at least \$250 in its first year.

(C): Yes

All 10-year CDs qualify for a 0.1% bonus, so this \$9,500 CD will earn a 2.9% interest rate in its first year. Use your calculator. 2.9% of the \$9,500 is \$275.50. So this CD does earn more than \$250 in its first year.

(D): No

A \$10,000 2-year CD does not qualify for any bonus, so earns a 2.4% interest rate. 2.4% of \$10,000 is \$240. So this CD earns less than \$250 in its first year.

Item 7:

(A): No

Since the CD has a term of 1 year, no bonus applies. The interest rate is 2.2%. So the interest is 2.2% of \$20,000, which is \$440. The interest is therefore less than \$500.

(B): Yes

Since the CD has a term of 5 years, there is a 0.1% interest bonus. So the interest rate is 2.6%. The interest for the first year is 2.6% of \$4,000, which is \$104. The interest

for each succeeding year will increase by around 2\$ (2.6% of \$104). So the total interest will be a bit more than \$520, but certainly less than \$600.

(C): No

Since the CD has a term of 2 years, there are no bonuses to consider. The rate for a 2-year CD is therefore 2.4%. The interest from the first year will be \$240 and the interest from the second year will be 2.4% of \$10,240, which is about \$246. So the total interest is \$486, less than \$500.

(D): Yes

Since the CD is withdrawn early, two years of interest and the bonus will be lost. Therefore the CD qualifies for 1 year of interest at the standard rate for a 5-year CD. The rate is 2.7%. Therefore the interest is 2.7% of \$20,000 or \$540, which is between \$500 and \$600.

Item 8:

(A): No

The memo refers to new penalties going into effect. This does not imply, however, that there were no other penalties in place previously.

(B): No

It is true that the stated policy offers a bonus available to preferred customers but not to new customers. There is no reference however to this being a reward for loyalty. Rather, the stated purpose is to increase the overall stability of the bank's portfolio. This statement introduces outside information.

(C): Yes

The stated intention is to shift the CD investments towards those with longer maturation periods. For each type of CD, this means paying higher interest rates to customers. So if the bank succeeds in making this shift, it will pay higher overall average interest rates than it will if a greater proportion of investments remain in shorter term CD's. This statement is well-supported by the evidence.

(D): No

Although it is true that early withdrawal of a CD allows the bank to charge penalties, the stated reason for the penalties is to discourage such withdrawals. The purpose of the policy changes is to increase stability of the CD investments, the opposite of encouraging early withdrawals. This statement is contradicted by the passage.

Item 9:

9-1. False

First sort by *Electoral Vote* since the question asks for the median electoral vote. There are 13 listings, so the 7th down, William Clinton (1992) will be the median. To compare with median popular vote, now sort by *Popular Vote*. Now Richard Nixon is in the direct middle of the list. Therefore, the President with the median electoral vote (Clinton) is not the same as the President with the median popular vote (Nixon).

9-2. True

First sort the chart by *Year of Election* to more easily see which Presidents won two terms. They are George W. Bush, Richard Nixon, Ronald Reagan, and William Clinton. Now look at the *Popular Vote* column (not the *% of Popular Vote* column) for each candidate, comparing the results for the two years in which each candidate was

elected. Use the percent change formula ($\frac{\text{difference}}{\text{original}}$) to compare the percent increases in popular vote, rounding to the nearest integer. You should get Bush: $\frac{12}{50}$; Nixon: $\frac{16}{31}$; Reagan: $\frac{11}{43}$; Clinton: $\frac{3}{45}$. Clinton's percentage increase is less than (10%), far lower than the other three. So, of the two-term Presidents, Clinton does have the smallest percent increase in popular vote.

9-3. False

Sort the chart by political party to easily separate the two groups. There are six Democrats and seven Republicans. To find the average electoral vote for each party, add the electoral votes of the Presidents in that party with your calculator and divide by the number of Presidents. The six Democrats add up to 2,200, which gives an average or about 367. The seven Republicans add up to 2,818, which gives an average of about 403. So the Democratic Presidents do not have the higher average.

9-4. True

Sort the chart by *% of Popular Vote* to make it easy to scan down the list. Now compare the *% of Popular Vote* and the *% of Electoral Vote* columns for each line in the table. Look for those lines in which the two values are closest together. There are three elections, 2000, 1976, and 2004, in which the two values are within about 5 points of each other. In 1976, the difference was slightly greater than 5, but in 2000 and 2004 it was closer to 3 points difference, (48.87% vs. 50.4% in 2000 and 50.73% to 53.2% in 2004). So 2000 and 2004 are the two years in which the percentages differ the least. Since George W. Bush was elected both years, it is true that the same President was elected in the two years in which the percentages were the closest.

Item 10:

(A): No

Memo #1 states that the management retreat *once again* will be held in Bloomsbury. However this only means that it has been held there at least once before. Therefore we cannot infer it to be true that the retreat is there more often than anywhere else.

(B): Yes

Memo #2 lists the regions and their respective average airfares. At \$200 the Midwest and the West are tied for the lowest. This means that no region is lower than the Midwest.

(C): No

Memo #1 states that Regional Office Managers will be responsible for the travel reservations for Level 2 managers, but we don't know that they will be the only persons in attendance. Therefore we cannot infer this to be true.

(D): Yes

Memo #1 states that Regional Office Managers may *delegate that task*, meaning that they do not have to do it themselves.

Item 11:

(A): True

Memo #1 states that regions will receive a "*Budget Bonus*" of 50% of the difference between the ticket price and the average airfare for tickets priced more than 1 standard deviation below the mean. Memo #2 states that the mean for the West is \$200 and the standard deviation is \$25. Thus the West will get a bonus for all tickets priced less than \$175. Since there are 18 tickets priced at \$150, the West will get a bonus of 50% of $(18)(200 - 150) = 50\%$ of 900 = \$450.

(B): False

Memo #2 states that the sample size for the Mid-Atlantic was 500. Since the standard deviation is \$50, \$450 is two standard deviations from the mean of \$350. In a normally distributed sample, approximately 2% lay more than two standard deviations from the mean. 2% of 500 is 10, which is half of 20.

(C): True

Memo #2 states that the sample size for the Northeast was 400. Since the standard deviation is \$50, \$250 is one standard deviation below the mean of \$300. In a normally distributed sample, approximately 16% lay more than one standard deviation below the mean. 16% of 400 is 64, which is more than 50.

(D): False

In Memo #2, the mean ticket price is \$200 in the Midwest and \$300 in the Plains. The Midwest has a standard deviation of \$25 and the Plains has a standard deviation of \$75. Two standard deviations below the Midwest's mean is $\$200 - \$50 = \$150$. Two standard deviation below the Plains' mean is $\$300 - \$150 = \$150$. Thus the two are equal.

Item 12:

Choice (C):

Memo #1 states that tickets will be fully reimbursed if it either falls within 1 standard deviation or below 1 standard deviation of the mean. Since the mean is \$200 and the standard deviation is \$25, 4 tickets fall within 1 standard deviation and 18 fall below 1 standard deviation. Thus 22 tickets out of 30 will be fully reimbursed, which gives a

probability of $\frac{11}{15}$.

INTEGRATED REASONING DRILLS:
Section 2

Item 1:

1-1. Choice A, 15 to 18

The number of clocks produced on Tuesday is 75 and the number of clocks produced on Wednesday is 40. Therefore, the ratio of these two numbers is 75 to 40. Since both numbers are multiples of 5, you can reduce this by a factor of 5 to get an equivalent ratio of 15 to 8.

1-2. Choice D, 36%

To get the percent, you need to get $\frac{\text{part}}{\text{whole}} \times 100$. The part is the sum of the combined number produced on Monday and the number produced on Wednesday, which is $50 + 40 = 90$. Now, you need the total number produced during the entire week. This is $50 + 75 + 40 + 55 + 30 = 250$. Therefore, the percent is

$$\frac{\text{part}}{\text{whole}} \times 100 = \frac{90}{250} \times 100 = \frac{9}{25} \times \frac{100}{1} = \frac{9}{1} \times \frac{4}{1} = 36$$

1-3. Choice D, 20

The number of clocks produced on Monday is 50. The number of clocks produced on Friday is 30. Therefore, the number of clocks produced Monday is $50 - 30 = 20$ more than the number produced on Friday.

Item 2:

Most Weakens A's Argument: Choice F

Company X: Portals 8, which was just released, contains bugs and design flaws that would impair Company X's ability to compete in the modern economy.

Conclusion:

"We have decided to purchase new computers ... that run Portals 8, the newest version of the world's best selling operating system."

Premise:

"Our company's computer technology is out of date. We will be unable to compete effectively in the modern economy if we are not using current computer technology."

Assumption:

The plan to purchase new computers running Portals 8 will allow Company X to compete effectively in the modern economy.

Company X's argument uses a planning structure; it describes a problem (the company's computer technology is out of date, and the company needs current technology to be able to compete effectively), and then proposes a plan to solve that problem (buy new computers running Portals 8).

In a planning argument, the assumption will always be that the plan will completely address the problem and that the plan will not make the problem worse. In this case, Company X is assuming that the new computers with Portals 8 will actually help the company to compete effectively in the modern economy.

Because this is a weaken question, the answer will likely suggest that the plan will not completely address the problem or that the plan will actually make the problem worse (i.e., that the plan will NOT allow the company to compete effectively in the modern economy).

The first answer choice is out of scope, because the argument is not concerned with *efficient use of computer resources*.

The second answer choice is irrelevant because the argument is concerned with whether the plan will allow the company to compete in the modern economy, not whether GreenCap is *the most cutting-edge software*.

The third answer choice does not explain in what way the amount of time GreenCap *has been available* would affect the company's ability to compete in the modern economy.

The fourth answer choice weakens the Technology Consultant's argument, because it provides a reason why the consulting firm's plan would not work, but it has no effect on Company X's argument.

The fifth answer choice is out of scope, because the fact that Portals 8 *is available in several different versions* has no logical bearing on the argument.

The sixth answer choice weakens Company X's argument by providing a reason why the plan would not help Company X compete in the modern economy (because Portals 8 *contains a number of bugs and design flaws that would impair Company X's ability to compete*).

Most Weakens B's Argument: Choice D
Technology Consultant: GreenCap requires purchase of an annual maintenance agreement, making it more expensive overall than Portals 8.

Conclusion:
"Company X should purchase GreenCap."

Premise:
"GreenCap costs substantially less than Portals 8, and it provides the same functionality with current computer technology. With the money it would save, Company X would be better able to compete effectively in the modern economy."

Assumption:
Purchasing GreenCap would actually end up saving money for Company X.

The Technology Consultant observes that GreenCap is substantially cheaper than Portals 8, while providing the same functionality, and that if Company X saves money, it will be better able to compete economically. Based on these premises, the consultant concludes that Company X ought to purchase GreenCap.

The argument assumes that Company X will actually save money by purchasing

GreenCap. Since this is a weaken question, the answer will likely provide a reason why the plan would not succeed (for example, a reason purchasing GreenCap would NOT end up saving money for Company X).

The first answer choice is out of scope, because the argument is not concerned with *efficient use of computer resources*.

The second answer choice is irrelevant because the argument is concerned with whether Company X will actually save money, not whether the GreenCap is *the most cutting-edge software*.

The third answer choice is out of scope, because the amount of time GreenCap *has been available* does not affect whether Company X would save money by purchasing GreenCap.

The fourth answer choice weakens the Technology Consultant's argument, because it provides a reason why purchasing GreenCap would not save money for Company X (because it requires a costly *annual maintenance agreement* that would eliminate the savings and end up costing more).

The fifth answer choice is out of scope, because the fact that Portals 8 *is available in several different versions* has no logical bearing on the argument.

The sixth answer choice weakens Company X's argument by providing a reason why the plan would not help Company X compete in the modern economy (because Portals 8 *contains a number of bugs and design flaws* that would *impair Company X's ability to compete*). It has no effect on (or, perhaps, strengthens) the Technology Consultant's argument.

Item 3:

3-1: Choice B, 26

The regression line for ice cream has a negative slope. The approximate slope of the regression line can be calculated by identifying two approximate points on the line,

$$\frac{y_2 - y_1}{x_2 - x_1}$$

such as (1991, 29) and (1999, 28), and using the slope formula ($x_2 - x_1$) to calculate

$$\frac{1}{8}$$

that the slope is approximately $-\frac{1}{8}$. In other words, based on the regression line, the predicted per capita consumption of ice cream would decrease by 1 pound for every eight years that passes. Since 2015 is 16 years after 1999, the predicted per capita consumption would be 28 minus 2 pounds, or 26 pounds.

3-2. Choice C, 6 to 5

This question requires two steps to solve: first, which year had the lowest total per capita consumption of both ice cream and cheese, and second, what was the ratio of ice cream consumption to cheese consumption in that year?

By examining the data points for particular years, you can identify that in 1989, the total consumption of ice cream and cheese was less than 53 pounds (because the ice cream consumption was less than 29 pounds, and the cheese consumption was less than 24 pounds.) Testing other years, such as 1990, confirms that 1989 had the lowest total

consumption. (In 1990, the total consumption was approximately 53 pounds, based on the data points of approximately 28.5 pounds of ice cream and 24.5 pounds of cheese.)

To calculate the ratio of per capita ice cream consumption to per capita cheese consumption for 1989, divide the data point for ice cream (approximately 29) by the data point for cheese (approximately 24) for a ratio of approximately 1.2 (or, in fractional terms, $\frac{6}{5}$).

3-3. Choice B, less than

The regression line for ice cream slopes down, while the line for cheese slopes up; per capita ice cream consumption is reducing over time, while per capita cheese consumption is increasing over time. Thus, the slope of the ice cream line is negative, and is less than the slope of the cheese line, which is positive.

Item 4:

Most Strengthens: Choice C

Once a geo-engineering innovation has been passed by the committee, the same innovation is automatically approved in all subsequent projects, without further review.

In disagreeing with the XM representative, the federal committee member has based her rebuttal on the statement that *if we fail to review your project, we also fail to observe innovations in geo-engineering that may need guidelines drafted for the safety of subsequent projects throughout the industry*. Setting a precedent for future projects is therefore the central concern of the committee member. To strengthen her argument, you need additional evidence that supports this assertion. Answer (C) states that once an innovation has been passed, the same innovation in subsequent projects is passed without further review. Including this additional evidence undermines the XM representative's claim that the project should be passed without review and thus supports the committee member's rebuttal.

Most Weakens: Choice A

XM's latest project is nearly identical to a previous project by XM that had successfully passed the committee review process.

The XM representative claims that *the costly and time-consuming review should be waived so that our latest project can be quickly passed and implemented*. The federal committee member disagrees because doing what the representative suggests could mean the committee would *also fail to observe innovations in geo-engineering that may need guidelines drafted for the safety of subsequent projects throughout the industry*. To weaken the committee member's argument, you need evidence that suggests that no such failure to observe innovations will occur in this case. If XM's latest project is identical to a previous project by XM that had successfully passed the committee review process, as answer choice (A) states, then there are no innovations to consider. This weakens the federal committee member's argument, and provides additional support for the XM representative's request.

Item 5:

Insect Species X: Choice A, 450

Insect Species Y: Choice C, 565

First, note that, if the populations are to become equal in four years, at a 10% and a 15% rate of decrease, respectively, then the two populations are not currently equal. Additionally, the current population of Insect Species Y must be more than the current population of Insect Species X, in order for their totals to converge, at these independent rates of decrease, in four years. Therefore, the current population of Insect Species X cannot be 625, and the current population of Insect Species Y cannot be 450.

The problem requires working with two unknowns: the current population of Insect Species X and the current population of Insect Species Y. Therefore, Plug In The Answers to determine which will satisfy the conditions of the question. To approach the problem most efficiently, recognize that a 10% decrease is the same as taking 90% of the original number. Suppose that the current population of Insect Species X is 500. A 10% decrease from 450 is equivalent to 90% of 500, or $(.9)(450)$, which is 405. That would be the decrease for one year. To find the decrease for the next year, you would need to begin with the adjusted population and decrease from there: a 10% decrease from 405 is equivalent to $(.9)(405)$, which is 364.5. So, finding the decrease for two subsequent years from a current population of 450 is equivalent to calculating $(.9)(.9)(450) = 364.5$. Similarly, finding the decrease for four subsequent years at a 10% rate from a current population of 450 is equivalent to calculating $(.9)(.9)(.9)(.9)(450) = (.6561)(450) = 295.245$. So, to find the decreased population of Insect Species X for four years at a 10% rate, you would calculate $(.6561)(\text{current population X})$.

A 15% decrease is the same as taking 85% of the original number, so to find the decreased population of Insect Species Y for four years at a 15% rate, you would calculate $(.85)(.85)(.85)(.85)(\text{current population Y})$, or approximately $(.522)(\text{current population Y})$.

To determine what two current populations will be equal (rounded to the nearest million) in four years, you are looking for values that satisfy the equation $(0.6561)(\text{current population X}) = (0.522)(\text{current population Y})$. Now you can simply calculate with each value provided to see what the future populations would be:

Insect Species X: 10% decrease, for four years	Insect Species Y: 15% decrease, for four years
450 $(.6561) = 295.245$	Y must be larger than X; 450 is not possible
525 $(.6561) = 344.4525$	525 $(.522) = 274.05$
565 $(.6561) = 370.6965$	565 $(.522) = 294.93$
600 $(.6561) = 393.66$	600 $(.522) = 313.2$
625 $(.6561) = 410.0625$	625 $(.522) = 326.25$
X must be smaller than Y; 770 is not possible	770 $(.522) = 401.94$

Rounded to the nearest million, the values that satisfy the equation $(0.6561)(\text{current population X}) = (0.522)(\text{current population Y})$ are 450 for the current

population of Insect Species X and 565 for the current population of Insect Species Y, which would both decrease to approximately 295 million, at their independent rates of decrease, in four years.

Item 6:

(A): No

Email #1 asked for the top rated shows among females 15-25 and *Memo #1* states that *Blonde Fury* is the most watched program among that group. However, it is still possible that another group watches it as much or more than do females aged 15-25.

(B): No

Careful. While this is certainly true in the real world, there is not enough information to make that inference here. The emails describe only two programs, thus you can only make inferences about those two.

(C): Yes

Blonde Fury has a ratio of viewers/dollar of 45% of viewers to \$70,000 or 45/70, which is 9/14, or about 0.643. *Hart Attack* has a ratio of 35% to \$55K or 35/55, or 7/11, or about 0.636, which is lower.

(D): No

Email #1 states females 15-25 are the company's *top consumers*, but they could represent a plurality without becoming a majority. For example, if females 15-25 purchased 40% of the company's products, males 15-25 purchased 35%, other females purchased 15%, and other males purchased 10%, then females 15-25 would make up the largest customer group (at 40%) even though they did not purchase the *majority* of the products.

Item 7:

Choice D, 9.6

Email #2 states that "80% of the audience for *Hart Attack* also watch *Blonde Fury*." If there are 20 million females 15-25, and 35% watch *Hart Attack*, then 7 million females 15-25 watch *Hart Attack*. Since 80% of *Hart Attack* viewers also watch *Blonde Fury*, that's 80% of 7 million is 5.6 million. If 45% of 20 million watch *Blonde Fury*, that's 45% of 20 million = 9 million. Using the Group Equation, Total = Group 1 + Group 2 – Both + Neither, we get $20 = 7 + 9 - 5.6 + \text{Neither}$. This gives $\text{Neither} = 9.6$ million. The answer is choice (D).

Item 8:

(A): Yes

In *Email #1*, the Marketing Director states that the company previously was able to increase revenues by buying advertisement. In stating that if the company increased its advertising expenditures, then *we will once again increase our revenues*, the Marketing Director assumes that this can work again.

(B): Yes

Memo #1 states that, since increased revenues followed increased advertising,

increasing advertising will increase revenues. Therefore it must be true that the Marketing Director thinks that some of the increased revenues were caused by the increased advertising, and thus assumes that advertising has some effect upon revenues.

(C): Yes

In *Email #1*, the Marketing Director states that the company previously had increased advertisement expenditures and now plans to increase the number of advertisements. This assumes that the effects are similar.

(D): No

In *Email #1*, the Marketing Director argues in favor of increasing television advertisements. However, nothing is mentioned about how effective the advertisements are now or were in the past.

Item 9:

9-1. Supported

Sort the countries by population in 2010. There are five countries with populations above 150 million: China, India, United States, Indonesia, and Brazil. If China were to have the median foreign-born population, there would be two countries with a higher foreign-born population and two countries with a lower foreign born population. First, estimate China's foreign-born population. According to the table 0.29% of China's population of 1,399,725,000 is foreign-born. This is close to 0.3% of 1.4 billion. Multiply 0.003 by 1,400 million: China has 4.2 million foreign-born inhabitants. Now, estimate the foreign-born population of the other four countries. India's foreign-born population is about 0.5% of 1.2 billion, or is 6 million, which is bigger than China's foreign born population. The foreign-born population of the United States is about 20% of 312 million, about 62 million. This is bigger than China's foreign-born population. Indonesia's foreign-born population is less than 1% of about 238 million. 1% of 238 million is about 2 million. Therefore, Indonesia's foreign-born population is less than 2 million and less than China's. Brazil's foreign-born population is less than 1% of about 190 million. Since 1% of 190 million is about 1.9 million, Brazil's foreign-born population is less than 1.9 million. Therefore, Brazil's foreign-born population is less than China's. Since two of the countries have a higher foreign born population than China and two of the countries have a lower foreign-born population than China, China's foreign born population is the median.

9-2. Unsupported

This might appear to be a reasonable conclusion, since 8 million is approximately the average of the population in 2010 and the projected population for 2050. However, there is no information in the table which allows you to assume a uniform population increase from 2010 to 2050. Therefore, this conclusion is unsupported.

9-3. Unsupported

Although Andorra has the highest percentage of its population that is foreign born, this does not mean it has the great number of immigrants. About 20% of Australia's population of about 20 million is made up of immigrants. Therefore, Australia has about 4 million immigrants. Since this is higher than the entire population of Andorra, the

statement is unsupported.

9-4. Supported

First determine which countries are projected to have a decrease in population. These countries are Andorra, China, Kazakhstan, Portugal, and Russia. Estimate the percent changes. They are

$$\text{Andorra: } \frac{84,000 - 75,000}{84,000} = \frac{9,000}{84,000} = \frac{9}{84} < 10\%$$

(a little more)

$$\text{China: } \frac{1,400,000,000 - 1,300,000,000}{1,400,000,000} = \frac{100,000,000}{1,400,000,000} < 10\%$$

$$\text{Kazakhstan: } \frac{16,500,000 - 1,500,000}{16,500,000} = \frac{1,500,000}{16,500,000} < 10\%$$

$$\text{Portugal: } \frac{10,600,000 - 9,900,000}{10,600,000} = \frac{700,000}{10,600,000} < 10\%$$

$$\text{Russia: } \frac{143,000,000 - 109,000,000}{143,000,000} = \frac{34,000,000}{143,000,000} > 10\%$$

(a lot more)

Since Russia percent decrease is the only one a lot larger than 10%, Russia has the highest percent decrease. This statement is supported.

Item 10:

(A): False

The chart on the second tab lists two types of tables for DoxySource, and the first tab mentions the maximum number attending: 400. The cost of the food would therefore be (appetizer + entrée + dessert)(400) or $(\$2.00 + \$6.25 + \$3.40)(400) = (\$11.65)(400) = \$4,660$.

The cost of the tables would vary according to type of tables used. If the less expensive tables (seating eight) are used, 50 tables are required at \$15.50 each, for a total of \$775. In this case, the cost of the tables (\$775) would be approximately 16.6% of the cost of the food (\$4,660). However, if the more expensive tables are used, the table cost rises to \$986, which is approximately 21% of the cost of the food (\$4,660).

(B): True

The chart on the first tab shows that the punch fountain from BrightRight comes

with 40 gallons of punch. To acquire the same amount from DoxySource, the Gala Coordinator would have to order six of the smaller fountains, providing seven gallons of punch each. Thus, the cost per gallon for the BrightRight fountain is $\$350 \div 40$ or $\$8.75$ per gallon. The cost per gallon for the DoxySource fountains is $(6)(\$47) \div 42$ gallons = $\$6.71$ per gallon. Since the question states percent less, you figure the percent

$$\frac{8.75 - 6.71}{8.75} = \frac{2.04}{8.75} = .233$$

decrease by calculating the difference over the original: which is approximately 23%.

(C): True

The first tab states that the present budget is \$6,000 and the maximum number of guests is 400. Assume the Gala Coordinator wants to use BrightRight, but to stay within the present budget. The costs are listed on the chart on the second tab. The least expensive food costs for BrightRight come with The Classic Western BBQ option, which is \$14.00 per person, so total food costs would be $(400)(\$14.00) = \$5,600.00$. Adding in the least expensive costs for the audio (\$650) and the punch fountain (\$350) brings the cost to \$6,600. Lastly, calculate the least expensive table cost: 400 guests at eight guests per table requires 50 tables; $(50)(\$20) = \$1,000$, and so the total cost is now \$7,600,

$$\frac{1600}{6000} = .266$$

\$1,600 over the current budget of \$6,000. The percent over budget is approximately 27%.

(D): False

The first tab states that the maximum number of guests is 400. Using this figure with the prices found in the chart on the second tab, you can calculate that the cost of food is \$4,660 and the cost of the least expensive tables is \$775. Add to this the price of enough punch fountains for the guests. Since each fountain serves 70, six fountains are needed, and the price would be $(6)(\$47) = \282 . All together, this totals $\$4,660 + \$775 + \$282 = \$5,717$. Since the chocolate fountain rental is \$105, this brings the total to \$5,822. So, there is only \$178 left of the budget, and a P.A. system still has not been added into the cost. This \$178 will not cover \$200 for chocolate fountain supplies.

Item 11:

Choice C, \$792.00

This question asks about the lowest costs for tables, using DoxySource. In the chart on the second tab, there are two prices listed for DoxySource tables: \$15.50 for a table that seats eight (less expensive), or \$17.00 for a table that seats seven (more expensive). The lowest cost way to use at least one of each table would be for the Gala Coordinator to use only one of the more expensive tables, and use the less expensive tables for the remaining guests.

Using one of the more expensive tables seats 7 guests, leaving 393 guests who need to be seated at the remaining less expensive tables. Calculate the number of tables needed: $393 \div 8 = 49.125$, meaning that 50 more tables would be required, since you can't have fractions of tables. So, there is one table at \$17.00 and 50 tables at \$15.50: $\$17.00 + (50)(\$15.50) = \$792.00$.

Item 12:

(A): True

Referring to the first email from the Gala Coordinator, the message states *Also, I'd like to consider how to justify any over-budget costs from using BrightRight*. The Gala Coordinator is considering how to justify any over-budget costs: therefore, she is willing to ask for a budgetary increase.

(B): False

Although the email from the Administrative Assistant on the second tab implies that the DoxySource PA systems are inadequate with the phrase *but the projected attendance is far above the recommended usage for DoxySource's PA systems*, there is no indication that DoxySource and BrightRight are the only event planning services available. On the contrary, the email from the Gala Coordinator on the first tab states that DoxySource and BrightRight are two under consideration, implying that there are more to choose from.

(C): True

Referring to the second tab, the Administrative Assistant mentions both *more flexibility in the catering and more hands-on involvement on our end* as factors to consider when weighing the benefits of one event planning service against another.

(D): False

On the first tab, the Gala Coordinator states *We require: tables, audio, food, and a punch fountain or fountains*, meaning that a punch fountain is required. Although she goes on to state *a dessert fountain would be a lovely addition*, this refers only to a dessert fountain; the punch fountains are necessary.

Part VII

The Princeton

Review GMAT

Warm-Up Test

and Explanations

22 GMAT Math and Verbal Warm-Up Test

23 GMAT Math and Verbal Warm-Up Test Scoring Guide

24 GMAT Math and Verbal Warm-Up Test: Answers and Explanations

Chapter 22

GMAT Math and Verbal Warm-Up Test

Click [here](#) to download a PDF of GMAT Math and Verbal Warm-Up Test.

The purpose of this 60-minute test is to get a rough idea of your current scoring range on the Math and Verbal sections of the GMAT and rough percentiles. Using these scores as a guide, you can then select from the bins of practice questions that follow to improve your performance.

According to the test makers, the computer-adaptive sections of the GMAT hones in on your approximate scoring level after only a few questions. You then spend the rest of the test time answering questions from around that level of difficulty, chosen by the computer from bins of potential questions.

To further refine your assessment of where you are right now, we recommend that you take one of The Princeton Review computer-adaptive tests (available free online). See the So Much More Online section at the beginning of this book for details. We also highly recommend that you take an actual computer-adaptive GMAT, downloadable for free from the GMAT website at www.mba.com.

Math Test Time—30 Minutes 20 Questions

This test is composed of both problem solving questions and data sufficiency questions.

Problem Solving Directions: Solve each problem and choose the best of the answer choices provided.

Data Sufficiency Directions: Data sufficiency problems consist of a question and two statements, labeled (1) and (2), in which certain data are given. You have to decide whether the data given in the statements are sufficient for answering the question. Using the data given in the statements plus your knowledge of mathematics and everyday facts (such as the number of days in July or the meaning of *counterclockwise*), you are to select

(A) if statement (1) ALONE is sufficient, but statement (2) alone is not sufficient to answer the question asked;

(B) if statement (2) ALONE is sufficient, but statement (1) alone is not sufficient to answer the question asked;

(C) if BOTH statements (1) and (2) TOGETHER are sufficient to answer the question asked, but NEITHER statement alone is sufficient;

(D) if EACH statement ALONE is sufficient to answer the question asked;

(E) if statements (1) and (2) TOGETHER are NOT sufficient to answer the question asked, and additional data specific to the problem are needed.

1. If $(16)(3)^2 = x(2^3)$, then $x =$

(A) 81

(B) 72

(C) 18

(D) 16

(E) 8

2. By how many dollars was the price of a certain portable tape recorder reduced during a sale?

(1) During the sale, the price of the tape recorder was reduced by 25 percent.

(2) The price of the tape recorder after the reduction was \$36.

(A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.

(B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.

(C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.

(D) EACH statement ALONE is sufficient.

(E) Statements (1) and (2) TOGETHER are NOT sufficient.

3. At a certain softball tournament, 65 percent of the players traveled more than 200 miles to participate. If 720 players took part in the softball tournament, what is the difference between the number of participants who traveled more than 200 miles and the number of participants who traveled 200 miles or less?

(A) 108

(B) 216

(C) 252

(D) 468

(E) 655

4. If $r - s = 240$, does $r = 320$?

(1) $r = 4s$

(2) $s = 80$

(A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.

(B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.

(C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.

(D) EACH statement ALONE is sufficient.

(E) Statements (1) and (2) TOGETHER are NOT sufficient.

5. If a heavy-load trailer traveled 7 miles in 1 hour and 10 minutes, what was its speed in miles per hour?

(A) 6

(B) 6.5

(C) 8

(D) 8.5

(E) 10

6. Bob purchased 18 cans of soda, some of which contained diet soda. How many of the cans did not contain diet soda?

(1) Of the cans Bob purchased, the number containing diet soda is equal to the number not containing diet soda.

(2) Of the cans Bob purchased, the number containing diet soda is odd.

(A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.

(B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.

(C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.

(D) EACH statement ALONE is sufficient.

(E) Statements (1) and (2) TOGETHER are NOT sufficient.

7. If y is an odd integer, which of the following must be an even integer?

(A) $y + 2$

(B) $y + 6$

(C) $2y - 1$

(D) $3y$

(E) $3y + 1$

8. At Perry High School, the ratio of students who participate in either the band program or the choral program to students who participate in neither program is 3 to 8. If 220 students attend Perry High School, how many of them do NOT participate in either program?

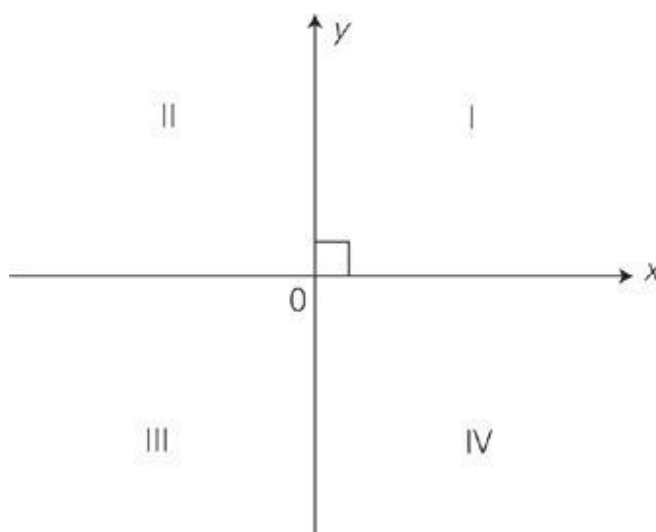
(A) 40

(B) 60

(C) 100

(D) 160

(E) 180



9. If $wxyz \neq 0$, in what quadrant of the coordinate system above does point (x, y) lie?

(1) (x, z) lies in quadrant I.

(2) (w, y) lies in quadrant III.

(A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.

(B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.

(C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.

(D) EACH statement ALONE is sufficient.

(E) Statements (1) and (2) TOGETHER are NOT sufficient.

10. Laura borrowed \$240, interest free, from her parents to pay for her college education. If she pays back $2\frac{1}{2}$ percent of this amount quarterly, and has already paid \$42.00, for how many months has she been paying back her loan?

(A) 6

(B) 7

(C) 19

(D) 21

(E) 24

11. If x and y are positive integers, is x a factor of 12?

(1) The product xy is a factor of 12.

(2) $y = 3$

(A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.

(B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.

(C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.

(D) EACH statement ALONE is sufficient.

(E) Statements (1) and (2) TOGETHER are NOT sufficient.

12. A zebra must get water from either a stream or pond. Which of the two sources of water is closer to the zebra's current position?

(1) Moving at a constant rate, it takes the zebra 2 hours to reach the stream from its current position.

(2) Moving at a constant rate, it takes the zebra 2 hours to reach the pond from the stream.

(A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.

(B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.

(C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.

(D) EACH statement ALONE is sufficient.

(E) Statements (1) and (2) TOGETHER are NOT sufficient.

13. What is the value of $x^2 - y^2$?

(1) $x - y = 0$

(2) $x + y = 4$

(A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.

(B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.

(C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.

(D) EACH statement ALONE is sufficient.

(E) Statements (1) and (2) TOGETHER are NOT sufficient.

14. If when a certain integer x is divided by 5 the remainder is 2, then each of the following could also be an integer EXCEPT

(A) $\frac{x}{17}$

(B) $\frac{x}{11}$

(C) $\frac{x}{10}$

(D) $\frac{x}{6}$

(E) $\frac{x}{3}$

15. If a mixture of ground meat consists of 2 pounds of veal that costs x dollars per pound, and 5 pounds of beef that costs y dollars per pound, what is the cost, in dollars, per pound of the mixture?

(A) $2x + 5y$

(B) $\frac{2x + 5y}{xy}$

(C) $5(2x + 5y)$

(D) $x + y$

(E) $\frac{2x + 5y}{7}$

16. Is $0 < y < 1$?

(1) $0 < \sqrt{y} < 1$

$$(2) y^2 = \frac{1}{4}$$

- (A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.
- (B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.
- (C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.
- (D) EACH statement ALONE is sufficient.
- (E) Statements (1) and (2) TOGETHER are NOT sufficient.

17. If a and b are positive integers, is the product ab odd?

- (1) $b = 3$
- (2) a and b are consecutive integers.
- (A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.
- (B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.
- (C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.
- (D) EACH statement ALONE is sufficient.
- (E) Statements (1) and (2) TOGETHER are NOT sufficient.

18. Last year, an appliance store sold an average (arithmetic mean) of 42 microwave ovens per month. In the first 10 months of this year, the store has sold an

average (arithmetic mean) of only 20 microwaves per month. What was the average number of microwaves sold per month during the entire 22-month period?

- (A) 21
- (B) 30
- (C) 31
- (D) 32
- (E) 44

19. A and B are the end points of the longest line that can be drawn in a circle with center X . If C is a point on the circle such that $AC = AX = 3$, what is the perimeter of triangle ABC ?

- (A) $\frac{9\sqrt{3}}{2}$
- (B) 9
- (C) $6 + 3\sqrt{3}$
- (D) $9 + 3\sqrt{3}$
- (E) $9\sqrt{3}$

ADVANCED PURCHASE DISCOUNTS FOR AIRLINE TRAVEL	
Days Prior to Departure	Percentage Discount
0–6 days	0%
7–13 days	10%
14–29 days	25%
30 days or more	40%

20. The table above shows the discount structure for advanced purchase of tickets at a particular airline. A passenger bought a ticket at this airline for \$1,050. The ticket agent informed her that, had she purchased the ticket one day later, she would have paid \$210 more. How many days before her departure did she purchase her ticket?

- (A) 6 days
- (B) 7 days
- (C) 13 days
- (D) 14 days
- (E) 29 days

Verbal Test
Time—30 Minutes
20 Questions

This test is made up of sentence correction, critical reasoning, and reading comprehension questions.

Sentence Correction Directions: In sentence corrections, some part of the sentence or the entire sentence is underlined. Beneath each sentence you will find five ways of phrasing the underlined part. The first of these repeats the original; the other four are different. If you think the original is the best of these answer choices, choose answer (A); otherwise, choose the best version and select the corresponding letter.

Reading Comprehension Directions: After reading the passage, choose the best answer to each question. Answer all questions following a passage on the basis of what is stated or implied in that passage.

Critical Reasoning Directions: Select the best of the answer choices given.

21. Unseasonable weather in the months before a wine harvest can cool vineyards in the Bordeaux region enough to affect the overall size of the grapes themselves, create unwanted moisture that can cause mold in some grape varieties and deterioration in others.

- (A) to affect the overall size of the grapes themselves, create
- (B) to affect the overall size of the grapes themselves, and create
- (C) that the overall size of the grapes themselves are affected, create
- (D) that it affects the overall size of the grapes themselves, creates
- (E) that the size of the grapes are affected and creates

22. It is posited by some scientists that the near extinction of the sap-eating gray bat of northwestern America was caused by government-sponsored logging operations in the early 1920s that greatly reduced the species' habitat.

Which of the following, if true, most strongly weakens the scientists' claims?

- (A) Logging operations in the 1920s are widely held responsible for the near extinction of other species that lived in the same area.
- (B) A boom in new home construction in the early 1920s led congress to open federal lands to logging operations.
- (C) A 5-year drought in the early 1920s severely reduced the output of sap in trees in northwestern America.
- (D) Numbers of sightings of sap-eating gray bats fell to their lowest numbers in 1926.

(E) Sightings of sap-eating gray bats in Europe stayed roughly the same during the same period.

23. Upset by the recent downturn in production numbers during the first half of the year, the possibility of adding worker incentives was raised by the board of directors at its quarterly meeting.

(A) the possibility of adding worker incentives was raised by the board of directors at its quarterly meeting

(B) the addition of worker incentives was raised as a possibility by the board of directors at its quarterly meeting

(C) added worker incentives was raised by the board of directors at its quarterly meeting as a possibility

(D) the board of directors raised at its quarterly meeting the possibility of worker incentives being added

(E) the board of directors, at its quarterly meeting, raised the possibility of adding worker incentives

24. Whenever a major airplane accident occurs, there is a dramatic increase in the number of airplane mishaps reported in the media, a phenomenon that may last for as long as a few months after the accident. Airline officials assert that the publicity given the gruesomeness of major airplane accidents focuses media attention on the airline industry, and the increase in the number of reported accidents is caused by an increase in the number of news sources covering airline accidents, not by an increase in the number of accidents.

Which of the following, if true, would seriously weaken the assertions of the airline officials?

(A) The publicity surrounding airline accidents is largely limited to the country in which the crash occurred.

(B) Airline accidents tend to occur far more often during certain peak travel months.

(C) News organizations do not have any guidelines to help them decide how severe an accident must be for it to receive coverage.

(D) Airplane accidents receive coverage by news sources only when the news sources find it advantageous to do so.

(E) Studies by government regulators show that the number of airplane flight miles remains relatively constant from month to month.

Questions 25–28 are based on the following passage:

The function of strategic planning is to position a company for long-term growth and expansion in a variety of markets by analyzing its strengths and weaknesses and examining current and potential
Line opportunities. Based on this information, the com-
 (5) pany develops strategy for itself. That strategy then becomes the basis for supporting strategies for its various departments.

This is where all too many strategic plans go
 (10) astray—at implementation. Recent business management surveys show that most CEOs who have a strategic plan are concerned with the potential breakdown in the implementation of the plan. Unlike 1980s corporations that blindly followed their
 (15) 5-year plans, even when they were misguided, today’s corporations tend to second-guess.

Outsiders can help facilitate the process, but in the final analysis, if the company doesn’t make the plan, the company won’t follow the plan. This was
 (20) one of the problems with strategic planning in the 1980s. In that era, it was an abstract, top-down process involving only a few top corporate officers and hired guns. Number crunching experts came into a company and generated tome-like volumes
 (25) filled with a mixture of abstruse facts and grand

theories which had little to do with the day-to-day realities of the company. Key middle managers were left out of planning sessions, resulting in lost opportunities and ruffled feelings.

- (30) However, more hands-on strategic planning can produce startling results. A recent survey queried more than a thousand small-to-medium sized businesses to compare companies with a strategic plan to companies without one. The survey found (35) that companies with strategic plans had annual revenue growth of 6.2 percent as opposed to 3.8 percent for the other companies.

Perhaps most important, a strategic plan helps companies anticipate—and survive—change.

- (40) New technology and the mobility of capital mean that markets can shift faster than ever before. Some financial analysts wonder why they should bother planning two years ahead when market dynamics might be transformed by next quarter. (45) The fact is that it's the very pace of change that

makes planning so crucial. Now, more than ever, companies have to stay alert to the marketplace. In an environment of continual and rapid change, long-range planning expands options and

- (50) organizational flexibility.

25. The primary purpose of the passage is to

- (A) refute the idea that change is bad for a corporation's long-term health
- (B) describe how long-term planning, despite some potential pitfalls, can help a corporation to grow
- (C) compare and contrast two styles of corporate planning
- (D) evaluate the strategic planning goals of corporate America today
- (E) defend a methodology that has come under sharp attack

26. It can be inferred from the passage that, in general, strategic planning during the 1980s had all of the following shortcomings EXCEPT

(A) a reliance on outside consultants who did not necessarily understand the nuts and bolts of the business

(B) a dependence on theoretical models that did not always perfectly describe the workings of the company

(C) an inherent weakness in the company's own ability to implement the strategic plan

(D) an excess of information and data that made it difficult to get to key concepts

(E) the lack of a forum for middle managers to express their ideas

27. The author most likely mentions the results of the survey of 1,000 companies in order to

(A) put forth an opposing view on strategic plans so that she can then refute it

(B) illustrate that when strategic planning is "hands-on," it produces uninspiring results

(C) give a concrete example of why strategic planning did not work during the 1980s

(D) support her contention that strategic planning, when done correctly, can be very successful

(E) give supporting data to prove that many companies have implemented strategic plans

28. The passage suggests which of the following about the "financial analysts" mentioned in lines 41–44?

(A) They believe that strategic planning is the key to weathering the rapid changes of the marketplace.

(B) They are working to understand and anticipate market developments that are two years ahead.

(C) Their study of market dynamics has led them to question the reliability of short-term planning strategies.

(D) They might not agree with the author that one way to survive rapidly changing conditions comes from long-range planning.

(E) They consider the mobility of capital to be a necessary condition for the growth of new technology.

29. The Internal Revenue Service has directed that taxpayers who generate no self-employment income can no longer deduct home offices, home office expenses, or nothing that was already depreciated as a business expense the previous year.

(A) or nothing that was already

(B) or that was already

(C) or anything that was already

(D) and anything

(E) and nothing that already was

30. Informed people generally assimilate information from several divergent sources before coming to an opinion. However, most popular news organizations view foreign affairs solely through the eyes of our State Department. In reporting the political crisis in foreign country B, news organizations must endeavor to find alternative sources of information.

Which of the following inferences can be drawn from the argument above?

(A) To the degree that a news source gives an account of another country that mirrors that of our State Department, that reporting is suspect.

(B) To protect their integrity, news media should avoid the influence of State Department releases in their coverage of foreign affairs.

(C) Reporting that is not influenced by the State Department is usually more accurate than are other accounts.

(D) The alternative sources of information mentioned in the passage might not share the same views as the State Department.

(E) A report cannot be seen as influenced by the State Department if it accurately depicts the events in a foreign country.

31. When automatic teller machines were first installed in the 1980s, bank officials promised they would be faster, more reliable, and less prone to make errors than their human counterparts.

(A) they would be faster, more reliable, and less prone to make errors

(B) they would be faster, more reliable, and that they would be less prone for making errors

(C) the machines would be faster, more reliable, and less prone to make errors

(D) the machines were faster, more reliable, and errors would occur much less

(E) faster, more reliable machines, and that errors would be less prone

32. With its plan to create a wildlife sanctuary out of previously unused landfill, Sweden is but one of a number of industrialized nations that is accepting its responsibility to protect endangered species and promote conservation.

(A) is accepting its responsibility to protect endangered species and promote

(B) is accepting its responsibility for protecting endangered species and promoting

(C) are accepting its responsibility to protect endangered species and promoting

(D) are accepting of their responsibility to protect endangered species and to promote

(E) are accepting their responsibility to protect endangered species and promote

33. A decade after a logging operation in India began cutting down trees in a territory that serves as a sanctuary for Bengal tigers, the incidence of tigers attacking humans in nearby villages has increased by 300 percent. Because the logging operation has reduced the number of acres of woodland per tiger on average from 15 acres to approximately 12 acres, scientists have theorized that tigers must need a minimum number of acres of woodland in order to remain content.

Which of the following statements, if true, would most strengthen the scientists' hypothesis?

(A) In other wildlife areas in India where the number of acres of woodland per tiger remains at least 15 acres, there has been no increase in the number of tiger attacks on humans.

(B) Before the logging operation began, there were many fewer humans living in the area.

(C) The largest number of acres per tiger before the logging operation began was 32 acres per tiger in one area of the sanctuary, whereas the smallest number of acres per tiger after the logging operation was 9 acres.

(D) Other species of wild animals have begun competing with the Bengal tigers for the dwindling food supply.

(E) The Bengal tiger has become completely extinct in other areas of Asia.

34. The machine press union and company management were not able to communicate effectively, and it was a major cause of the 1999 strike in Seattle.

(A) The machine press union and company management were not able to communicate effectively, and it

(B) Communications between the machine press union and company management were not effective, and it

(C) For the machine press union and company management, to be unable to communicate effectively

(D) The inability of the machine press union and company management to communicate effectively

(E) The machine press union, being unable to communicate effectively with company management,

35. A greater number of fresh vegetables are sold in City X than in City Y. Therefore, the people in City X have better nutritional habits than those in City Y.

Each of the following, if true, weakens the conclusion above EXCEPT:

(A) City X has more people living in it than City Y.

(B) Most of the people in City Y work in City X and buy their vegetables there.

(C) The people in City X buy many of their vegetables as decorations, not to eat.

(D) The per capita consumption of junk food in City X is three times that of City Y.

(E) The average price per pound of vegetables in City Y is lower than the average price per pound of vegetables in City X.

36. Heavy metals, toxic waste by-products that can cause tumors in fish, are generally found in the waters off industrial shorelines, but have been discovered in trace amounts even in the relatively pristine waters of the South Pacific.

(A) are generally found in the waters off industrial shorelines, but have been discovered in trace amounts even

(B) are generally to be found in the waters off industrial shorelines, and have even been discovered in trace amounts

(C) can, in general, be found in the waters off industrial shorelines, and have been discovered in trace amounts even

(D) had generally been found in the waters off industrial shorelines, but have even been discovered in trace amounts

(E) are found generally in the waters off industrial shorelines, but have been discovered in a trace amount even

Questions 37–40 are based on the following passage:

In Roman times, defeated enemies were generally put to death as criminals for having offended the emperor of Rome. In the Middle Ages, however, the practice of ransoming, or returning prisoners
Line (5) in exchange for money, became common. Though

some saw this custom as a step toward a more humane society, the primary reasons behind it were economic rather than humanitarian.

In those times, rulers had only a limited ability to
(10) raise taxes. They could neither force their subjects to fight nor pay them to do so. The promise of material compensation in the form of goods and ransom was therefore the only way of inducing combatants to participate in a war. In the Middle
(15) Ages, the predominant incentive for the individual

soldier was the expectation of spoils. Although collecting ransom clearly brought financial gain, keeping a prisoner and arranging for his exchange had its costs. Consequently, procedures were devised to reduce transaction costs.

One such device was a rule asserting that the prisoner had to assess his own value. This compelled the prisoner to establish a value without too much distortion; indicating too low a value would increase the captive's chances of being killed, while indicating too high a value would either ruin him financially or create a prohibitively expensive ransom that would also result in death.

37. The primary purpose of the passage is to

(A) discuss the economic basis of the medieval practice of exchanging prisoners for ransom

(B) examine the history of the treatment of prisoners of war

(C) emphasize the importance of a warrior's code of honor during the Middle Ages

(D) explore a way of reducing the costs of ransom

(E) demonstrate why warriors of the Middle Ages looked forward to battles

38. It can be inferred from the passage that a medieval soldier

(A) was less likely to kill captured members of opposing armies than was a soldier of the Roman Empire

(B) operated on a basically independent level and was motivated solely by economic incentives

(C) had few economic options and chose to fight because it was the only way to earn an adequate living

(D) was motivated to spare prisoners' lives by humanitarian rather than economic ideals

(E) had no respect for his captured enemies since captives were typically regarded as weak

39. Which of the following best describes the change in policy from executing prisoners in Roman times to ransoming prisoners in the Middle Ages?

(A) The emperors of Rome demanded more respect than did medieval rulers, and thus Roman subjects went to greater lengths to defend their nation.

(B) It was a reflection of the lesser degree of direct control medieval rulers had over their subjects.

(C) It became a show of strength and honor for warriors of the Middle Ages to be able to capture and return their enemies.

(D) Medieval soldiers were not as humanitarian as their ransoming practices might have indicated.

(E) Medieval soldiers demonstrated more concern about economic policy than did their Roman counterparts.

40. The author uses the phrase "without too much distortion" (lines 23–24) in order to

(A) indicate that prisoners would fairly assess their worth

(B) emphasize the important role medieval prisoners played in determining whether they should be ransomed

(C) explain how prisoners often paid more than an appropriate ransom in order to increase their chances for survival

(D) suggest that captors and captives often had understanding relationships

(E) show that when in prison a soldier's view could become distorted

END OF WARM-UP TEST

Chapter 23

GMAT Math and Verbal Warm-Up Test Scoring Guide

GMAT WARM-UP TEST SCORING GUIDE

Detailed explanations to these answers can be found in the next chapter.

Answer Key			
Math		Verbal	
1.	C	21.	B
2.	C	22.	C
3.	B	23.	E
4.	D	24.	B
5.	A	25.	B
6.	A	26.	C
7.	E	27.	D
8.	D	28.	D
9.	C	29.	C
10.	D	30.	D
11.	A	31.	C
12.	E	32.	E
13.	A	33.	A
14.	C	34.	D
15.	E	35.	E
16.	A	36.	A
17.	B	37.	A
18.	D	38.	A
19.	D	39.	B
20.	D	40.	A

The Math Score

If you got 6 or fewer math questions correct: Your percentile rank is in the lower one-third of the testing group and you should begin by practicing the problems in Math Bin 1. Once you've mastered the material in Math Bin 1, you should move on to the questions in Math Bin 2 of our practice test.

If you got between 6 and 13 math questions correct: Your percentile rank is in the middle one-third of the testing group and you should begin by practicing the problems in Math Bin 2 of our practice test. Once you've mastered the material in Math Bin 2, you should move on to the questions in Math Bin 3.

If you got 14 or more math questions correct: Your percentile rank is in the top one-third of the testing group and you should begin by practicing the problems in Math Bins 3 and 4 of our practice test.

The Verbal Score

If you got 6 or fewer verbal questions correct: Your percentile rank is in the lower one-third of the testing group and you should begin by practicing the problems in Verbal Bin 1 of our practice test. Once you've mastered the material in Verbal Bin 1, you should move on to the questions in Verbal Bin 2.

If you got between 6 and 13 verbal questions correct: Your percentile rank is in the middle one-third of the testing group and you should begin by practicing the problems in Verbal Bin 2 of our practice test. Once you've mastered the material in Verbal Bin 2, you should move on to the questions in Verbal Bin 3 of our practice test.

If you got 14 or more verbal questions correct: Your percentile rank is in the top one-third of the testing group and you should begin by practicing the problems in Verbal Bin 3 of our practice test.

(If you want additional practice for either the Math or the Verbal section, you may find it helpful to do the problems in a bin with a lower number than the one suggested. So if your math diagnostic score indicates that you should do the questions in Math Bin 2, you might want to do the questions in Math Bin 1 as well.)

The Combined Score

If you got 12 or fewer of the 40 total questions correct: Your combined score at the moment is less than 450.

If you got between 12 and 31 of the 40 total questions correct: Your combined score at the moment is between 450 and 550.

If you got 32 or more of the 40 total questions correct: Your combined score at the moment is more than 550.

Chapter 24 GMAT Math and Verbal Warm-Up Test: Answers and Explanations

MATH EXPLANATIONS

1. C Rather than multiply out each side of the equation, let's simplify. We can rewrite 16 as 2^4 . If we cancel 2^3 from each side of the equation, we are left with $2(3)^2 = x$. The correct answer is C, 18.

2. C Statement (1) tells us the reduction as a percentage, but without a dollar figure we can't know the exact amount of the reduction. We're down to BCE. Looking at Statement (2), we now know the dollar amount after the reduction, but without knowing either the original amount, or the percentage of the reduction, we don't know enough to answer the question. We're down to C or E. However, when we put the two statements together, we have enough information to write an equation: $.75x = \$36$, where x is the original amount. Once we subtract the price after the reduction, we'll have answered the question. But remember, in Data Sufficiency, we don't need to answer it; we just need to know that we can. The best answer is choice C.

3. B This is a percent problem, so let's start by finding the number of players who traveled more than 200 miles: 65% of 720 is 468. The number of players who traveled 200 miles or less, then, is $720 - 468 = 252$ (or, alternatively, 35% of 720 is 252). Although both 468 and 252 are answer choices, the question asks us for the difference between the two types of participants: $468 - 252 = 216$. If you'd prefer, you can also deal with the difference of the percentages rather than that of the actual people: $65\% - 35\% = 30\%$ and 30% of 720 is 216. This approach might make it easier to ballpark with a reasonable degree of accuracy: since our difference is a little less than a third, our answer should be a little less than $720 \div 3$, or 240.

4. D Joe Bloggs might be tempted by B on this yes-or-no problem, because Statement (2) certainly does answer the question. But look at Statement (1) by itself. If $r = 4s$, then we can substitute $4s$ for r in the first equation, making it $4s - s = 240$, or $3s = 240$, which means s equals 80, and r again must equal 320.

5. A Any problem with terms like "speed" or "miles per hour" can probably be solved with the formula: $distance = rate \times time$. This problem asks for the speed, or rate, which means $distance$ divided by $time$. 7 divided by $1\frac{1}{6}$ (or $\frac{7}{6}$) equals 6.

6. A The original question tells us the total number of cans. Statement (1) tells us there is an equal number of diet and non-diet cans. This answers the question (there are 9 of each, not that we really needed to know to get this data sufficiency question correct). We are down to A or D. Statement (2) may seem to *agree* with Statement (1) because we may have noticed that the number of diet cans supplied by the information in Statement (1) happens to be odd. However, there are lots of odd numbers. The correct answer is A.

7. E Variables in the answer choices means this is a Plugging In problem—a total gift as long as you use our techniques—but the word "must" means you may have to plug in *twice* to be sure you have the right answer. Whenever you Plug In, be sure to write down the number you are using so you won't forget it as you work. Because y must be an odd integer, let's use 3. Now, all we have to do is plug 3 into each of the answer

choices. Any choice that does *not* yield an even integer can be crossed off immediately. If more than one of the choices yields an even integer, we will have to plug in a second number for y to see which choice *always* yields an even number. Using 3 as our value for y , we find that choices A, B, C, and D all yield odd numbers. Therefore, the correct answer is E.

8. D This is a ratio problem, so we need to add the “parts” of our ratio to get the “whole” required to form a fraction. Since our parts are 3 and 8, our whole is 11; the

fraction of the students that does not participate in the band or choral program is thus $\frac{8}{11}$

. Now we can set up an equation: $\frac{8}{11} = \frac{x}{220}$. The correct answer is D, 160.

Be careful not to choose B, the number of students who do participate in one of the programs, or C, the difference between the number of students who participate and the number who don’t. Judicious use of POE might have eliminated both answers, though, along with A: Since we know that more than half of the students do not participate in either program, we can eliminate any answer less than 110.

9. C To help understand this question, try plugging in some values. Statement (1) tells us that point (x, z) lies in quadrant I, which essentially means that x and z must both be positive. For example, let’s say (x, z) was $(3, 4)$. We know x is positive, but does this tell us anything about y ? Nope, so we are down to BCE.

Statement (2) tells us that point (w, y) lies in quadrant III, which essentially means that w and y must both be negative. For example, let’s say (w, y) was $(-2, -5)$. In this case, we know y must be negative, but does this tell us anything about x ? Nope, so we are down to answer choices C or E.

If we put the two statements together, we know x must be positive and we know y must be negative—for example, using the points we plugged in, (x, y) would be $(3, -5)$ —which means point (x, y) must be in quadrant IV. The answer is C.

10. D Laura pays back 2.5 percent of the loan each quarter of the year. 2.5% of \$240 is \$6.00. If she has already paid \$42.00, that means she has paid that \$6.00 for seven quarters. How many months is that? Each quarter of the year is 3 months. The correct answer is D.

11. A To solve this yes-or-no question, plug values into the two statements. To be a factor of 12, the product of xy must be equal to 1, 2, 3, 4, 6, or 12. Let’s make x equal 2 and y equal 3. Is x a factor of 12? Yes. In fact, as long as xy must be a factor of 12 and x and y are integers, x must ALWAYS be a factor of 12. We are down to AD.

Now, let’s look at Statement (2). The fact that $y = 3$ does not help us know if x is a factor of 12. The answer is A. Joe Bloggs might have been tempted by C because it gives us a definitive value for x . But Statement (1) had already answered this yes-or-no question all by itself.

12. E Statement (1) only tells us the time it takes the zebra to reach the stream from its current position; since it gives us no information about the time required to reach the pond, Statement (1) is insufficient alone, and we’re down to B, C, or E. Similarly, since Statement (2) only tells us the time it takes the zebra to get from the pond to the stream—and doesn’t mention the zebra’s current position—Statement (2) is insufficient

alone, and we're down to C or E.

Be careful when you combine the two statements: Although it may be tempting to simply add our travel time and calculate that it would take the zebra 4 hours to go from its current position to the pond, this is only true if all 3 given locations were in a straight line, so that the pond would be directly on the other side of the stream. We, of course, can't assume that to be the case. For instance, if the zebra travels 2 hours due west from its current position to the stream, and then travels 2 hours due east from the stream to the pond, the zebra's current location would be *at* the pond! The correct answer to this question is E.

13. A Joe Bloggs wants to pick either answer choice E (because he doesn't know how to factor $x^2 - y^2$) or answer C because he knows that $x^2 - y^2 = (x + y)(x - y)$ and he figures he will need both statements to give him the answer. But if $(x - y) = 0$, then what $(x + y)$ equals is irrelevant because zero times anything equals zero.

14. C As always, when there are variables in the answer choices, the easiest thing to do is plug in. If you always get a remainder of 2 when you divide x by 5, then x has to be some multiple of 5 plus 2 more. In other words, x could be 7 or 12 or 17 or 22, etc. Now, we have to go through the answer choices Plugging In numbers for x that allow them to be integers as well. For example, in A, if we plugged in 17 for x , that would give

us $\frac{17}{17}$, which is an integer. Cross off choice A. In choice B, if we plugged in 22, we

would get $\frac{22}{11}$ which is an integer. Cross off B. In D and E, Plugging In the number 12 would make both choices integers. Only choice C can never be an integer as long as x can be divided by 5 with a remainder of 2. The correct answer is C.

15. E When you see variables among the answer choices, the best way to solve the problem is by plugging in. Because the total number of pounds of meat will be 7, it makes sense to choose numbers that divide evenly by 7. Choosing \$14 for x and \$7 for y , we end up with \$9 per pound for the mixture. Plugging our values for x and y into the answer choices, only one gives us \$9: E.

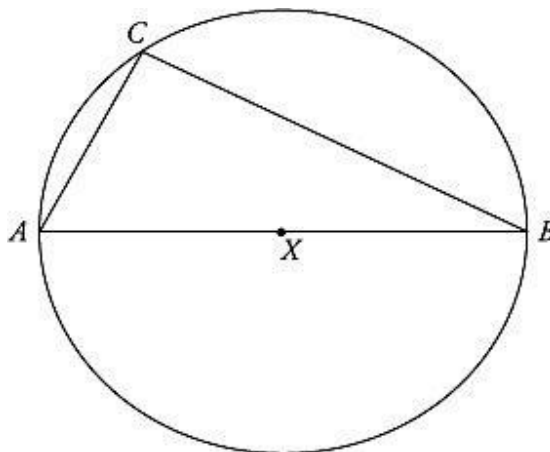
16. A To solve this yes-or-no question, plug values into the two statements. Joe Bloggs liked Statement (2) because he forgot that y could equal $-\frac{1}{2}$. However, only Statement (1) answered the question. On the GMAT, square roots are always positive. The correct answer is A.

17. B To solve this yes-or-no question, try plugging values into the statements. Looking first at Statement (1), we know that $b = 3$. If we plug in 2 for a , we get a "no" answer to the question "is the product ab odd." If we plug in 5 for a , we get a "yes" answer, so we are down to BCE. Now, Plugging In for Statement (2), we eventually realize that if a and b are consecutive integers, one of them must always be even, and the other odd. And the product of even times odd is always even. So Statement (2) answers this yes-or-no question with a resounding "No." Joe Bloggs was probably tempted by C.

18. D To find this average, you have to divide the total number of sales by the

total number of months. The sales for the first year were 12 times 42 or 504. The sales for the first 10 months of this year were 10 times 20 or 200. So the average number of sales per month can be found by dividing the total number of sales, 704, by the total number of months, 22. The answer is 32. Note that A and E are completely out of the ballpark. Because there were more months when the sales averaged 42 than when they averaged 20, the correct answer is bound to be a *little* more than the average of the two averages, 31. Choice C, 31, is the Joe Bloggs answer; Joe loves to take an average of two averages.

19. **D** First, draw the picture. It should look something like this:



AB is the diameter—another way of saying “the longest line that can be drawn in”—of the circle. C is a point on the circle that’s closer to A than it is to B . ABC is the triangle that connects the 3 points. AC and AX can be labeled 3—as can BX , since, like AX , it’s a radius.

Hey! We’ve already got 2 of the 3 sides we need to find the perimeter! To find the 3rd, we’ll need to know a somewhat arcane fact: Triangle ABC , because it’s inscribed in a semi-circle, is a right triangle. Now we can use the Pythagorean theorem—or, even better, recognize ABC as a 30–60–90 triangle—to determine that BC is $3\sqrt{3}$. Our perimeter is thus $6 + 3 + 3\sqrt{3}$, or $9 + 3\sqrt{3}$. The correct answer is D. Be careful not to fall for any trap answers: A is the *area* of triangle ABC ; B and C are the perimeters of the 2 smaller triangles.

20. **D** If we add up what this passenger actually paid, \$1,050, plus the \$210 she saved, we get what the purchase price would have been the following day, or \$1,260. Now, according to the table, if she had purchased her ticket 6 days before the flight, she would not have saved any money at all, so we can eliminate A. If she bought the ticket 7 days before, she would have saved 10%. Does 10% of \$1,260 equal \$210? Nope. She saved more than that. If she purchased her ticket 13 days before the flight, she would not have saved any more money than if she had bought it the next day (12 days before the flight) so we can eliminate choice C. At this point, you might want to guess between D and E. To see if she bought the ticket 14 days before the flight, the easiest thing to do is Plug In the Answers. Let’s assume she bought the ticket 14 days in advance of the flight

for \$1,050, representing a \$210 saving from what it would have cost the day after. That means the ticket would have cost \$1,260 from day 13 through day 7, and \$1,400 without the 10% discount (90% of $x = 1,260$). If D is correct, then 1,050 is 75% of 1,400. It is.

VERBAL EXPLANATIONS

21. **B** Go through your checklist of potential errors. Is there a misplaced modifier here? No. Is there a pronoun problem? No. Is there a parallel construction problem? Yes! At first it seems as if this sentence contains a list of three actions: to affect ... create ... and deteriorate—but wait! The third action is not an action, it’s a noun: deterioration. However, since *deterioration* is not underlined, we can’t fix this. Going back to the original sentence, it becomes clear that, in fact, there are only two main actions: to affect the overall size of the grapes and (to) create unwanted moisture. To correctly use this compound verb, the original sentence would need an “and” between the verbs. Only choice B gives you this option. Choices C, D, and E use the idiomatic expression “enough that” which is not necessarily wrong, but which would require the word “creating.”

22. **C** This is a causal argument. The scientists claim that the bat’s near extinction was caused by logging. How do we weaken this argument? By presenting an alternate cause—another reason why the bat almost became extinct. Choices A and B actually strengthen the argument. Choice A says that other species were also threatened with extinction by logging, and choice B gives us a reason the government might have been tempted to agree to logging on federal lands. Choice D is outside the scope of the argument since “sightings” are irrelevant. Choice E also goes outside the scope of the argument by telling us about the bat population on another continent. But choice C gives us an alternate cause for the near extinction of these bats: the sap they depended on for nourishment was severely reduced at the time in question by a five-year drought.

23. **E** This is a misplaced modifier question. Who was “upset by the recent downturn”? It was the board of directors. This eliminates choices A, B, and C. Choice E correctly positions the prepositional phrase “at its quarterly meeting” and avoids the passive “being added” in D.

24. **B** This is a statistical argument. The officials assert that there is in fact no increase in actual mishaps during the months after an accident, but an increase in the number of news sources *reporting* the mishaps—in other words, they argue that the statistics are not representative. To weaken this assertion, we would have to show that the statistics are in fact representative. B does this by implying that certain months are more likely to have more frequent accidents due to high volume of flights. A is outside the scope of the argument. C, D, and E would all *strengthen* the assertions of the officials.

25. **B** Most reading comprehension passages ask some form of this question. Choice B best summarizes the main idea of the passage: that despite some potential problems, strategic planning can allow a company to expand and grow.

26. **C** According to the passage, the difficulty in implementation of strategic plans

is a more modern phenomenon, not related to the weaknesses of the 1980s.

27. D Skim the passage quickly to find the survey, then read that portion carefully. According to the passage, the survey shows that companies with strategic plans outperformed companies without strategic plans.

28. D It's always a good idea to read a few lines above and below the cited lines, just to make sure you understand the context. The financial analysts mentioned in the passage seem to say that it is not worth trying to plan when the market is changing so rapidly. The author mentions their views in order to refute them.

29. C After running down your checklist of potential errors without encountering an ambiguous pronoun, a misplaced modifier, a tense problem, or a subject-verb disagreement, you should begin thinking about the possibility of an idiomatic error. Try making your own sentence: "I no longer deduct ... nothing on my taxes." Does that seem right? In fact, it is incorrect: a double negative. Scanning the answer choices can give you a clue as well: You have a choice of "nothing" or "anything." Which is better? If you said "anything," you were absolutely correct. Choice D includes "anything" but begins with the conjunction "and." In a list of three things you can't do, use "or" instead of "and."

30. D To get an inference question correct, you almost never actually want to infer. Look for an answer that seems ludicrously obvious. Choice A implies that the State Department's views are always likely to diverge from other news sources, which is not only silly, but something the GMAT test writers would be unlikely to say. B implies that the State Department should never be used as a news source, which goes way too far. Choice C also goes much further than the passage itself. E is a bit bizarre, because sometimes the State Department is bound to be right. Choice D is the best answer because the argument makes it clear that the "alternative" sources of information would provide the "divergent" opinions mentioned in the first sentence.

31. C Go through your checklist of potential errors. Is there a misplaced modifier here? No. Is there a pronoun problem? Well, wait a minute. There certainly is a pronoun here. Is it possible that the "they" could be ambiguous? As a matter of fact, "they" is obviously supposed to refer to the automatic teller machines, but it also could refer to the bank officials. Replacing "they" with "the machines" clarifies the sentence, which means we are down to C, D, or E, but C has a much more parallel construction.

32. E This is a subject-verb question. The verb *is* in the underlined portion seems to agree with the subject of the sentence, *Sweden*, but in fact, the noun *is* must agree with *nations*, which is plural. We're down to C, D, or E. C keeps the singular pronoun *its*, so we can eliminate that. Choice D contains the unidiomatic *accepting of*, making E the best answer.

33. A In this causal argument, the decrease in the number of acres of woodland per tiger is said to cause the increasing number of tiger attacks on humans. To strengthen this argument, it would help if the Bengal tigers in areas with a normal number of acres of woodland per tiger have NOT increased their attacks on humans. That's what A tells us. B gives us an alternate cause for the increase in tiger attacks—in other words, it weakens the argument instead of strengthening it. Choice C adds details without really

strengthening the argument. Choice D weakens the scientists' hypothesis by presenting a possible alternate cause for the tigers' attacks on humans. Choice E emphasizes the seriousness of the problem without shedding light on its cause.

34. D The tip-off here is the pronoun *it*. To what does *it* refer? Not the union, or the management. Really what *it* seems to refer to is the inability of the two sides to communicate. We can eliminate A and B. C seems to indicate that it was effective communication that led to the strike. E is both awkward and unidiomatic.

35. E We are looking for an answer that does NOT weaken the argument. You might think that means the correct answer would *strengthen* the argument, but while that COULD be the case, it doesn't have to be. The correct answer might simply be irrelevant to the argument. In this causal argument, more fresh vegetable sales in City X are said to mean that City X has better nutritional habits than City Y. Each of the answer choices pokes holes in that argument, except for E. It suggests that if vegetables are cheaper in City Y, and yet more vegetables are being sold in City X, then the argument that X has better nutritional habits might be right.

36. A In both B and C, the conjunction *and* wrongly gives the impression that the second half of the sentence is merely an added thought, instead of a new and dangerous development that goes beyond what *generally* happens. D needlessly changes the verb tense. E's *in a trace amount* does not agree with the plural *heavy metals*.

37. A Choice A best summarizes the main idea of the first paragraph. While D reflects a part of the passage, it does not encompass the main idea of the passage.

38. A The first paragraph gives us the information to answer this question. Note the trigger word *however* that underscores the difference between the Roman era and the Middle Ages.

39. B The best answer can be found in the first line of the second paragraph. Ransom was one of the few ways a ruler could give his subjects what they wanted to get them to do something *he* wanted.

40. A To get the best answer, we have to understand the meaning of the quoted words, but it also helps to read the rest of the paragraph. It talks about a value that was neither too low nor too high.

Part VIII

The Princeton Review GMAT Math and Verbal Practice Bins and Explanations

25 GMAT Math and Verbal Practice Bins

26 GMAT Math and Verbal Practice Bins: Answers and Explanations

Chapter 25

GMAT Math and Verbal Practice Bins

Click [here](#) to download a PDF of GMAT Math and Verbal Practice Bins.

Once you know your current scoring level from taking the Warm-Up Test, use the “bins” in the following pages to improve your performance.

If you got six or fewer math questions correct on the Warm-Up Test, start by practicing with the problems in [Math Bin 1](#). If you got 6–13 math questions correct on the Warm-Up Test, start by practicing with the problems in [Math Bin 2](#). If you got 14 or more math questions correct, practice with the problems in [Math Bins 3](#) and [4](#).

If you got six or fewer verbal questions correct on the Warm-up Test, start by practicing with the problems in [Verbal Bin 1](#). If you got 6–13 verbal questions correct on the Warm-Up Test, start by practicing with the problems in [Verbal Bin 2](#). If you got 14 or more verbal questions correct, practice with the problems in [Verbal Bin 3](#).

Math Test

Bin One—Easier Questions

26 Questions

This test is composed of both problem solving questions and data sufficiency questions.

Problem Solving Directions: Solve each problem and choose the best of the answer choices provided.

Data Sufficiency Directions: Data sufficiency problems consist of a question and two statements, labeled (1) and (2), in which certain data are given. You have to decide whether the data given in the statements are sufficient for answering the question. Using the data given in the statements plus your knowledge of mathematics and everyday facts (such as the number of days in July or the meaning of *counterclockwise*), you are to select

(A) if statement (1) ALONE is sufficient, but statement (2) alone is not sufficient to answer the question asked;

(B) if statement (2) ALONE is sufficient, but statement (1) alone is not sufficient to answer the question asked;

(C) if BOTH statements (1) and (2) TOGETHER are sufficient to answer the

question asked, but NEITHER statement alone is sufficient;

(D) if EACH statement ALONE is sufficient to answer the question asked;

(E) if statements (1) and (2) TOGETHER are NOT sufficient to answer the question asked, and additional data specific to the problem are needed.

1. What percent of 112 is 14?

(A) .125%

(B) 8%

(C) 12.5%

(D) 125%

(E) 800%

2. The number of flights leaving a certain airport doubles during every one-hour period between its 9 A.M. opening and noon; after noon, the number of flights leaving from the airport doubles during every two-hour period. If 4 flights left from the airport between 9 and 10 a.m., how many flights left the airport between 2 and 4 P.M.?

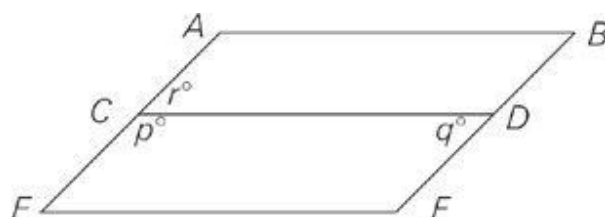
(A) 32

(B) 48

(C) 64

(D) 128

(E) 256



3. If both $ABDC$ and $CDFE$ are parallelograms, what is $q + r$?
- (1) $r = 70$
- (2) $p = 110$
- (A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.
- (B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.
- (C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.
- (D) EACH statement ALONE is sufficient.
- (E) Statements (1) and (2) TOGETHER are NOT sufficient.
4. Chris's convertible gets gas mileage that is 40 percent higher than that of Stan's SUV. If Harry's hatchback gets gas mileage that is 15 percent higher than that of Chris's convertible, then Harry's hatchback gets gas mileage that is what percent greater than that of Stan's SUV?

- (A) 25%
- (B) 46%
- (C) 55%

(D) 61%

(E) 66%

5. If x is equal to 1 more than the product of 3 and z , and y is equal to 1 less than the product of 2 and z , then $2x$ is how much greater than $3y$ when z is 4?

(A) 1

(B) 2

(C) 3

(D) 5

(E) 6

6. In 2005, did Company A have more than twice the number of employees as did Company B?

(1) In 2005, Company A had 11,500 more employees than did Company B.

(2) In 2005, the 3,000 employees with advanced degrees at Company A made up 12.5 percent of that company's total number employees, and the 2,500 employees with advanced degrees at Company B made up 20 percent of that company's total number of employees.

(A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.

(B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.

(C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.

(D) EACH statement ALONE is sufficient.

(E) Statements (1) and (2) TOGETHER are NOT sufficient.

7. Is x^3 equal to 125?

(1) $x > 4$

(2) $x < 6$

(A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.

(B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.

(C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.

(D) EACH statement ALONE is sufficient.

(E) Statements (1) and (2) TOGETHER are NOT sufficient.

8. Bob leaves point A and drives due west to point B. From point B, he drives due south to point C. How far is Bob from his original location?

(1) Point A is 24 miles from point B.

(2) Point B is 18 miles from point C.

(A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.

(B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.

(C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone

is sufficient.

(D) EACH statement ALONE is sufficient.

(E) Statements (1) and (2) TOGETHER are NOT sufficient.

9. The formula $M = \sqrt{l^2 + w^2 + d^2}$ describes the relationship between M , the length of the longest line that can be drawn in a rectangular solid, and l , w , and d , the length, width, and depth of that rectangular solid. The longest line that can be drawn in a rectangular solid with a length of 12, a width of 4, and a depth of 3 is how much longer than the longest line that can be drawn in a rectangular solid with a length of 6, a width of 3, and a depth of 2?

(A) 5

(B) 6

(C) 7

(D) 9

(E) 13

10. Is the average (arithmetic mean) of a , b , and c equal to 8?

(1) Three times the sum of a , b , and c is equal to 72.

(2) The sum of $2a$, $2b$, and $2c$ is equal to 48.

(A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.

(B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.

(C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone

is sufficient.

(D) EACH statement ALONE is sufficient.

(E) Statements (1) and (2) TOGETHER are NOT sufficient.

11. $\sqrt{\sqrt{1 + \frac{17}{64}}} =$

(A) $\frac{\sqrt{34}}{8}$

(B) $\frac{3\sqrt{2}}{4}$

(C) $\frac{9}{8}$

(D) $\frac{\sqrt{68}}{4}$

(E) $\frac{3\sqrt{2}}{2}$

12. A certain stadium is currently full to $\frac{13}{16}$ of its maximum seating capacity. What is the maximum seating capacity of the stadium?

(1) If 1,250 people were to enter the stadium, the stadium would be full to $\frac{15}{16}$ of its maximum seating capacity.

(2) If 2,500 people were to leave the stadium, the stadium would be full to $\frac{9}{16}$ of its maximum seating capacity.

- (A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.
- (B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.
- (C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.
- (D) EACH statement ALONE is sufficient.
- (E) Statements (1) and (2) TOGETHER are NOT sufficient.

13. Andre has already saved $\frac{3}{7}$ of the cost of a new car, and he has calculated that he will be able to save $\frac{2}{5}$ of the remaining amount before the end of the summer. If his calculations are correct, what fraction of the cost of the new car will he still need to save at the end of summer vacation?

(A) $\frac{6}{35}$

(B) $\frac{8}{35}$

(C) $\frac{12}{35}$

(D) $\frac{23}{35}$

(E) $\frac{29}{35}$

{1, 4, 6, y}

14. If the average (arithmetic mean) of the set of numbers above is 6, then what is

the median?

- (A) 5
- (B) 6
- (C) 7
- (D) 13
- (E) 24

15. A store sells a six-pack of soda for \$2.70. If this represents a savings of 10 percent of the individual price of cans of soda, then what is the price of a single can of soda?

- (A) \$ 0.35
- (B) \$ 0.40
- (C) \$ 0.45
- (D) \$ 0.50
- (E) \$ 0.55

16. If Beth spent \$400 of her earnings last month on rent, how much did Beth earn last month?

(1) Beth saved $\frac{1}{3}$ of her earnings last month and spent half of the remainder on rent.

(2) Beth earned twice as much this month as last month.

(A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.

(B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.

(C) Both statements TOGETHER are sufficient, but NEITHER statement ALONE is sufficient.

(D) EACH statement ALONE is sufficient.

(E) Statements (1) and (2) TOGETHER are NOT sufficient.

17. If n is an integer, is n even?

(1) $2n$ is an even integer.

(2) $n - 1$ is an odd integer.

(A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.

(B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.

(C) Both statements TOGETHER are sufficient, but NEITHER statement ALONE is sufficient.

(D) EACH statement ALONE is sufficient.

(E) Statements (1) and (2) TOGETHER are NOT sufficient.

18. At apartment complex Z , 30 percent of the residents are men over the age of 18, and 40 percent are women over the age of 18. If there are 24 children living in the complex, how many total residents live in apartment complex Z ?

(A) 32

(B) 80

(C) 94

(D) 112

(E) 124

19. Over the course of a soccer season, 30 percent of the players on a team scored goals. What is the ratio of players on the team who scored goals to those who did not?

(A) 3 to 10

(B) 1 to 3

(C) 3 to 7

(D) 1 to 1

(E) 3 to 1

20. At a restaurant, Luis left a tip for his waiter equal to 20 percent of his entire dinner check, including tax. What was the amount of the dinner check?

(1) The sum of the dinner check and the tip was \$16.80.

(2) Luis's tip consisted of two bills and four coins.

(A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.

(B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.

(C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.

(D) EACH statement ALONE is sufficient.

(E) Statements (1) and (2) TOGETHER are NOT sufficient.

21. Which sport utility vehicle has a higher list price, the Touristo or the Leisure?

(1) The list price of the Leisure is $\frac{5}{6}$ the list price of the Touristo.

(2) The list price of the Touristo is 1.2 times the list price of the Leisure.

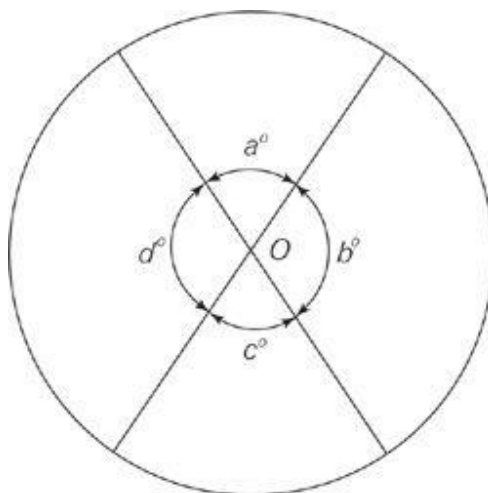
(A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.

(B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.

(C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.

(D) EACH statement ALONE is sufficient.

(E) Statements (1) and (2) TOGETHER are NOT sufficient.



22. In the circle above, with center O intersected by 2 straight lines, $3a = b$. What is the value of $b - a$?

- (A) 2
- (B) 30
- (C) 45
- (D) 90
- (E) 135

23. What is the value of integer w ?

(1) w is a multiple of 3.

(2) $420 < w < 425$

(A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.

(B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.

(C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.

(D) EACH statement ALONE is sufficient.

(E) Statements (1) and (2) TOGETHER are NOT sufficient.

24. What is the quotient when .25% of 600 is divided by .25 of 600?

(A) 10

(B) 1

(C) .1

(D) .01

(E) .001

25. A certain town's economic development council has 21 members. If the number of females on the council is 3 less than 3 times the number of males on the council, then the town's economic development council has how many male members?

(A) 5

(B) 6

(C) 7

(D) 9

(E) 15

26. Roger can chop down 4 trees in an hour. How long does it take Vincent to chop down 4 trees?

- (1) Vincent spends 6 hours per day chopping down trees.
- (2) Vincent takes twice as long as Roger to chop down trees.
- (A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.
- (B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.
- (C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.
- (D) EACH statement ALONE is sufficient.
- (E) Statements (1) and (2) TOGETHER are NOT sufficient.

Math Test
Bin Two—Medium Questions
27 Questions

This test is composed of both problem solving questions and data sufficiency questions.

Problem Solving Directions: Solve each problem and choose the best of the answer choices provided.

Data Sufficiency Directions: Data sufficiency problems consist of a question and two statements, labeled (1) and (2), in which certain data are given. You have to decide whether the data given in the statements are sufficient for answering the question. Using the data given in the statements plus your knowledge of mathematics and everyday facts (such as the number of days in July or the meaning of *counterclockwise*), you are to select

(A) if statement (1) ALONE is sufficient, but statement (2) alone is not sufficient to answer the question asked;

(B) if statement (2) ALONE is sufficient, but statement (1) alone is not sufficient to answer the question asked;

(C) if BOTH statements (1) and (2) TOGETHER are sufficient to answer the question asked, but NEITHER statement alone is sufficient;

(D) if EACH statement ALONE is sufficient to answer the question asked;

(E) if statements (1) and (2) TOGETHER are NOT sufficient to answer the question asked, and additional data specific to the problem are needed.

1. If $x = \frac{\frac{5}{9} + \frac{15}{27} + \frac{45}{81}}{3}$, then $\sqrt{1-x} =$

(A) $\frac{\sqrt{5}}{9}$

(B) $\frac{5}{9}$

(C) $\frac{2}{3}$

(D) $\frac{\sqrt{5}}{3}$

(E) $\frac{15}{9}$

2. For the past x laps around the track, Steven's average time per lap was 51 seconds. If a lap of 39 seconds would reduce his average time per lap to 49 seconds, what is the value of x ?

(A) 2

(B) 5

(C) 6

(D) 10

(E) 12

3. $200^2 - 2(200)(199) + 199^2 =$

(A) -79,201

(B) -200

(C) 1

(D) 200

(E) 79,999

4. If $x \neq -\frac{1}{2}$, then $\frac{6x^2 + 11x - 7}{2x - 1} =$

(A) $3x + 7$

(B) $3x - 7$

(C) $3x + 1$

(D) $x + 7$

(E) $x - 7$

5. If Amy drove the distance from her home to the beach in less than 2 hours, was her average speed greater than 60 miles per hour?

(1) The distance that Amy drove from her home to the beach was less than 125 miles.

(2) The distance that Amy drove from her home to the beach was greater than 122 miles.

(A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.

(B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.

(C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.

(D) EACH statement ALONE is sufficient.

(E) Statements (1) and (2) TOGETHER are NOT sufficient.

6. If $x = m - 1$, which of the following is true when $m = \frac{1}{2}$?

(A) $x^0 > x^2 > x^3 > x^1$

(B) $x^0 > x^2 > x^1 > x^3$

(C) $x^0 > x^1 > x^2 > x^3$

(D) $x^2 > x^0 > x^3 > x^1$

(E) $x^3 > x^2 > x^1 > x^0$

7. A comedian is playing two shows at a certain comedy club, and twice as many tickets have been issued for the evening show as for the afternoon show. Of the total number of tickets issued for both shows, what percentage has been sold?

(1) A total of 450 tickets have been issued for both shows.

(2) Exactly $\frac{3}{5}$ of the tickets issued for the afternoon show have been sold, and exactly $\frac{1}{5}$ of the tickets issued for the evening show have been sold.

(A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.

(B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.

(C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.

(D) EACH statement ALONE is sufficient.

(E) Statements (1) and (2) TOGETHER are NOT sufficient.

8. If $\frac{1}{y} = 2\frac{2}{3}$, then $2 = \left(\frac{1}{y+1}\right)^2 =$

(A) $\frac{9}{64}$

(B) $\frac{3}{8}$

(C) $\frac{64}{121}$

(D) $\frac{121}{64}$

(E) $\frac{64}{9}$

9. An operation \sim is defined by the equation $a \sim b = \frac{a+b}{(ab)^2}$ for all numbers a and b such that $ab \neq 0$. If $c \neq 0$ and $a \sim c = 0$, then $c =$

(A) $-a$

(B) 0

(C) \sqrt{a}

(D) a

(E) a^2

10. If x is a positive integer, is the greatest common factor of 150 and x a prime number?

(1) x is a prime number.

(2) $x < 4$

(A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.

(B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.

(C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.

(D) EACH statement ALONE is sufficient.

(E) Statements (1) and (2) TOGETHER are NOT sufficient.

$$X = \{9, 10, 11, 12\}$$

$$Y = \{2, 3, 4, 5\}$$

11. One number will be chosen randomly from each of the sets above. If x represents the chosen member of Set X and y represents the chosen member of Set Y , what is the probability that $\frac{x}{y}$ will be an integer?

(A) $\frac{1}{16}$

(B) $\frac{3}{8}$

(C) $\frac{1}{2}$

(D) $\frac{3}{4}$

(E) $\frac{15}{16}$

12. If p and q are integers, is $\frac{p+q}{2}$ an integer?

(1) $p < 17$

(2) $p = q$

- (A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.
- (B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.
- (C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.
- (D) EACH statement ALONE is sufficient.
- (E) Statements (1) and (2) TOGETHER are NOT sufficient.

13. A perfectly spherical satellite with a radius of 4 feet is being packed for shipment to its launch site. If the inside dimensions of the rectangular crates available for shipment, when measured in feet, are consecutive even integers, then what is the volume of the smallest available crate that can be used? (Note: the volume of a sphere is given by

the equation $V = \frac{4}{3}\pi r^3$.)

- (A) 48
- (B) 192
- (C) 480
- (D) 960
- (E) 1,680

14. A certain family has 3 sons: Richard is 6 years older than David, and David is 8 years older than Scott. If in 8 years, Richard will be twice as old as Scott, then how old was David 4 years ago?

- (A) 8
- (B) 10
- (C) 12
- (D) 14
- (E) 16

15. What is the value of x ?

(1) $x^2 - 5x + 4 = 0$

(2) x is not prime.

- (A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.
- (B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.
- (C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.
- (D) EACH statement ALONE is sufficient.
- (E) Statements (1) and (2) TOGETHER are NOT sufficient.

16. Sam and Jessica are invited to a dance. If there are 7 men and 7 women in total at the dance, and one woman and one man are chosen to lead the dance, what is the probability that Sam and Jessica will NOT be the pair chosen to lead the dance?

- (A) $\frac{1}{49}$

(B) $\frac{1}{7}$

(C) $\frac{6}{7}$

(D) $\frac{47}{49}$

(E) $\frac{48}{49}$

17. What is the surface area of rectangular solid y ?

(1) The dimensions of one face of rectangular solid y are 2 by 3.

(2) The area of another face of rectangular solid y is 6.

(A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.

(B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.

(C) Both statements TOGETHER are sufficient, but NEITHER statement ALONE is sufficient.

(D) EACH statement ALONE is sufficient.

(E) Statements (1) and (2) TOGETHER are NOT sufficient.

18. A six-sided die with faces numbered one through six is rolled three times. What is the probability that the face with the number 6 on it will NOT be facing upward on all three rolls?

(A) $\frac{1}{216}$

(B) $\frac{1}{6}$

(C) $\frac{2}{3}$

(D) $\frac{17}{18}$

(E) $\frac{215}{216}$

19. What is the sum of x , y , and z ?

(1) $2x + y + 3z = 45$

(2) $x + 2y = 30$

(A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.

(B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.

(C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.

(D) EACH statement ALONE is sufficient.

(E) Statements (1) and (2) TOGETHER are NOT sufficient.

20. A department store receives a shipment of 1,000 shirts, for which it pays \$9,000. The store sells the shirts at a price 80 percent above cost for one month, after which it reduces the price of the shirts to 20 percent above cost. The store sells 75 percent of the shirts during the first month and 50 percent of the remaining shirts afterward. How much gross income did sales of the shirts generate?

(A) \$10,000

(B) \$10,800

(C) \$12,150

(D) \$13,500

(E) \$16,200

21. David has three credit cards: a Passport card, an EverywhereCard, and an American Local card. He owes balances on all three cards. Does he owe the greatest balance on the EverywhereCard?

(1) The sum of the balances on his EverywhereCard and American Local card is \$1,350, which is three times the balance on his Passport card.

(2) The balance on his EverywhereCard is $\frac{4}{3}$ of the balance on his Passport card and $\frac{4}{5}$ of the balance on his American Local card.

(A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.

(B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.

(C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.

(D) EACH statement ALONE is sufficient.

(E) Statements (1) and (2) TOGETHER are NOT sufficient.

22. Automobile A is traveling at two-thirds the speed that Automobile B is traveling. How fast is Automobile A traveling?

(1) If both automobiles increased their speed by 10 miles per hour, Automobile A would be traveling at three-quarters the speed that Automobile B would be traveling.

(2) If both automobiles decreased their speed by 10 miles per hour, Automobile A would be traveling at half the speed that Automobile B would be traveling.

(A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.

(B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.

(C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.

(D) EACH statement ALONE is sufficient.

(E) Statements (1) and (2) TOGETHER are NOT sufficient.

23. a and b are nonzero integers such that $0.35a = 0.2b$. What is the value of b in terms of a ?

(A) $0.07a$

(B) $0.57a$

(C) $0.7a$

(D) $1.75a$

(E) $17.5a$

24. The Binary Ice Cream Shoppe sells two flavors, vanilla and chocolate. On

Friday, the ratio of vanilla cones sold to chocolate cones sold was 2 to 3. If the store had sold 4 more vanilla cones, the ratio of vanilla cones sold to chocolate cones sold would have been 3 to 4. How many vanilla cones did the store sell on Friday?

- (A) 32
- (B) 35
- (C) 42
- (D) 48
- (E) 54

25. Is integer a a prime number?

- (1) $2a$ has exactly three factors.
- (2) a is an even number.

- (A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.
- (B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.
- (C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.
- (D) EACH statement ALONE is sufficient.
- (E) Statements (1) and (2) TOGETHER are NOT sufficient.

26. Renee rides her bicycle 20 miles in m minutes. If she can ride x miles in 10 minutes, which of the following equals x ?

(A) $\frac{m}{200}$

(B) $\frac{m}{20}$

(C) $\frac{m}{2}$

(D) $2m$

(E) $\frac{200}{m}$

27. If s and w are integers, is $\frac{w}{5}$ an integer?

(1) $4s + 2$ is divisible by 5.

(2) $w + 3 = 4s$

(A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.

(B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.

(C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.

(D) EACH statement ALONE is sufficient.

(E) Statements (1) and (2) TOGETHER are NOT sufficient.

Math Test
Bin Three—Medium-Hard Questions
26 Questions

This test is composed of both problem solving questions and data sufficiency questions.

Problem Solving Directions: Solve each problem and choose the best of the answer choices provided.

Data Sufficiency Directions: Data Sufficiency problems consist of a question and two statements, labeled (1) and (2), in which certain data are given. You have to decide whether the data given in the statements are sufficient for answering the question. Using the data given in the statements plus your knowledge of mathematics and everyday facts (such as the number of days in July or the meaning of *counterclockwise*), you are to select

(A) if statement (1) ALONE is sufficient, but statement (2) alone is not sufficient to answer the question asked;

(B) if statement (2) ALONE is sufficient, but statement (1) alone is not sufficient to answer the question asked;

(C) if BOTH statements (1) and (2) TOGETHER are sufficient to answer the question asked, but NEITHER statement alone is sufficient;

(D) if EACH statement ALONE is sufficient to answer the question asked;

(E) if statements (1) and (2) TOGETHER are NOT sufficient to answer the question asked, and additional data specific to the problem are needed.

1. A discount electronics store normally sells all merchandise at a discount of 10 percent to 30 percent off the suggested retail price. If, during a special sale, an additional 20 percent were to be deducted from the discount price, what would be the lowest possible price of an item costing \$260 before any discount?

(A) \$130.00

(B) \$145.60

(C) \$163.80

(D) \$182.00

(E) \$210.00

2. During a special promotion, a certain filling station is offering a 10 percent discount on gas purchased after the first 10 gallons. If Kim purchased 20 gallons of gas, and Isabella purchased 25 gallons of gas, then Isabella's total per-gallon discount is what percent of Kim's total per-gallon discount?

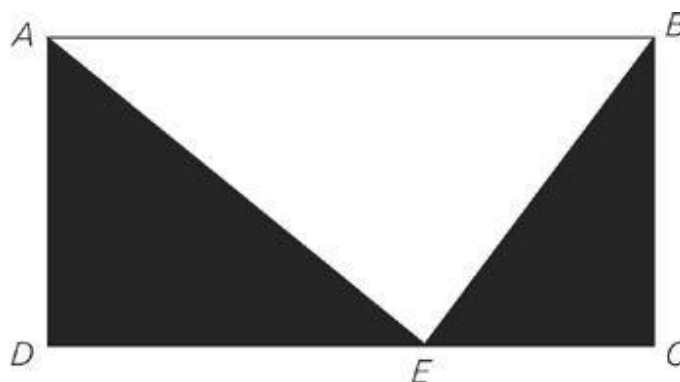
(A) 80%

(B) 100%

(C) 116.7%

(D) 120%

(E) 140%

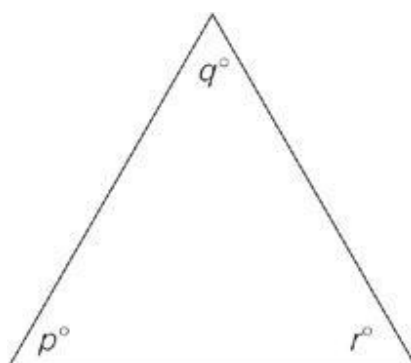


3. What is the area of the shaded region in the figure shown above?

(1) The area of rectangle $ABCD$ is 54.

(2) $DE = 2EC$

- (A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.
- (B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.
- (C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.
- (D) EACH statement ALONE is sufficient.
- (E) Statements (1) and (2) TOGETHER are NOT sufficient.



4. Is the triangle above equilateral?
- (1) $r = 180 - (p + r)$
- (2) $p = 60$
- (A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.
- (B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.
- (C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.
- (D) EACH statement ALONE is sufficient.

(E) Statements (1) and (2) TOGETHER are NOT sufficient.

5. During a certain two-week period, 70 percent of the movies rented from a video store were comedies, and of the remaining movies rented, there were 5 times as many dramas as action movies. If no other movies were rented during that two-week period and there were A action movies rented, then how many comedies, in terms of A , were rented during that two-week period?

(A) $\frac{A}{14}$

(B) $\frac{5A}{7}$

(C) $\frac{7A}{5}$

(D) $14A$

(E) $35A$

6. x , y , and z are consecutive positive integers such that $x < y < z$. If the units digit of x^2 is 6 and the units digit of y^2 is 9, what is the units digit of z^2 ?

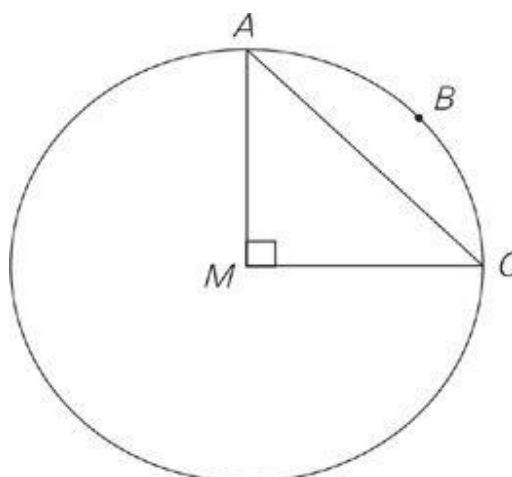
(A) 0

(B) 1

(C) 2

(D) 4

(E) 5



7. What is the area of the circle above with center M ?
- (1) The length of AC is $8\sqrt{2}$.
- (2) The length of arc ABC is 4π .
- (A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.
- (B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.
- (C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.
- (D) EACH statement ALONE is sufficient.
- (E) Statements (1) and (2) TOGETHER are NOT sufficient.
8. At a certain school, 60 percent of the senior class is female. If, among the members of the senior class, 70 percent of the females and 90 percent of the males are going on the senior trip, then what percent of the senior class is going on the senior trip?
- (A) 82%

(B) 80%

(C) 78%

(D) 76%

(E) 72%

9. If P is a set of integers and 3 is in P , is every positive multiple of 3 in P ?

(1) For any integer in P , the sum of 3 and that integer is also in P .

(2) For any integer in P , that integer minus 3 is also in P .

(A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.

(B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.

(C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.

(D) EACH statement ALONE is sufficient.

(E) Statements (1) and (2) TOGETHER are NOT sufficient.

10. Sarah's seafood restaurant gets a delivery of fresh seafood every day, 7 days per week, and her delivery company charges her d dollars per delivery plus c cents per item delivered. If last week Sarah's seafood restaurant had an average of x items per day delivered, then which of the following is the total cost, in dollars, of last week's deliveries?

(A) $\frac{7cdx}{100}$

(B) $d + \frac{7cx}{100}$

(C) $7d + \frac{xc}{100}$

(D) $7d + \frac{7xc}{100}$

(E) $7cdx$

11. The arithmetic mean of a data set is 46 and the standard deviation of the set is 4. Which of the following contains the interval two standard deviations from the mean of the set?

(A) 38 to 46

(B) 38 to 54

(C) 42 to 50

(D) 44 to 48

(E) 46 to 50

12. If a and b are positive integers, is a a multiple of b ?

(1) Every distinct prime factor of b is also a distinct prime factor of a .

(2) Every factor of b is also a factor of a .

(A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.

(B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.

(C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.

(D) EACH statement ALONE is sufficient.

(E) Statements (1) and (2) TOGETHER are NOT sufficient.

13. Set X contains 10 consecutive integers. If the sum of the 5 smallest members of Set X is 265, then what is the sum of the 5 largest members of Set X ?

(A) 290

(B) 285

(C) 280

(D) 275

(E) 270

14. If $a - b = c$, what is the value of b ?

(1) $c + 6 = a$

(2) $a = 6$

(A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.

(B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.

(C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.

(D) EACH statement ALONE is sufficient.

(E) Statements (1) and (2) TOGETHER are NOT sufficient.

$$\{3, 5, 9, 13, y\}$$

15. If the average (arithmetic mean) of the set of numbers above is equal to the median of the same set of numbers above, then what is the value of y ?

(A) 7

(B) 8

(C) 10

(D) 15

(E) 17

16. A foot race will be held on Saturday. How many different arrangements of medal winners are possible?

(1) Medals will be given for 1st, 2nd, and 3rd place.

(2) There are 10 runners in the race.

(A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.

(B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.

(C) Both statements TOGETHER are sufficient, but NEITHER statement ALONE is sufficient.

(D) EACH statement ALONE is sufficient.

(E) Statements (1) and (2) TOGETHER are NOT sufficient.

$$\{x, y, z\}$$

17. If the first term in the data set above is 3, what is the third term?

(1) The range of this data set is 0.

(2) The standard deviation of this data set is 0.

(A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.

(B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.

(C) Both statements TOGETHER are sufficient, but NEITHER statement ALONE is sufficient.

(D) EACH statement ALONE is sufficient.

(E) Statements (1) and (2) TOGETHER are NOT sufficient.

18. To fill a number of vacancies, an employer must hire 3 programmers from among 6 applicants and 2 managers from among 4 applicants. What is the total number of ways in which she can make her selection?

(A) 1,490

(B) 132

(C) 120

(D) 60

(E) 23

19. On Monday, a certain animal shelter housed 55 cats and dogs. By Friday, exactly $\frac{1}{5}$ of the cats and $\frac{1}{4}$ of the dogs had been adopted; no new cats or dogs were brought to the shelter during this period. What is the greatest possible number of pets that could have been adopted from the animal shelter between Monday and Friday?

(A) 11

(B) 12

(C) 13

(D) 14

(E) 20

20. If x is an integer, then which of the following statements about $x^2 - x - 1$ is true?

(A) It is always odd.

(B) It is always even.

(C) It is always positive.

(D) It is even when x is even and odd when x is odd.

(E) It is even when x is odd and odd when x is even.

21. During a five-day period, Monday through Friday, the average (arithmetic mean) high temperature was 86 degrees Fahrenheit. What was the high temperature on Friday?

(1) The average high temperature for Monday through Thursday was 87 degrees Fahrenheit.

(2) The high temperature on Friday reduced the average high temperature for the week by 1 degree Fahrenheit.

(A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.

(B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.

(C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.

(D) EACH statement ALONE is sufficient.

(E) Statements (1) and (2) TOGETHER are NOT sufficient.

22. What is the value of $x^2 - y^2$?

(1) $x + y = 0$

(2) $x - y = 2$

(A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.

(B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.

(C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.

(D) EACH statement ALONE is sufficient.

(E) Statements (1) and (2) TOGETHER are NOT sufficient.

23. If P is the perimeter of an equilateral triangle, which of the following represents the height of the triangle?

(A) $\frac{P}{3}$

(B) $\frac{P\sqrt{3}}{3}$

(C) $\frac{P}{4}$

(D) $\frac{P\sqrt{3}}{6}$

(E) $\frac{P}{6}$

24. If 75 percent of all Americans own an automobile, 15 percent of all Americans own a bicycle, and 20 percent of all Americans own neither an automobile nor a bicycle, what percent of Americans own *both* an automobile and a bicycle?

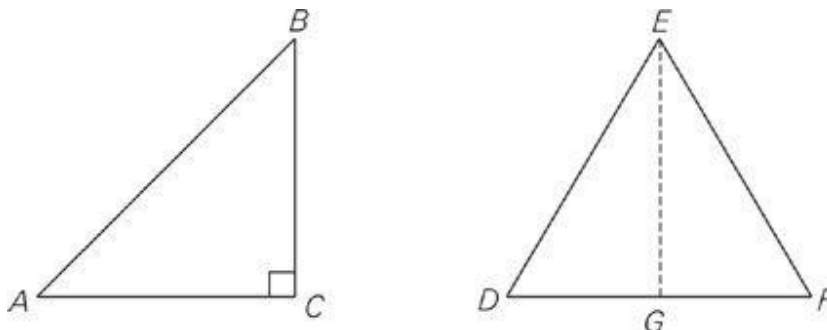
(A) 0%

(B) 1.33%

(C) 3.75%

(D) 5%

(E) 10%



25. Triangle ABC above is an isosceles right triangle; triangle DEF above is an equilateral triangle with height EG . What is the ratio of the area of ABC to the area of DEF ?

(1) The ratio of BC to EG is 1:1.

(2) The ratio of AC to DF is $\sqrt{3} : 2$.

(A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.

(B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.

(C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.

(D) EACH statement ALONE is sufficient.

(E) Statements (1) and (2) TOGETHER are NOT sufficient.

26. What is the value of integer x ?

(1) $\sqrt[3]{64} = 4$

(2) $x^2 = 2x + 8$

- (A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.
- (B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.
- (C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.
- (D) EACH statement ALONE is sufficient.
- (E) Statements (1) and (2) TOGETHER are NOT sufficient.

Math Test
Bin Four—Hard Questions
26 Questions

This test is composed of both problem solving questions and data sufficiency questions.

Problem Solving Directions: Solve each problem and choose the best of the answer choices provided.

Data Sufficiency Directions: Data Sufficiency problems consist of a question and two statements, labeled (1) and (2), in which certain data are given. You have to decide whether the data given in the statements are sufficient for answering the question. Using the data given in the statements plus your knowledge of mathematics and everyday facts (such as the number of days in July or the meaning of *counterclockwise*), you are to select

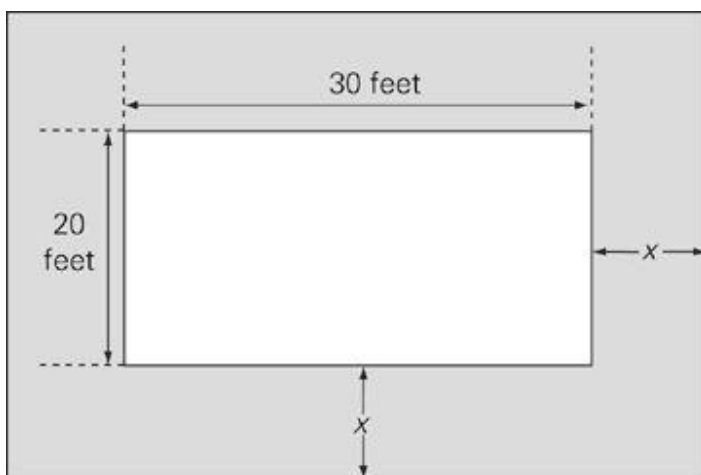
(A) if statement (1) ALONE is sufficient, but statement (2) alone is not sufficient to answer the question asked;

(B) if statement (2) ALONE is sufficient, but statement (1) alone is not sufficient to answer the question asked;

(C) if BOTH statements (1) and (2) TOGETHER are sufficient to answer the question asked, but NEITHER statement alone is sufficient;

(D) if EACH statement ALONE is sufficient to answer the question asked;

(E) if statements (1) and (2) TOGETHER are NOT sufficient to answer the question asked, and additional data specific to the problem are needed.



1. Martin planted a rectangular garden with dimensions 20 feet by 30 feet and then surrounded the garden with a rectangular brick walkway of uniform width (represented by the shaded area in the drawing above). If the area of the walkway equals the area of the garden, what is the width of the walkway?

- (A) 1 foot
- (B) 3 feet
- (C) 5 feet
- (D) 8 feet
- (E) 10 feet

2. A fair 2-sided coin is flipped 6 times. What is the probability that tails will be the result at least twice, but not more than 5 times?

(A) $\frac{5}{8}$

(B) $\frac{3}{4}$

(C) $\frac{7}{8}$

(D) $\frac{57}{64}$

(E) $\frac{15}{16}$

3. The members of the newest recruiting class of a certain military organization are taking their physical conditioning test, and those who score in the bottom 16 percent will have to retest. If the scores are normally distributed and have an arithmetic mean of 72, what is the score at or below which the recruits will have to retest?

(1) There are 500 recruits in the class.

(2) 10 recruits scored 82 or higher.

(A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.

(B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.

(C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.

(D) EACH statement ALONE is sufficient.

(E) Statements (1) and (2) TOGETHER are NOT sufficient.

4. Jerome wrote each of the integers 1 through 20, inclusive, on a separate index card. He placed the cards in a box, then drew cards one at a time randomly from the box, without returning the cards he had already drawn to the box. In order to ensure that the product of all the cards he drew was even, how many cards did Jerome have to draw?

- (A) 19
- (B) 12
- (C) 11
- (D) 10
- (E) 3

5. The average (arithmetic mean) of integers r , s , t , u , and v is 100. Are exactly two of the integers greater than 100?

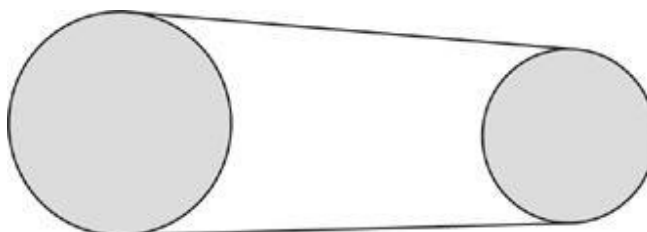
- (1) Three of the integers are less than 50.
- (2) None of the integers is equal to 100.

- (A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.
- (B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.
- (C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.
- (D) EACH statement ALONE is sufficient.
- (E) Statements (1) and (2) TOGETHER are NOT sufficient.

6. Paul jogs at a constant rate for 80 minutes along the same route every day.

How long is the route?

- (1) Yesterday, Paul began jogging at 5:00 P.M.
- (2) Yesterday, Paul had jogged 5 miles by 5:40 P.M. and 8 miles by 6:04 P.M.
- (A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.
- (B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.
- (C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.
- (D) EACH statement ALONE is sufficient.
- (E) Statements (1) and (2) TOGETHER are NOT sufficient.



7. The diagram above shows two wheels that drive a conveyor belt. The larger wheel has a diameter of 40 centimeters; the smaller wheel has a diameter of 32 centimeters. In order for the conveyor belt to run smoothly, each wheel must rotate the exact same number of centimeters per minute. If the larger wheel makes r revolutions per minute, how many revolutions does the smaller wheel make per hour, in terms of r ?

- (A) $\frac{1,280\pi}{3}$
- (B) $75r$
- (C) $48r$

(D) $24r$

(E) $\frac{64\pi}{3}$

8. An automobile dealership sells only sedans and coupes. It sells each in only two colors: red and blue. Last year, the dealership sold 9,000 vehicles, half of which were red. How many coupes did the dealership sell last year?

(1) The dealership sold three times as many blue coupes as red sedans last year.

(2) The dealership sold half as many blue sedans as blue coupes last year.

(A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.

(B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.

(C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.

(D) EACH statement ALONE is sufficient.

(E) Statements (1) and (2) TOGETHER are NOT sufficient.

9. At a college football game, $\frac{4}{5}$ of the seats in the lower deck of the stadium were sold. If $\frac{1}{4}$ of all the seating in the stadium is located in the lower deck, and if $\frac{2}{3}$ of all the seats in the stadium were sold, what fraction of the unsold seats in the stadium were in the lower deck?

(A) $\frac{3}{20}$

(B) $\frac{1}{6}$

(C) $\frac{1}{5}$

(D) $\frac{1}{3}$

(E) $\frac{7}{15}$

10. At Company R , the average (arithmetic mean) age of executive employees is 54 years old and the average age of non-executive employees is 34 years old. What is the average age of all the employees at Company R ?

(1) There are 10 executive employees at Company R .

(2) The number of non-executive employees at Company R is four times the number of executive employees at Company R .

(A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.

(B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.

(C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.

(D) EACH statement ALONE is sufficient.

(E) Statements (1) and (2) TOGETHER are NOT sufficient.

11. If a , b , c , d , and x are all nonzero integers, is the product $ax \cdot (bx)^2 \cdot (cx)^3 \cdot (dx)^4$ positive or negative?

(1) $a < c < x < 0$

(2) $b < d < x < 0$

- (A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.
- (B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.
- (C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.
- (D) EACH statement ALONE is sufficient.
- (E) Statements (1) and (2) TOGETHER are NOT sufficient.

12. A four-character password consists of one letter of the alphabet and three different digits between 0 and 9, inclusive. The letter must appear as the second or third character of the password. How many different passwords are possible?

- (A) 5,040
- (B) 18,720
- (C) 26,000
- (D) 37,440
- (E) 52,000

13. If x is a positive integer, is x divisible by 48?

- (1) x is divisible by 8.

(2) x is divisible by 6.

(A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.

(B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.

(C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.

(D) EACH statement ALONE is sufficient.

(E) Statements (1) and (2) TOGETHER are NOT sufficient.

$$\begin{array}{r} FGF \\ \times G \\ \hline HGG \end{array}$$

14. In the multiplication problem above, F , G , and H represent unique odd digits. What is the value of the three-digit number FGF ?

(A) 151

(B) 161

(C) 171

(D) 313

(E) 353

15. A group of 20 friends formed an investment club, with each member contributing an equal amount to the general fund. The club then invested the entire fund, which amounted to d dollars, in Stock X . The value of the stock subsequently increased 40 percent, at which point the stock was sold and the proceeds divided evenly among the members. In terms of d , how much money did each member of the club receive from the sale? (Assume that transaction fees and other associated costs were negligible.)

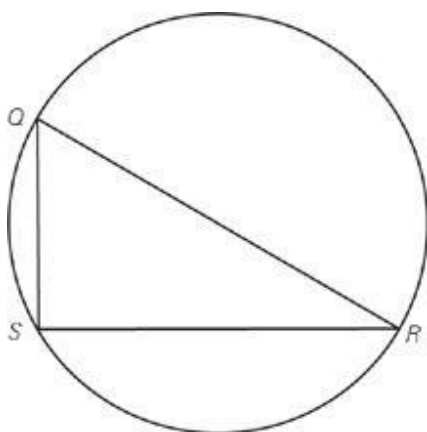
(A) $800d$

(B) $\frac{7d}{5}$

(C) $\frac{d}{20} + 40$

(D) $\frac{d}{2}$

(E) $\frac{7d}{100}$



16. Triangle QSR is inscribed in a circle. Is QSR a right triangle?

(1) QR is a diameter of the circle.

(2) Length QS equals 3 and length QR equals 5.

(A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.

(B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.

(C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.

(D) EACH statement ALONE is sufficient.

(E) Statements (1) and (2) TOGETHER are NOT sufficient.

17. Jolene began building a picket fence by planting stakes in a row; the stakes were evenly spaced. After planting the first 10 stakes, Jolene measured the length of the row and found that the row was 27 feet long. She continued the row by planting another 10 stakes, then measured the length of the entire row. How many feet long was the row of stakes Jolene had planted?

(A) 37

(B) 54

(C) 57

(D) 60

(E) 81

18. Square G has sides of length 4 inches. Is the area of Square H exactly one half the area of Square G ?

(1) The length of the diagonal of Square H equals the length of one side of Square G .

(2) The perimeter of Square H is twice the length of the diagonal of Square G .

(A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.

(B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.

(C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.

(D) EACH statement ALONE is sufficient.

(E) Statements (1) and (2) TOGETHER are NOT sufficient.

19. In a particular state, 70 percent of the counties received some rain on Monday, and 65 percent of the counties received some rain on Tuesday. No rain fell either day in 25 percent of the counties in the state. What percent of the counties received some rain on Monday and Tuesday?

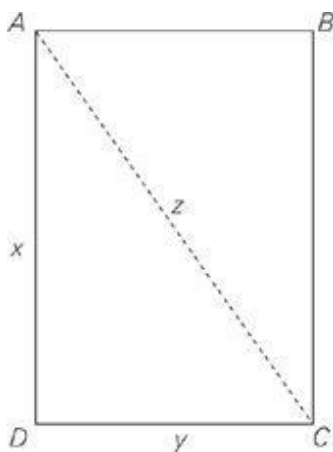
(A) 12.5%

(B) 40%

(C) 50%

(D) 60%

(E) 67.5%



20. Figure $ABCD$ is a rectangle with sides of length x centimeters and width y centimeters, and a diagonal of length z centimeters. What is the measure, in centimeters,

of the perimeter of $ABCD$?

(1) $x - y = 7$

(2) $z = 13$

(A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.

(B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.

(C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.

(D) EACH statement ALONE is sufficient.

(E) Statements (1) and (2) TOGETHER are NOT sufficient.

21. Together, Andrea and Brian weigh p pounds; Brian weighs 10 pounds more than Andrea. Andrea's dog, Cubby, weighs $\frac{p}{4}$ pounds more than Andrea. In terms of p , what is Cubby's weight in pounds?

(A) $\frac{p}{2} - 10$

(B) $\frac{3p}{4} - 5$

(C) $\frac{3p}{2} - 5$

(D) $\frac{5p}{4} - 10$

(E) $5p - 5$

22. A first-grade teacher uses ten flash cards, numbered 1 through 10, to teach her students to order numbers correctly. She has students choose four flash cards randomly, then arrange the cards in ascending order. One day, she removes the cards numbered “2” and “4” from the deck of flash cards. On that day, how many different correct arrangements of four randomly selected cards are possible?

(A) 70

(B) 210

(C) 336

(D) 840

(E) 1,680

23. If a and b are two-digit numbers that share the same digits, except in reverse order, then what is the sum of a and b ?

(1) $a - b = 45$

(2) The difference between the two digits in each number is 5.

(A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.

(B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.

(C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.

(D) EACH statement ALONE is sufficient.

(E) Statements (1) and (2) TOGETHER are NOT sufficient.

24. A university awarded grants in the amount of either \$7,000 or \$10,000 to some incoming freshmen. The total amount of all such awards was \$2,300,000. Did the university award more \$7,000 grants than \$10,000 grants to its incoming freshmen?

(1) A total of 275 freshmen received grants in one of the two amounts.

(2) The amount of money awarded in \$10,000 grants was \$200,000 more than the amount of money awarded in \$7,000 grants.

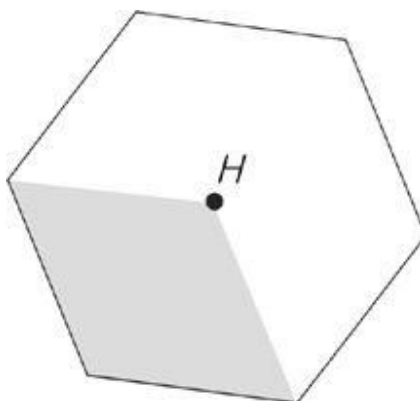
(A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.

(B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.

(C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.

(D) EACH statement ALONE is sufficient.

(E) Statements (1) and (2) TOGETHER are NOT sufficient.



25. The figure above is a regular hexagon with center H . The shaded area is a parallelogram that shares three vertices with the hexagon; its fourth vertex is the center of the hexagon. If the length of one side of the hexagon is 8 centimeters, what is the area of the unshaded region?

(A) $16\sqrt{3} \text{ cm}^2$

(B) 96 cm^2

(C) $64\sqrt{3} \text{ cm}^2$

(D) $96\sqrt{3} \text{ cm}^2$

(E) 256 cm^2

26. A fish tank contains a number of fish, including 5 Fantails. If two fish are selected from the tank at random, what is the probability that both will be Fantails?

(1) The probability that the first fish chosen will be a Fantail is $\frac{1}{2}$.

(2) The probability that the second fish chosen will be a Fantail is $\frac{4}{9}$.

(A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.

(B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.

(C) BOTH statements TOGETHER are sufficient, but NEITHER statement alone is sufficient.

(D) EACH statement ALONE is sufficient.

(E) Statements (1) and (2) TOGETHER are NOT sufficient.

Verbal Test
Bin One—Easy Questions
25 Questions

This test is made up of sentence correction, critical reasoning, and reading comprehension questions.

Sentence Correction Directions: In sentence corrections, some part of the sentence or the entire sentence is underlined. Beneath each sentence you will find five ways of phrasing the underlined part. The first of these repeats the original; the other four are different. If you think the original is the best of these answer choices, choose answer A; otherwise, choose the best version and select the corresponding letter.

Reading Comprehension Directions: After reading the passage, choose the best answer to each question. Answer all questions following a passage on the basis of what is stated or implied in that passage.

Critical Reasoning Directions: Select the best of the answer choices given.

1. As its reputation for making acquisitions of important masterpieces has grown, the museum has increasingly turned down gifts of lesser-known paintings they would in the past have accepted gratefully.

- (A) they would in the past have accepted gratefully
- (B) they would have accepted gratefully in the past
- (C) it would in the past have accepted gratefully
- (D) it previously would have accepted gratefully in the past
- (E) that previously would have been accepted in the past

2. Over the past few decades, despite periodic attempts to reign in spending, currencies in South America are devalued by rampant inflation.

- (A) are devalued
- (B) are becoming more devalued
- (C) which have lost value

(D) have become devalued

(E) have since become devalued

3. A fashion designer's fall line for women utilizing new soft fabrics broke all sales records last year. To capitalize on her success, the designer plans to launch a line of clothing for men this year that makes use of the same new soft fabrics.

The designer's plan assumes that

(A) other designers are not planning to introduce new lines for men utilizing the same soft fabrics

(B) men will be as interested in the new soft fabrics as women were the year before

(C) the designer will have time to develop new lines for both men and women

(D) the line for men will be considered innovative and daring because of its use of fabrics

(E) women who bought the new line last year will continue to buy it this year

4. The standard lamp is becoming outmoded, and so too is the incandescent light bulb, it is Edison's miraculous invention to use so much more energy than the new low-wattage halogen bulbs.

(A) so too is the incandescent light bulb, it is Edison's miraculous invention to use

(B) so too is the incandescent light bulb, Edison's miraculous invention that uses

(C) so too the incandescent light bulb, Edison's miraculous invention using

(D) also the incandescent light bulb, it is Edison's miraculous invention that uses

(E) also the incandescent light bulb, which is Edison's miraculous invention to use

5. Over the last 20 years, the growth of information technology has been more rapid than any other business field, but has recently begun to lag behind as newly emerging fields seem more enticing to new graduates.

(A) the growth of information technology has been more rapid than any other business field

(B) the growth of information technology has been more rapid than any other fields of business

(C) information technology's growth has been more rapid than any other fields of business

(D) the growing of information technology has been more rapid than that of any other business field

(E) the growth of information technology has been more rapid than that of any other business field

6. According to mutual fund sales experts, a successful year for a stock fund should result not only in increased investor dollars flowing into the fund, but also in increased investor dollars flowing into other mutual stock funds offered by the same company. However, while last year the Grafton Mutual Company's "Growth Stock Fund" beat average market returns by a factor of two and recorded substantial new investment, the other stock funds offered by Grafton did not report any increase whatsoever.

Which of the following conclusions can properly be drawn from the statements above?

(A) When one of the mutual funds offered by a company beats average market

returns, the other mutual funds offered by that company will beat average market returns.

(B) The mutual fund sales experts neglected to consider bond funds in formulating their theory.

(C) The performance of the Grafton “Growth Stock Fund” was a result of a wave of mergers and acquisitions that year.

(D) Investors currently dislike all stock mutual funds because of market volatility.

(E) The success of one mutual fund is not the only factor affecting whether investors will invest in other mutual funds run by the same company.

7. With less than thirty thousand dollars in advance ticket sales and fewer acceptances by guest-speakers than expected, the one-day symposium on art and religion was canceled for lack of interest.

(A) less than thirty thousand dollars in advance ticket sales and fewer

(B) fewer than thirty thousand dollars in advance ticket sales and less

(C) fewer than thirty thousand dollars in advance ticket sales and fewer

(D) lesser than thirty thousand dollars in advance ticket sales and fewer

(E) less than thirty thousand dollars in advance ticket sales and as few

8. New technology now makes it feasible for computer call-in help desk services to route calls they receive to almost anywhere, theoretically allowing employees to work from home, without the need for a daily commute.

The adoption of this policy would be most likely to increase productivity if employees did not _____.

- (A) commute from a distance of fewer than 10 miles
- (B) commute by car as opposed to by rail
- (C) live in areas with dependable phone service
- (D) need to consult frequently with each other to solve callers' problems
- (E) have more than one telephone line

9. The port cities of England in the 19th century saw a renaissance of ship construction, with some innovative designs breaking new ground, stretching the limits of ship-building theory, and received acclaim from around the world.

- (A) received
- (B) it received
- (C) receiving
- (D) would receive
- (E) it had received

10. According to a consumer research group survey, the majority of kitchen appliances purchased in the United States are purchased by men. This appears to belie the myth that women spend more time in the kitchen than men.

The argument is flawed primarily because the author _____.

- (A) fails to differentiate between buying and using
- (B) does not provide information about the types of kitchen appliances surveyed

- (C) depends on the results of one survey
- (D) does not give exact statistics to back up his case
- (E) does not provide information on other appliances such as washers and dryers

11. A contribution to a favorite charity being sent instead of flowers when a colleague dies is becoming more the rule than the exception when it comes to funeral etiquette.

- (A) A contribution to a favorite charity being sent instead
- (B) A contribution being sent to a favorite charity as opposed
- (C) To send a contribution for a favorite charity instead
- (D) Sending a contribution to a favorite charity instead
- (E) Sending a contribution to a favorite charity as opposed

Questions 12–15 are based on the following passage:

As a business model, the world of publishing has always been a somewhat sleepy enclave, but now all that seems poised to change. Several
Line companies have moved aggressively into a new
(5) business endeavor whose genesis comes from the question: Who owns the great works of literature?
 Text-on-demand is not a completely new idea, of course. In the 1990s, the Gutenberg project sought volunteers to type literary classics that had
(10) expired copyrights into word processing files so

that scholars would have searchable databases for their research. Most of the works of Shakespeare, Cervantes, Proust, and Moliere were to be found free online by as early as 1995.

(15) However, now large-scale companies have moved into the market, with scanners and business plans, and are looking for bargain basement content. These companies are striking deals with libraries, and some publishers, to be able to provide
(20) their content, for a price, to individual buyers over the Internet.

At stake are the rights to an estimated store of 30 million books, most of which are now out of print. Many of these books are now also in the
(25) public domain, giving any company the right to sell them online. Still, a good portion of the books a general audience might actually want to buy is still under copyright. The urgent question: Who owns those copyrights? In the case of all too
(30) many books put out more than 20 years ago by now-defunct publishing companies, the answer is unclear—a situation the new text-on-demand companies are eager to exploit. An association of publishers has sued, claiming massive copyright
(35) infringement. The case is several years away from trial.

12. The primary purpose of the passage is to

- (A) present the results of a statistical analysis and propose further study
- (B) explain a recent development and explore its consequences
- (C) identify the reasons for a trend and recommend measures to address it
- (D) outline several theories about a phenomenon and advocate one of them

(E) describe the potential consequences of implementing a new policy and argue in favor of that policy

13. It can be inferred from the passage that the works of Shakespeare, Cervantes, and Moliere

(A) are some of the most popular works of literature

(B) are no longer copyrighted

(C) are among the works for which the association of publishers is suing text-on-demand companies

(D) do not currently exist as searchable databases

(E) were owned by now-defunct publishing companies

14. Which of the following is an example of a book that a text-on-demand company would not have to acquire the rights to?

(A) a book still under copyright

(B) a book more than 20 years old

(C) a book in the public domain

(D) a book a general audience might want to buy

(E) a book not already owned by publishers the company has a deal with

15. It can be inferred from the passage that text-on-demand companies are

(A) using scanners to find books they want to acquire

- (B) creating business plans well before they have any actual business
- (C) buying content at premium prices
- (D) acquiring the rights to books for as little as possible
- (E) attempting to supplant the role of traditional publishers

16. Exit polls, conducted by an independent organization among voters at five polling locations during a recent election, suggested that the incumbent mayor—a Democrat—was going to lose the election by a wide margin. But, in fact, by the time the final results were tabulated, the incumbent had won the election by a narrow margin.

Which of the following, if true, would explain the apparent contradiction in the results of the exit polls?

(A) The people chosen at random to be polled by the independent organization happened to be Democrats.

(B) The exit poll locations chosen by the independent organization were in predominantly Republican districts.

(C) The exit polls were conducted during the afternoon, when most of the districts' younger voters, who did not support the incumbent mayor, were at work.

(D) The incumbent mayor ran on a platform that promised to lower taxes if elected.

(E) An earlier poll, conducted the week before the election, had predicted that the incumbent mayor would win.

17. The spread of Avian flu from animals to humans has been well-documented, but less understood is the mechanism by which it is spread from one bird species to another. **In order to avoid a worldwide epidemic of Avian flu, scientists must make that study a first priority.** To solely tackle the human dimension of this possible pandemic is to miss half of the problem: its spread from one hemisphere to another.

The bolded phrase plays which of the following roles in the argument above?

- (A) The bolded phrase states a premise of the argument.
- (B) The bolded phrase contradicts the author's main point.
- (C) The bolded phrase makes a statement that the author is about to contradict.
- (D) The bolded phrase states the author's conclusion.
- (E) The bolded phrase states an assumption the author is making.

18. Successful business leaders not only anticipate potential problems and have contingency plans ready, instead proceeding as if they are likely to occur at any time.

- (A) ready, instead proceeding as if they are likely to occur at any time
- (B) ready, but also proceed as if such problems are likely to occur at any time
- (C) ready, but also proceeding as if the occurrence of them is at any time likely
- (D) ready; they instead proceed as if their occurrence is likely at any time
- (E) ready; such problems are likely to occur at any time, is how they proceed

19. An artist who sells her paintings for a fixed price decides that she must increase her income. Because she does not believe that customers will pay more for her paintings, she decides to cut costs by using cheaper paints and canvases. She expects that, by cutting costs, she will increase her profit margin per painting and thus increase her annual net income.

Which of the following, if true, most weakens the argument above?

(A) Other area artists charge more for their paintings than the artist charges for hers.

(B) The artist has failed to consider other options, such as renting cheaper studio space.

(C) The artist's plan will result in the production of inferior paintings which, in turn, will cause a reduction in sales.

(D) If the economy were to enter a period of inflation, the artist's projected increase in income could be wiped out by increases in the price of art supplies.

(E) The artist considered trying to complete paintings more quickly and thus increase production, but concluded that it would be impossible.

20. Although tapirs reared in captivity are generally docile and have even been kept as pets by South American villagers, it is nonetheless a volatile creature prone to unpredictable and dangerous temper tantrums.

(A) it is nonetheless a volatile creature

(B) it is nonetheless volatile creatures

(C) being nonetheless volatile creatures

(D) they are nonetheless a volatile creature

(E) they are nonetheless volatile creatures

21. According to a recent report, the original tires supplied with the Impressivo, a new sedan-class automobile, wore much more quickly than tires conventionally wear. The report suggested two possible causes: (1) defects in the tires, and (2) improper wheel alignment of the automobile.

Which of the following would best help the authors of the report determine which of the two causes identified was responsible for the extra wear?

(A) a study in which the rate of tire wear in the Impressivo is compared to the rate of tire wear in all automobiles in the same class

(B) a study in which a second set of tires, manufactured by a different company than the one that made the first set, is installed on all Impressivos and the rate of wear is measured

(C) a study in which the level of satisfaction of workers in the Impressivo manufacturing plant is measured and compared to that of workers at other automobile manufacturing plants

(D) a study that determines how often improper wheel alignment results in major problems for manufacturers of other automobiles in the Impressivo's class

(E) a study that determines the degree to which faulty driving techniques employed by Impressivo drivers contributed to tire wear

Questions 22–25 are based on the following passage:

Founded at the dawn of the modern industrial era, the nearly forgotten Women's Trade Union League (WTUL) played an instrumental role in
Line advancing the cause of working women through-
(5) out the early part of the twentieth century. In the face of considerable adversity, the WTUL made a contribution far greater than did most historical footnotes.

The organization's successes did not come easily; conflict beset the WTUL in many forms. During
(10) those early days of American unions, organized labor was aggressively opposed by both industry and government. The WTUL, which represented a largely unskilled labor force, had little leverage
(15) against these powerful opponents. Also, because

of the skill level of its workers as well as inherent societal gender bias, the WTUL had great difficulty finding allies among other unions. Even the large and powerful American Federation of Labor (AFL), (20) which nominally took the WTUL under its wing, kept it at a distance. Because the AFL's power stemmed from its highly skilled labor force, the organization saw little economic benefit in working with the WTUL. The affiliation provided the AFL (25) with political cover, allowing it to claim support for women workers; in return, the WTUL gained a potent but largely absent ally.

The WTUL also had to overcome internal discord. While the majority of the group's members (30) were working women, a sizeable and powerful

ERROR: stackunderflow
OFFENDING COMMAND: ~

STACK: