



Brian Galvin
Chris Kane

Foundations of GMAT Logic

Authors	Brian Galvin Chris Kane
Co-founders	Markus Moberg Chad Troutwine
Contributing Writers	David Newland Ashley Newman-Owens
Contributing Editor	Jodi Brandon
Cover Design	Nick Mason
Interior Design	Tom Ahn Dennis Anderson

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Print Batch 2013.1



This book is dedicated to Veritas Prep's instructors, whose enthusiasm and experience have contributed mightily to our educational philosophy and our students' success.

It is also dedicated to the teachers who inspired Veritas Prep's instructors. The lesson that follows was only made possible by a lifelong love of learning and of undertaking educational challenges; we have teachers around the world to thank for that.

Finally and most importantly, this book is dedicated to our thousands of students, who have taught us more about teaching and learning than they will ever know. And to you, the reader, thank you for adding yourself to that group.

Personal Dedications

Veritas Prep is a community of educators, students, and support staff, and these books would not be possible without our cast of thousands. We thank you all, but would like to specifically acknowledge the following people for their inspiration:

Bogdan Andriychenko (GMAT Club), Clay Christensen (Harvard Business School), Tom Cotner (Plymouth-Salem High School), David Cromwell (Yale School of Management), Henry Grubb (Fort Osage High School), Dana Jinaru (Beat the GMAT), Steven Levitt (University of Chicago), Walter Lewin (Massachusetts Institute of Technology), Lawrence Rudner (Graduate Management Admissions Council), Jeff Stanzler (University of Michigan), and Robert Weber (Kellogg School of Management).

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INTRODUCTION TO THE VERITAS PREP COURSE

This lesson marks the initial lesson in the 12-lesson Veritas Prep GMAT Course. In the lesson that follows, and the 11 that follow it, you will learn how to approach the GMAT from both a content standpoint and a strategic standpoint. These lessons have been developed using one of the hallmark Veritas Prep strategies: “Learning by Doing.” After 10 years of teaching students around the world, our top instructors pooled their knowledge to create this unparalleled collection of GMAT strategies and targeted content coverage. In these lessons you will learn by doing challenging problems; you will master the core GMAT content that is critical to success; and you will begin to “Think Like the Testmaker,” understanding how the authors of the GMAT take these content areas and question types and challenge even the most capable pre-MBA students.

Foundations of GMAT Logic

This lesson will introduce the GMAT format and its question types, and then proceed to a crucial first step in your mission to “Think Like the Testmaker”: You will need to understand logic and the way that it relates to GMAT questions. You will learn the common fallacies that lead to tempting, incorrect answers; you will see how correct answers are built; and you will see how to arrive at those answers by logically leveraging information. By the end of this lesson, you will have developed a thought process through which you can efficiently and successfully navigate each type of GMAT problem.

The authors of the GMAT are careful to use the word “reasoning” when they refer to any section of the exam (e.g., Integrated Reasoning, Quantitative Reasoning, Verbal Reasoning). The GMAT is a reasoning test more than it is a content test. As such, it is only fitting that you begin your study with this coverage of the foundations of GMAT logic and reasoning.



////////////////// **GMAT OVERVIEW** //////////////////////////

Format of the GMAT

Sections	Questions	Allotted Time
Interactive Tutorial	0	
Analytical Writing Assessment	1	30 minutes
Integrated Reasoning	12	30 minutes
Optional break		8 minutes
Quantitative Problem Solving/Data Sufficiency	37	75 minutes
Optional break		8 minutes
Verbal Sentence Correction/Critical Reasoning/Reading Comprehension	41	75 minutes

Total Time: Approximately 3 hours, 50 minutes

Content on the GMAT

Analytical Writing Assessment The Analytical Writing Assessment (AWA) is the first section of the GMAT, and provides schools with a writing sample with which to gauge your communication ability. In the 12th lesson of this course you will learn strategies to master the AWA efficiently, saving mental stamina for the remainder of the test while posting a high score.

Integrated Reasoning Test-takers will face the Integrated Reasoning (IR) section as their second section of the exam. This section features 12 problems in 30 minutes, with problems taking four forms: Graphics Interpretation, Table Analysis, Two-Part Reasoning, and Multi-Source Reasoning. True to its name, the Integrated Reasoning section assesses a set of skills that integrates quantitative ability with verbal and logical reasoning. Your study of the other sections of the GMAT will aid you directly with Integrated Reasoning problems, and lesson 12 of this course will thoroughly cover the IR section and specific strategies to attack it.

Quantitative Reasoning The Quantitative Reasoning section of the GMAT consists of 37 questions designed to assess your skill with arithmetic, elementary algebra, and basic geometry. The section features two different types of multiple-choice problems: Problem Solving and Data Sufficiency. Problem Solving questions test your mathematical skills through a familiar construct; you are asked a question, and the five choices are each potential solutions. Data Sufficiency questions focus even more on logic, with a set of answer choices that assesses your ability to determine which pieces of information are relative for quantitative analysis.

In lessons 2, 4, and 6 you will review the fundamental topics behind arithmetic, algebra, and geometry, and learn to break them down to the level upon which difficult GMAT questions are based. In lesson 8 you will learn to master the “gamesmanship” behind Data Sufficiency by truly understanding the problem format from the perspective of the testmaker. In lesson 10 you will cover the advanced quantitative topics of probability, statistics, and combinatorics. And in lesson 11, you will learn problem-solving strategies and prepare for advanced word problems.

Verbal Reasoning The Verbal Reasoning section of the GMAT consists of 41 problems collectively designed to measure your ability to read critically, evaluate arguments, and recognize formal written English. The section contains three different types of multiple-choice problems: Reading Comprehension, Critical Reasoning, and Sentence Correction.

Lesson 3 will cover important strategies for Critical Reasoning. Lesson 5 will teach you to strategically tackle Sentence Correction. Lesson 7 will provide you with techniques for Reading Comprehension. Lesson 9 will take you inside the GMAT authors’ playbook, showing you how testmakers make problems difficult by playing on your mental tendencies. Lesson 12 will cover the AWA and IR sections, as well as final test-taking and study strategies to send you on your way to the test center with confidence.



GMAT OVERVIEW

Understanding Computer-Adaptive Tests (CATs)



Understanding Computer-Adaptive Tests (CATs)

Since 1997, the Graduate Management Admissions Council (GMAC) has administered the GMAT as a computer-adaptive test (CAT). This means that you will not have to squeeze into a crowded auditorium or cafeteria with hundreds of other test-takers at one appointed time as you must for the SAT or LSAT. Instead you will take the GMAT at a computer terminal in a test center and have the ability to schedule your GMAT appointment at a time convenient for you.

The most notable impact that the CAT format will have for your strategy resides in the way that it is scored. When you take a CAT, the result of each question you answer will dictate the difficulty level of the next question, so that the computer can present you with problems that narrow in on your own ability level. Computer-adaptive tests have a very different feel than paper tests for a variety of reasons:

- **You cannot return to previously answered questions to check your work.**
- **Pacing is extremely important, as you cannot save difficult questions for later.**
- **When you are performing well, almost all of the questions you receive will be very difficult.**

How does this affect your strategy? There are a few important things to consider:

1. **Stubbornness is particularly punished on computer-adaptive tests.**
Because you will see so many hard questions when you are performing well, you cannot get bogged down on any one question. If you are completely stumped after 90 seconds, it is a good idea to logically guess on a question. Learning when to dig in your heels and spend extra time on a question and when to give up is a fundamentally important decision on computer-adaptive tests.
2. **Pacing is not linear.** While the average time per question is approximately two minutes, there are some questions you will be able to answer in 30 seconds and there are others that will require three minutes. If you are going to spend more than three minutes on a problem, be fairly certain that you are going to get an answer. The worst thing that you can do on this test is spend four minutes on a question and then still guess.

- 3. Your floor is more important than your ceiling.** Many students chase what they consider to be high-difficulty questions, but in doing so leave fundamental flaws in their preparation that lead to a leaky floor, so to speak, on the exam. If you miss questions that you should answer correctly, you dig yourself a hole; the next question is then even easier, and it takes multiple questions to get back to the level at which you should have been. Do not neglect fundamentals, and be certain to double-check common mistakes that you tend to make to ensure that you don't give back questions that should be yours. "False positives" on the GMAT are a gift—you can accidentally get questions right or narrow down hard questions to a higher-percentage guess—but "false negatives" (wrong answers that you should have gotten right) are very problematic. Those tend to count against you more than false positives tend to help you. Do not neglect your floor while you chase a higher ceiling.

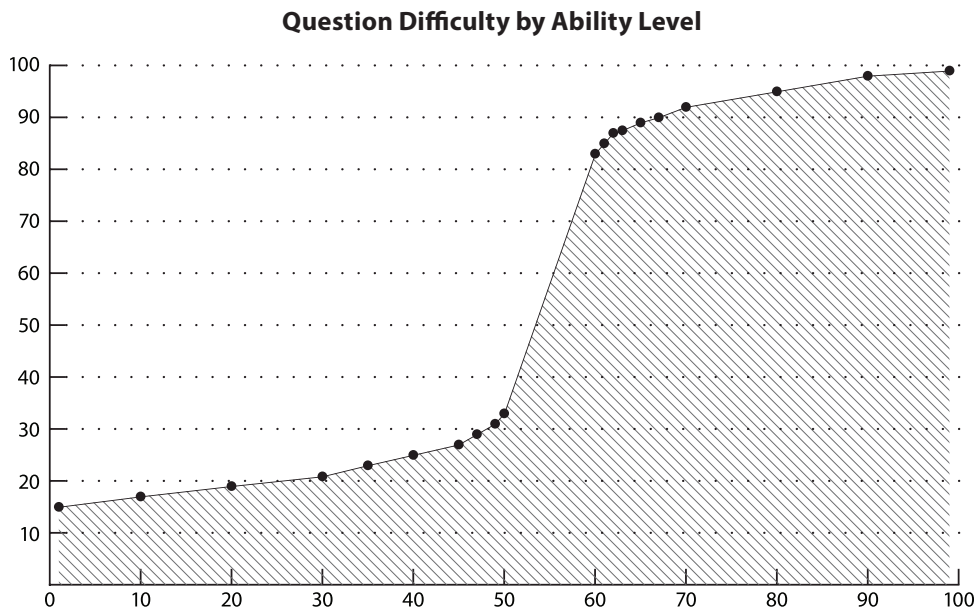


GMAT OVERVIEW

Understanding Computer-Adaptive Tests (CATs)

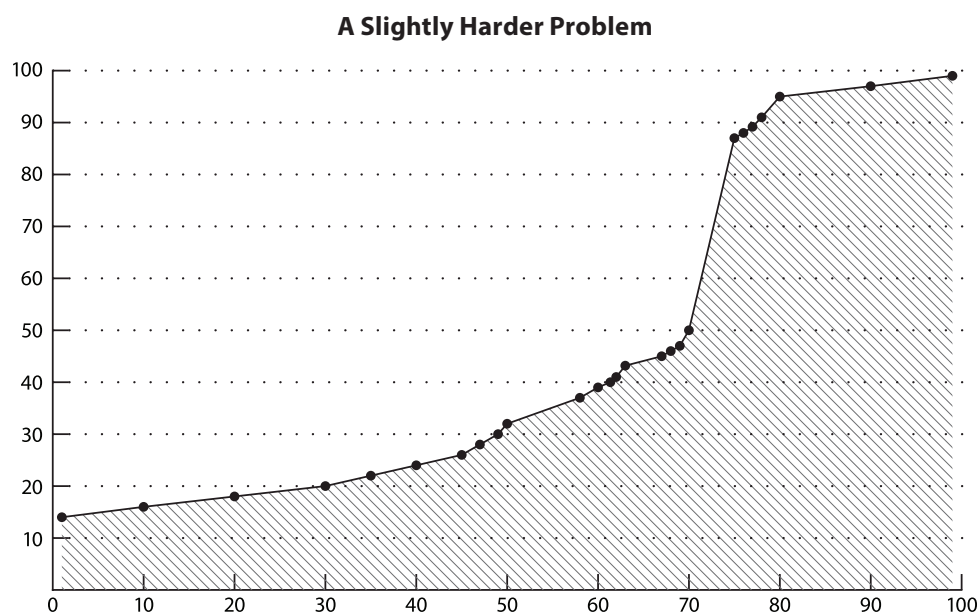


The following graph demonstrates how the GMAT CAT processes information regarding its questions:



The x-axis represents the user ability level of GMAT test-takers (shown here as final percentiles). The y-axis shows the percentage of users at each ability level who answer a particular problem correctly.

Where the curve is steepest (for this particular question, between the 50th and 60th percentiles) is where the CAT algorithm deems this question an effective separator. This question is good at determining which users are above the 60th percentile (almost all answer correctly) and which are below the 50th (almost all answer incorrectly). Using the CAT algorithm, those who answer correctly will then likely receive a question that looks like the following:



The GMAT CAT constantly monitors user performance on each question and provides you with questions that provide additional data relative to the data it has collected already from you. Also know this: The CAT understands that it will often receive false positives or false negatives, and is programmed to solicit more data to correct for that. Accordingly, one or two mistakes will not doom your score, and getting the first 10 questions right does not guarantee you a high score! What you should embrace, however, is that you can (and will) miss a fair number of questions and still achieve a high score. The CAT is designed to gauge your upper limit by feeding you questions that consistently challenge you on the higher end. Many lament the CAT algorithm as intimidating or even “evil,” but it is merely an advanced scoring technique that allows the GMAT to grade you fairly while using time wisely. Embrace the positives of the CAT, and in later lessons we will talk about how to pace yourself accordingly to not fall victim to some of the potential pitfalls that come with it.



GMAT OVERVIEW

What Is the GMAT testing?

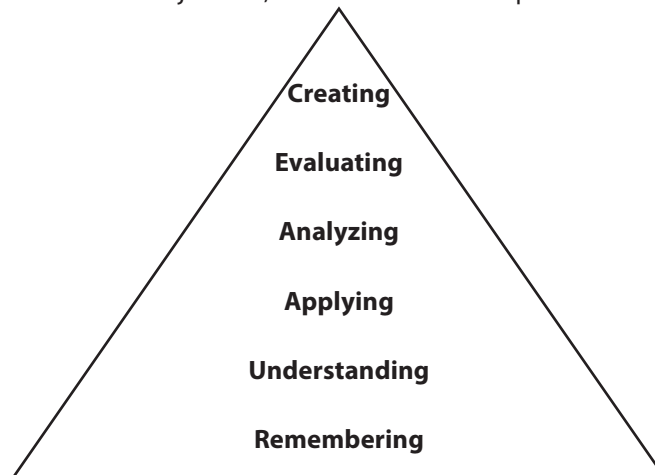


What Is the GMAT testing?

The authors of the GMAT are public with their mission. The GMAT is designed to:

- **Predict student success in business school, allowing schools to accept those most likely to be successful.**
- **Measure higher-order thinking abilities through quantitative reasoning and verbal reasoning.**

What is higher-order thinking? Educational theory is based largely on Bloom's Taxonomy of Educational Objectives, which is often best represented in pyramid form:



The pyramid shows the foundation of thought processes up to the pinnacle. To apply a concept (third row) you must first know it (first row) and understand it (second row). "Higher-order thinking," a stated aim of the GMAT authors and administrators, refers to the higher levels on the pyramid. While those levels rely on some base knowledge (remembering), that knowledge is only the basis for the questions. The questions will test your understanding, your ability to apply, and in most cases your ability to analyze and create. So while content knowledge is required in order to showcase those abilities, the GMAT is not a content-based exam. Simply memorizing (remembering) information does not guarantee you a high score. In order to succeed, you need to study the higher-order thought processes; you must understand and be able to apply.

Simply put, the GMAT is a test of how you think, not a test of what you know.

This makes sense. Your smartphone knows more than you do right now, but only you can apply that information to business success. B-schools want someone who can take knowledge and do something with it; they want critical thinkers and innovators.

CREATING *Think Like the Testmaker*

Creating is the top of the pyramid in Bloom's Taxonomy. When you have completely mastered the GMAT, you are able to *Think Like the Testmaker*: You are on top of the pyramid looking down! You don't just have good content knowledge and lots of practice with GMAT problems; you understand how the problem has been made, what makes it hard, and how to break it down. This is what sets apart the Veritas Prep curriculum from others. To break 700, you not only need mastery of skills (remembering) and lots of practice (applying), but also a deep understanding of how the test is made (creating).



APPLYING *Learning by Doing*

Another hallmark of the Veritas Prep curriculum is an emphasis on "Learning by Doing." What makes the GMAT difficult is not so much the underlying skills and concepts, but rather the way those skills and concepts are tested. Rote lecturing in the classroom and rote memorization of skills have limited utility in preparation for a reasoning test such as the GMAT. To be successful, you must learn how to marry skill proficiency with strategic thinking into what we call "Guiding Principles." Our curriculum emphasizes learning through challenging problems to help you:

1. Learn how to combine skills and strategies to effectively solve any GMAT problem.
2. Stay focused and engaged, even after a long day in the office.
3. Most effectively utilize the classroom time you spend with a true GMAT expert.



REMEMBERING *Skillbuilder*

The stated goal of the GMAT is to test higher-order thinking and problem-solving skills. In order to achieve that goal, testmakers must have some underlying content from which to create questions. On the GMAT, this content is mostly math curriculum through the early high school level and basic grammar skills through the elementary school level. To succeed on the GMAT you must have a thorough mastery of this content, but most students already have a relatively strong command of this material. In order to maximize the value added from instruction in the classroom, we have taken out all core skills that simply require refreshing and/or memorizing, and put them first in a Skillbuilder section. By doing this:

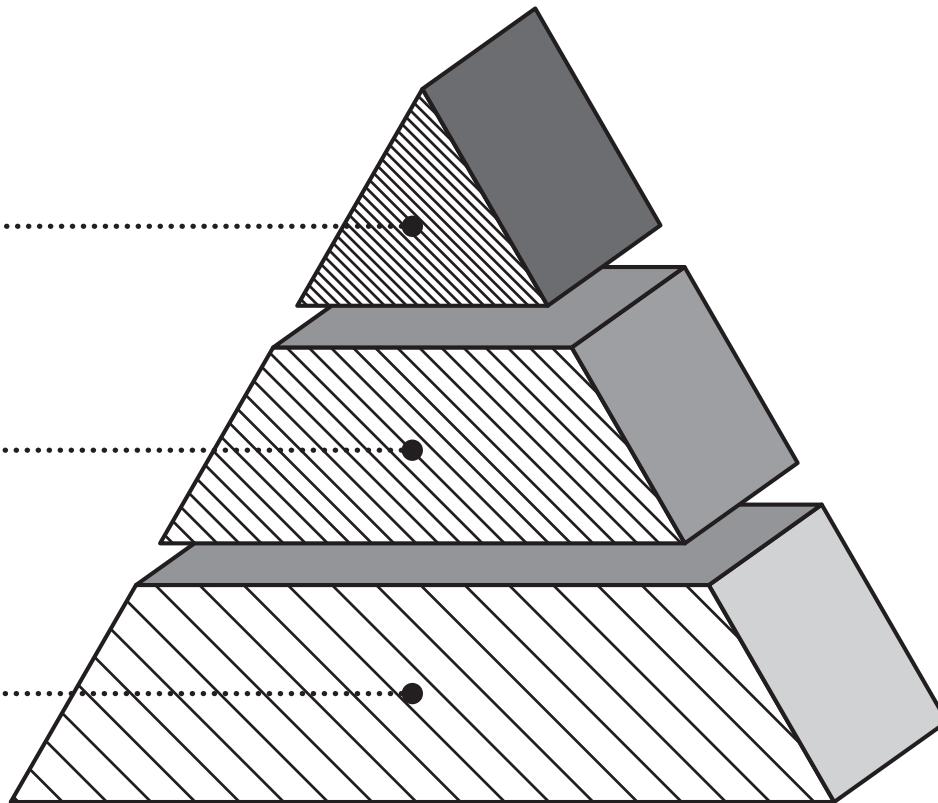
1. Students who need to thoroughly review or relearn these skills can do so at their own pace, and then focus on strategic thinking and problem solving during in-class time.
2. Students who have a solid command of the underlying content will not become disengaged because of tedious review of material they've already mastered.





THE VERITAS PREP METHODOLOGY

The educational philosophy at Veritas Prep is based on this multi-tiered Bloom Taxonomy, which classifies different orders of thinking in terms of understanding and complexity. To achieve a high score on the GMAT, it is essential that you understand the test from the top of the pyramid. In each book, you will learn specifically how to achieve that goal and how that lesson in particular relates to the Veritas Prep Pyramid.





Think Like the Testmaker

In a phrase, Veritas Prep wants to teach you to “Think Like the Testmaker,” understanding not just a list of skills and facts that fall under “testable content,” but also understanding how the GMAT likes to test these skills, how the question structures lend themselves to tricky problem solving, and how the authors of the GMAT design questions to align rewards so that correct answers aren’t just “correct,” but separate average from good, and good from great.

As you go through each book, know that each question provides multiple learning opportunities:

- **Why is the correct answer correct?**
- **Why is the incorrect answer incorrect?**
- **Why is the incorrect answer tempting?**

While some questions are designed to separate test-takers simply at the knowledge level (those without the base ability to accumulate and remember knowledge have little chance at the higher-order skills, so some questions need to provide the exam with that information), most are cleverly written to separate test-takers at higher levels. If you can learn the constructs that allow the GMAT to achieve separation at those levels, you will unlock a much more robust understanding of how to take the test.

In the movie *Rounders*, Matt Damon’s character famously uttered the line, regarding poker, that “if you can’t spot the sucker at the table, you probably are the sucker.” On most GMAT questions, if you can’t spot the “sucker choice,” there’s often a high likelihood that you are selecting the sucker choice. For example, consider the question:

If $x^2 = x^3$, is x positive?

Well, x must be 1, right? -1 would work if it was x^2 and x^4 , but the odd exponent for x^3 means that $(-1)^3$ would be -1 . So the answer is yes—or is it? 0 would also work, and 0 is neither positive nor negative. “Yes, x must be 1” is the trap answer—and if you become adept at recognizing and anticipating GMAT trap answers, you can confidently attack the test. Why is “yes” tempting? It’s satisfying. You’ve eliminated -1 en route to arriving at 1, so that satisfaction carries you happily toward that answer. But the GMAT rewards “devil’s advocacy”; the test wants you to consider all available options. Leaving a decision a step short without double-checking for not-so-obvious threats is often a catastrophe in business—and on the GMAT.

With the Veritas Prep program, you will learn to Think Like the Testmaker and look down from the top of the pyramid—to anticipate ways that questions will be asked and that concepts can be crafted into questions; to be on guard for the trap answer and to know which traps are likely to appear in which situations; to recognize common question set-ups and know how to attack them; and to see multiple steps ahead when looking at an intimidating problem, knowing to be patient because you have a good idea where it’s headed. The GMAT, ultimately, is a test of how you think, and through this program you will learn to think much like those who write the questions.



Recurring Themes in the Veritas Prep Pyramid

Embrace Pattern Thinking

In each of the lessons, you learn specific skills and approaches for common problems within that content area. For instance, in the Arithmetic lesson you learn that most problems do not require any calculations and are based more on a conceptual understanding of how calculations work. “Math Without Doing Math” is a Guiding Principle throughout the Arithmetic lesson that is also important in other content areas. The top two levels of the pyramid (Think Like the Testmaker and Skills Meet Strategy) contain important recurring themes that are essential to success on the GMAT.

The skills that you acquire from each of the Skillbuilders also have important relevance in other content areas. For instance, most exponent problems involve prime factorization, and most equilateral triangle problems involve root manipulation. A Sentence Correction problem that appears to be testing difficult subject-verb agreement might best be solved by focusing on an easier but well-disguised modifier error. After examining hundreds of GMAT problems, you realize quickly that a problem that appears to be testing, say, probability might really be testing your ability to compare fractions. Likewise, problems may appear very different on the surface because they are testing different content areas but actually are constructed using very similar themes or mechanisms. A probability question and a geometry question that are completely different in content might be difficult for exactly the same reason: abstraction and misdirection.

For each problem, we want to highlight these recurring themes so that you get better and better at picking them out, regardless of the question type. For each problem in the lesson, there will be a themed explanation that puts together all elements of the pyramid to help you understand the problem. However, a special emphasis will be put on recurring themes at the middle or top of the pyramid, and those will be highlighted separately. The next few pages explain the important recurring themes for Think Like the Testmaker and Skills Meet Strategy (i.e., application of skills and concepts). These will be highlighted with the appropriate section in the pyramid throughout the book and are mapped out on the next few pages.



THINK LIKE THE TESTMAKER

Recurring Themes

Abstraction → Testmakers often make simple questions difficult by presenting concepts and skills in an abstract form. For instance, in an Arithmetic problem testing division, you will not have to actually calculate a remainder, but rather understand patterns with quotient and remainders on the number line. To deal with abstraction, you must truly understand concepts on a gut conceptual level, not just through rote memorization or repetition.

Reverse Engineering → Similar to abstraction, reverse engineering is a tool used by testmakers to differentiate between those who really understand a core concept and those who do not. If you memorize a concept or skill from $A \rightarrow B$ but don't truly understand that concept, it is unlikely you will be able to answer a question that makes you go from $B \rightarrow A$. A great example is the concept of lowest common multiple (LCM) in arithmetic. If you ask a student preparing for the GMAT what the LCM of 6 and 5 is, he will almost surely get it right. (The answer is 30.) But if you tell students that the LCM of X and Y is 30, and ask them to list the possible values for x and y (go backward), less than 10% will do it successfully. The makers of the GMAT know which concepts are difficult backward and will use this technique frequently to make difficult questions

Large and/or Awkward Numbers → Testmakers have learned that when a question is asked using simple numbers, people tend to get it correct. For instance if you are told that $31 - n$ is divisible by 3 and asked for a possible value for n, it is relatively simple, because you know the multiples of 3 near 31. Given that, n could be 1, 4, 7, etc. However, if you are asked the same question with a large, awkward number, the success rate dwindles, because you then must really understand the concept and have a good problem-solving approach. If you are told that $13,333 - n$ is divisible by 11 and then asked for a possible value for n, you must truly understand division and remainders.

Exploiting Common Mistakes → On both the verbal and quantitative side, testmakers know the common mathematical errors or errors in logic and grammar that people will make. Most questions are actually designed around a particular common mistake or misconception. For instance, in a ratio problem that states the ratio of men to women is $\frac{1}{4}$, many people will say that men are 25% of the total when they are really 20%. On a Critical Reasoning question with correlated data, testmakers know that people tend to assume causation when they see correlation. When you understand concepts well, you not only know the correct answer, but you also understand the common mistakes they are baiting you to make.

Selling the Wrong Answer and Hiding the Correct Answer → Recognizing this tool is particularly important on the verbal side of the test. Testmakers will do everything possible to obscure the correct answer and make the incorrect answer enticing. For instance, on a Sentence Correction problem, the correct answer will contain an unusual grammatical construction that does not sound correct but is. The incorrect answer will contain a normal-sounding structure but hide cleverly a well-defined error such as pronoun agreement. A math example would be a problem such as: What is the greatest prime factor of $11!10! + 10!9!$? If you pick 11 on this problem, you should probably ask: Is it really that easy? The bottom line is that on hard problems, the obvious-looking answer is never the answer.

Misdirection → Misdirection is exactly what it sounds like. On a Critical Reasoning question, testmakers will insert a piece of information or use a particular topic to get your brain focused on the wrong thing. In a Geometry problem, testmakers always create a problem knowing that the important relationship is put in the "last place you will look." Your first inclination on most difficult GMAT problems is incorrect because of misdirection; they have baited you down one path when the answer really lies elsewhere.

Content-Specific Themes → Each content area will have specific "Think Like the Testmaker" themes particular to that one content area or question type. For instance, in Data Sufficiency some of the important constructs, such as "The C Trap" or "Why Are You Here?," are essential to success but only are important in Data Sufficiency. In algebra, "An Inconvenient Truth" refers to how testmakers always give you algebraic equations or expressions in the most inconvenient form possible and require you to manipulate them in order to solve the problem.



THE VERITAS PREP METHODOLOGY

Recurring Themes in the Veritas Prep Pyramid



SKILLS MEET STRATEGY

Recurring Themes

Guiding Principles → Memorizing facts and learning skills is important for the GMAT, but it only helps you at the bottom of the pyramid. In each content area, you will learn “Guiding Principles” that will take collections of skills and put strategic direction to them. These principles will show you how to best apply knowledge and skills for particular types of GMAT problems. For instance, memorizing exponent rules is helpful, but what is really important is learning how to unlock GMAT exponent problems with the Guiding Principles in algebra. Important guiding principles will be highlighted following each question.

Problem-Solving Strategies → Since the stated goal of the GMAT is to test higher-order thinking and problem-solving skills, it is essential to understand that how you attack the problem is just as important as what the problem is about. For instance, you will learn when to back-solve or use answer choices to shortcut work (answer choices are part of the problem!). You will also learn how to use your own numbers to clarify a concept or problem, and in data sufficiency you will spend an entire lesson unlocking this sophisticated problem type.

Leveraging Assets → Similar to Guiding Principles, “Leveraging Assets” is about learning how and when to leverage the skills and knowledge that you learn at the bottom of the pyramid and that you are given in any one problem. People who are good at leveraging all the information in a problem and all the information they have learned do well on the GMAT. Geometry questions are based almost entirely on this idea; those who are able to leverage every little piece of information within a figure will be able to unlock the relevant relationships and solve the problem.

Learning by Doing → As you learned earlier, every problem is an opportunity to learn strategies, content, and skills. For every lesson problem and homework problem, you should isolate all important takeaways relating to both content and strategy.

Don't Mistake Activity for Achievement!

Focus on Recurring Themes

The famous John Wooden quote “Don’t mistake activity for achievement” could not be more relevant to your GMAT preparation. Simply doing problems without isolating important takeaways and recurring themes will not help you in preparation for this test. Remember that it is not so much about the content, but how the problems are designed and broader thematic concepts. Each book is structured so that you can most efficiently prepare for this test by maximizing your time through highlighted takeaways.

How Each Book Is Structured

Our Curriculum Is Designed to Maximize your Time

The Veritas Prep Teaching Philosophy: *Learning by Doing*

Business schools have long featured the Case Method of education, providing students with real-world problems to solve by applying the frameworks they have studied. The Veritas Prep Learning by Doing method is similar: In class, you will spend your time applying skills and concepts to challenging GMAT problems, at the same time reviewing and better understanding core skills while focusing your attention on application and strategy. The Case Method in business school maximizes student engagement and develops higher-order thinking skills because students must apply and create, not just remember. So will the Learning by Doing philosophy maximize the value of your study time, forcing you to engage with difficult questions and develop top-of-the-pyramid reasoning skills.

An important note on Learning by Doing: In business school, your goal with a business case is not to simply master the details of a particular company's historical situation, but rather to develop a broader understanding of how to apply frameworks to real situations. In this course, you should be certain to reflect on each question not simply through that narrow lens (Did you answer correctly? What key word made the difference?), but rather as an example of larger GMAT strategy (How could the exam bait you with a similar trap? How deeply do you need to understand the content to solve this genre of problem more efficiently?).



Each book in the Veritas Prep curriculum contains four distinct sections:

1. **Skillbuilder.** We strongly suggest that you **complete each Skillbuilder lesson before class** at your own pace, and return to the Skillbuilders when you recognize a content deficiency through practice tests and GMAT homework problem sets.

The Skillbuilder section will:

- Cover content that is **vital to your success** on the GMAT, but is best learned at your own pace outside the classroom.
- Allow you to **review and/or relearn** the skills, facts, formulas, and content of the GMAT. Each student will have his or her own set of skills that are “rusty” or even brand-new, and will find other items that come back quickly.
- **Vary in length** significantly for each book, based on the number underlying concepts. (For instance, the Advanced Verbal lesson does not have a Skillbuilder because you are already building on the concepts introduced in three previous lessons.)

2. **Lesson.** The lessons are designed to provide students with maximum value added from an instructor by:

- Doing in class problems together (*Learning by Doing*), and
- Analyzing those problems for recurring takeaways (*Skills Meet Strategy* and *Think Like the Testmaker*).

With each problem, there will be a detailed explanation that we call “Learn from the Problem,” which will emphasize the concept of Learning by Doing from the middle of the Veritas Prep Pyramid. That will help you understand how the problem is testing a particular concept or series of concepts, what makes the problem hard, and what underlying skills are required to solve it.

When relevant, there will be particular boxes for *Think Like the Testmaker*, *Skills Meet Strategy*, and *Skillbuilder* when you should be focused on particular aspects of the how the question is made or how the underlying content is being tested.

NOTE: When doing in-class and homework problems, you should **do your work below the problem** and you **should not circle the answer** on the actual question (just note it on the bottom of the page). That way, if you want to redo problems, you can simply cover up your work and proceed as if you had never done it.

3. You Oughta Know. The *You Oughta Know* sections will follow the lesson and cover:

- Obscure topics that arise infrequently, or
- More advanced topics that are not common on the GMAT but that do get tested.

While these uncommon content areas do not warrant in-class time, we believe you should have some exposure to these topics before taking the GMAT. Therefore you should **complete these sections before moving to the homework problems**. As with the Skillbuilders, the length of these will vary depending on their importance.

4. Homework Problems. In many ways, the homework problems are **the most important part of each book**. After refreshing core content in the Skillbuilder and then applying that knowledge in the lesson, you must reinforce your understanding with more problems.

Each question is accompanied by a **detailed explanation** in your online student account, as well as a quick-reference answer key on the last page of the book. A majority of questions are above the 50th percentile in difficulty, and they are arranged in approximate order of difficulty (easiest to most difficult). By completing all of the homework problems, you will learn most of the different iterations of how concepts and skills are tested on the GMAT.

Homework problems should be challenging, with most of them carrying an above-average difficulty rating. Do not despair if you are answering questions incorrectly in the homework! Your goal should be to learn from every mistake. Students can miss a significant percentage of questions in each book and still score extremely high on the GMAT, provided that they learn by doing and analyzing the problems. Embrace the challenge of hard problems and plan to learn from your mistakes.



GMAT QUESTION TYPES AND STRATEGIES

The quantitative and verbal sections of the GMAT, among them, cover five main question types:

- **Problem Solving**
- **Data Sufficiency**
- **Sentence Correction**
- **Critical Reasoning**
- **Reading Comprehension**

To succeed on the exam, it is immensely helpful to recognize the questions not merely as vehicles for assessment, but as the assessment themselves. For example, a Data Sufficiency question is not merely the delivery mechanism to test a geometry concept. The geometry concept is often more of a platform upon which the GMAT can ask a tricky Data Sufficiency question. In the lessons that follow, you will learn the rules of the game for each question type, and learn to use each to your advantage. For example, “Decision Points” is the art of recognizing differences between Sentence Correction answer choices, and Data Sufficiency questions are often solvable by leveraging the construct of a question to help you unlock that secret, “eureka” key to the concept.

Over the next few pages, you will see examples of each question type and of the strategies you can employ. **The goal of this section is to briefly introduce students to the content of the GMAT and to introduce core Veritas Prep approaches for each of the question types. Do not worry as much about the underlying content in these examples as the “strategy” and bigger picture takeaways.** A special emphasis is given to Data Sufficiency, as it is a particularly foreign question type that you must understand broadly before starting the quantitative lessons. Lastly, the detailed solutions for each of the example problems are given at the end of this section.

Problem Solving

1. What is $\sqrt{157,609}$?

(A) 323

(B) 378

(C) 392

(D) 397

(E) 403

General Strategy for Problem Solving Questions

As you can see from this example, Problem Solving is more than just a type of math question. It truly does test your ability to solve problems, often creatively or in ways that use answer choices as more than potential answers, but also assets. Problem Solving questions are generally designed to reward you for seeing a simpler, more efficient way to attack a math problem than just by “doing math.” In the quantitative lessons that follow, you will learn the necessary math skills and, perhaps more importantly, the essential problem-solving techniques needed to attack these questions.

To be efficient and accurate in problem solving, it is essential that you use good strategy:

1. **Read the question carefully and make sure you are answering the proper question.**
2. **After you read the question, look at answer choices and determine how much work you must accomplish to pick one of the five answer choices. Remember: *The answer choices are part of the problem.*** Probably the biggest mistake people make on Problem-Solving questions is that they answer the question in a vacuum—that is, they do all the work and then look back to see if their answer is one of the five. Often, if you are actively using answer choices, it is clear which one is correct after a minimum amount of work.
3. **Don’t be too eager to start the problem.** Your first inclination on Problem-Solving questions is often incorrect. Digest the problem thoughtfully and look for the simple, elegant solution. Because of the difficult timing on the GMAT, people are scared to spend too much time understanding a problem, but that time is usually well spent.
4. **Avoid careless mistakes in calculations.** Try to avoid too many calculations (as they are rarely required) but when you do make them, employ methods and approaches that limit careless mistakes.



Data Sufficiency

In Lesson 8, we will thoroughly cover Data Sufficiency strategy. Before you reach that point you will see several Data Sufficiency questions in the preceding quantitative lessons, so you should have a basic understanding of the Data Sufficiency structure first. Data Sufficiency questions ask you, true to their name, “when is the data sufficient?” or “when do you have enough information?” to answer the specific question. The answer choices are fixed, so you will want to memorize those, and each offers a different point at which you have enough information to answer the question: with just one statement; with either statement; needing both statements; or not even with both statements. Consider the following example, not worrying about the math for now but just the structure:

By what percent was the price of a certain candy bar increased?

- (1) The price of the candy bar was increased by 5 cents.
- (2) The price of the candy bar after the increase was 45 cents.

QUESTION STEM

STATEMENTS

- (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.

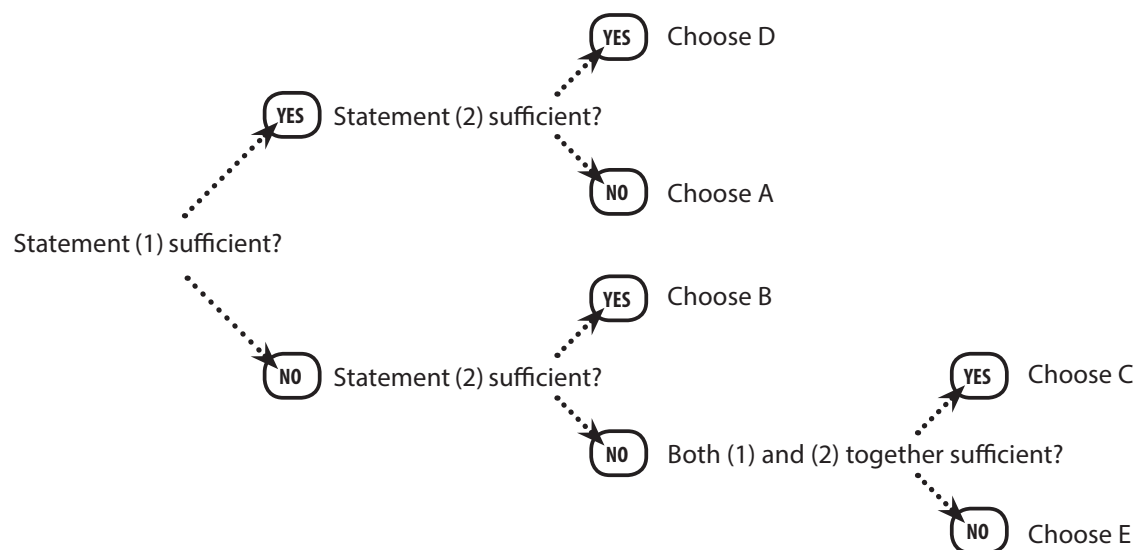
ANSWER CHOICES

For every Data Sufficiency question, ask yourself the following questions (if starting with statement (1)):

- Is the information in statement (1) alone enough to answer the question?
- Is the information in statement (2) alone enough to answer the question?
- Can I answer the question if I combine the information from statements (1) and (2)? (Only ask this of yourself if neither statement alone was enough to answer the question.)

Data Sufficiency Decision Tree

Assess each statement to determine whether it is sufficient or not, and this tree will lead you to the correct answer:





The Two Types of Data Sufficiency Problems

There are two types of data sufficiency problems: “Yes or No” questions and “What Is the Value?” questions. For each one you must understand what constitutes sufficiency so you can properly employ the decision tree.

“Yes or No” Question

2. Is $x > 9$?

(1) $x^2 + 3x = 28$

(2) $9x = 5x - 28$

- (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.

General Strategy for “Yes or No” Questions

In “Yes or No” questions, you must get a definitive answer to the question in order for a statement to be sufficient. In statement (1), after factoring the quadratic equation, you learn that x could be -7 or 4 . At this point there are two mistakes that students will make:

- They think it is not sufficient because there are multiple solutions, or
- They think it is not sufficient because the two results are less than 9 , thus providing an answer of no to the question.

Because this statement gives you a definitive no answer to the question, it is sufficient. Regardless of whether x is -7 or 4 , it is not greater than 9 , so it is a sufficient piece of information to answer the question. In statement (2), you learn that x is -7 , which is also sufficient by itself, so the answer is answer choice D. **Remember: If a statement gives you a definitive yes or no answer, then the statement is sufficient. If a statement provides you with an answer of maybe—a yes and a no—then that statement is not sufficient.**

“What Is the Value?” Question

3. What is the value of x ?
- (1) $3 < x < 5$
 - (2) $x^2 = 16$
- (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.

General Strategy for “What Is the Value?” Questions

In a “What Is the Value?” question, a statement must provide exactly one value in order for it to be sufficient. In statement (1), x could be any of the infinite set of real numbers between 3 and 4, so it is not sufficient. In statement (2), x could be 4 or -4 , so it is not sufficient. Together, x must be 4 (the only overlapping solution between the two statements), so the answer is answer choice C.

As you will learn in the full lesson, Data Sufficiency questions are an exercise in resource management. In order to succeed, you need to know both how much information is required to answer the question, and how much information you have at any given point in time. The authors of these questions are quite adept at disguising both. As seen in this question, the authors can craft situations in which you’re apt to make an assumption about a variable, perhaps that it is positive or that it is an integer. In this way they can make you think you have more information than you actually do. But they can also disguise how much information is necessary. Were the question to lead with the introductory phrase “If x represents the number of chickens on a farm,” how would the answer be entirely different?

In the GMAT Logic portion of this lesson you will learn about leveraging facts to draw conclusions, an important skill for Data Sufficiency. You will also learn to master the above answer choices—which will never change! The often-intimidating Data Sufficiency question format offers you as many competitive advantages as it does threats. Over the duration of this course, you will learn to appreciate those opportunities and to harbor significantly less anxiety over the threats.



Sentence Correction

4. Forming stunning perches from which hikers can view an endless array of forests and lakes, the high alpine sections of the Wind River mountain range remain barren regions where little water or nutrients exist to sustain plant or animal life.
- (A) little water or nutrients exist
- (B) little water or nutrients exists
- (C) few nutrients and little water exists
- (D) there is little available water or nutrients available
- (E) there are few nutrients and little available water

General Strategy for Sentence Correction Questions

Contrary to popular belief, the Sentence Correction question format is as much a problem-solving exercise as the other question types. Here, the question may seem to hinge on difficult subject-verb agreement (agreement by location) and an important idiomatic principle of countability (little vs. few).

But an appreciation for the question format can take you beyond those rules and in a great many cases overcome your lack of pure grammar knowledge. Here, recognize that without the changes in the answer choices (“Decision Points”), you might not notice what is wrong with the original. The sentence is merely describing the nutrients as “little,” meaning that there are miniature nutrients and not, as required for this to be logical, a scarce number of nutrient. In the Sentence Correction lesson you will learn to play the answers off of each other looking for meaning differences—the true skill being tested in Sentence Correction. This “Decision Point” strategy will allow you to succeed on Sentence Correction problems with only a solid base of grammar skills. **Much as you saw in the square-root-themed Problem Solving example, an efficient approach to logic and problem solving will take you much, much further than the mechanical application of facts, formulas, and rules.**

Critical Reasoning

5. All of the athletes who will win a medal in competition have spent many hours training under an elite coach. Michael is coached by one of the world's elite coaches; therefore it follows logically that Michael will win a medal in competition.

The argument above logically depends on which of the following assumptions?

- (A) Michael has not suffered any major injuries in the past year.
- (B) Michael's competitors did not spend as much time in training as Michael did.
- (C) Michael's coach trained him for many hours.
- (D) Most of the time Michael spent in training was productive.
- (E) Michael performs as well in competition as he does in training.

General Strategy for Critical Reasoning Questions

In the Critical Reasoning lesson, you will learn about the different types of questions that exist (Strengthen, Weaken, Inference, and Method of Reasoning). This a Strengthen question, in which the goal is to insert a new premise that improves the quality of the conclusion.

Do you see how they make this question difficult? Answer choices A, B, D, and E all seem to matter in your preconceived view of athletic performances. However, only one of them specifically improves the relationship between the exact conclusion and the stated premises. **As you will learn in the full Critical Reasoning lesson, beware of the seemingly relevant answer choice that does not exactly match the content of the argument and the specific conclusion.**

In the Critical Reasoning lesson, you will learn the types of questions and application of logical principles upon which Critical Reasoning questions rely. But from this example, walk away with this: The authors of the GMAT are quite adept at setting traps that will punish you for making assumptions or entering with preconceived ideas. Much as you saw in the Data Sufficiency example, in which assuming that a variable had certain traits that were not made explicit, your job is to use the facts that exist to answer a question—to only make decisions based on what is known, and not on what you expect to see.



Reading Comprehension

At this point in your academic career you have likely seen dozens of Reading Comprehension passages on standardized tests. Due to the time-consuming nature of breaking down passages, we will save the full coverage of Reading Comprehension for that lesson, but for now we offer this example of a passage for your review (and because we know you've been interested in learning more about blueworms and heatworms):

Example Passage

Until recently, *Ascaris azure*, known as the Diaz blueworm, and *Ascaris tropica*, known as the Costa Rican heatworm, were thought to be different species of roundworm. The heatworm is about 0.5 centimeters long, and lives within the bark of huge cecropia trees in Southeast Asian rain forests. The blueworm, barely visible with the naked eye, is found in frigid seafloors. Despite these apparent differences, The Institute of Helminthological Studies has officially stated that “both” species are actually Diaz blueworms.

Dr. Ginny Bolton, examining roundworm samples collected in Borneo, noticed that the heatworm's tiny cilia (hairlike organelles) appeared to beat in a single direction, aiding in the expulsion of food. Dr. Bolton later determined that the cilia also made it much easier for the heatworm to live in the stifling confines of tree bark. The cilia project from a cuticle that is made of keratin, a protein that protects the worm's epidermis from drying out and overheating. The cilia help regulate the proliferation of the keratin, and the force of the cilia's movements varies as the external temperature changes, allowing for a highly responsive thermostatic system, constantly adjusting the amount of keratin so that the worm would be neither overexposed nor stifled.

Knowing that the only other roundworm with directional cilia is the blueworm, Dr. Bolton consulted with several blueworm specialists. The thermostatic system that served the heatworm so well proved to be identical to the one used by oceangoing blueworm. However, the blueworm, which has been known to colonize methane ice mounds, uses the keratin to protect itself from frigid temperatures. The cilia sensed when the temperature was high enough to allow the production of keratin to slow down. Without the surrounding wall of keratin, the worm can more easily graze on bacteria.

Genetic testing showed that the blueworm and the heatworm were not merely structurally similar; to the scientists' surprise, the worms were identical. This was startling, not only because of their vastly differing habitats, but also because of the difference in size. The answer again was to be found in the keratin, a tough substance that normally inhibits growth, keeping the hydrostatic pressure very high within the worm. The relatively large worm found in the rainforest molts as it grows, allowing the worm to increase its volume a very small amount each time it does, but the smaller worm cannot afford this much exposure. The freezing temperatures trigger the production of keratin so quickly that the worm has little chance to grow, thus keeping its volume approximately one-fourth that of the larger worm.

General Strategy for Reading Comprehension Questions

As you will learn in the lesson, the key to Reading Comprehension is your reading approach. In a passage such as this, it is easy to get bogged down in the complex, scientific details and spend way too much time reading material that is not important. By employing the “STOP” reading approach, you will learn how to read only for core information required for the broader, “Universal” question types, leaving precious time for the more difficult detail-oriented questions (that you *must go back to the passage for*).



Detailed Solutions to Sample Questions

1. In a nutshell, this problem is testing how multiplication works (and thus the arithmetic concept of “units digit” number properties). When you are asked for the square root of a number, you are really being asked what number, when multiplied by itself, will equal the number under the root sign. Since the number under the root sign ends in 9, then the correct answer must yield a units digit of 9 when multiplied by itself. Only numbers ending in 3 or 7 can give that result (many people will forget about 7—one of the primary difficulties of the problem). Given that fact, the correct answer must be A, D, or E. At this point, you must be able to roughly estimate the calculation. Since you know that 4×4 is 16, you can reason that 400×400 is 160,000 and that answer choice E is too big. Likewise, 323×323 will be far too small, so the answer must be answer choice D—the only answer that is just less than 400 ending in 3 or 7. As you will learn in the Arithmetic lesson, this problem is a classic example of “Math Without Doing Math”—that is, a problem that appears to require tedious math can be accomplished with pure conceptual understanding and virtually no underlying math.
2. As you saw in the discussion following this question, the math is relatively straightforward, but the Data Sufficiency construct can be difficult if you have never seen it before. Statement (1) gives you a simple quadratic that you can break down as $x^2 + 3x - 28 = 0$. This can be factored to show that $(x + 7)(x - 4) = 0$ and $x = -7$ or 4. This statement is sufficient, as each possible solution for x gives you a definitive no answer to the question. Statement (2) is simpler, as it is just a linear equation with one unknown and shows that $4x = -28$ and $x = -7$, also sufficient to answer the question. Answer choice D is correct.
3. This problem hinges mainly on your ability to avoid careless assumptions. For statement (1), there are an infinite number of possible values for x , so the statement is “infinitely” insufficient to answer the question. Statement (2) shows that x could be either 4 or -4 , so it is also not sufficient, as you must prove one distinct value for a statement to be sufficient. However, together you know that x must be 4 or -4 and it must lie between 3 and 5. Only 4 meets those conditions, so the correct answer choice is C, as both statements together are sufficient.

4. As you will learn in the full lesson, the key to success in sentence correction is what we call “Decision Points,” which involves leveraging the options that they give you in the answer choices. Here there are a few important Decision Points on this problem: the choice between “exist” and “exists”/“there is” and “there are”; the choice between “few” and “little”; and the choice between “and” and “or.” If you start with the subject-verb agreement decision points, you can eliminate answer choices B and C first. Since “nutrients” must agree with the verb (agreement by location), “exists” is incorrect and should be “exist.” In answer choice C there is a plural compound noun (nutrients and water) that does not agree with “exists.” In answer choices A and D you cannot have the adjective “little” modifying the noun “nutrients” (which it must do logically when put in front of both nouns), as that is illogical. In answer choice E, “few” is properly put in front of “nutrients” and “little available” in front of water. There is also proper subject-verb agreement as well as the correct conjunction “and.” The correct answer choice is E.
5. The goal in a Strengthen question is to insert a new piece of information (a missing premise—aka an assumption) that improves the quality of the argument. The argument states that there are two necessary conditions for winning the gold: You must train for many hours, and you must have an elite coach. You then learn that because he has an elite coach he will win the gold medal. What is a required premise that is missing in this argument? Answer choice C. If the conclusion is that he will win the gold, then it must also be stated that he also trained for many hours. Note that the argument is still very poor after you insert that piece of information, but it is necessarily better. Also, you should note why the other answer choices are wrong. While it might seem like they matter in your own mind, they do not relate at all to the line of reasoning in the stimulus.



GMAT LOGIC

What Is an Argument?

Logicians and mathematicians have developed a language that is precise and logical, and the GMAT is built upon this foundation. **In essence, over 80% of GMAT questions are arguments containing premises, assumptions, and conclusions, and all GMAT questions are based on logical principles. Unlike GMAT courses that rely on tricks and gimmicks, the Veritas Prep course starts with these logical tenets.** These building blocks will help you crack the verbal section of the GMAT, much of which tests your ability to reason through argument structure. The logic of arguments is also directly applicable to both types of questions you will encounter on the quantitative section. By understanding this underlying logic and the proven Veritas Prep strategies for tackling each question type, you will achieve a GMAT score that genuinely reflects your true potential.

While the GMAT directions do state that knowledge of formal logic is not necessary, you will nonetheless be at a distinct advantage if you have at least a rudimentary understanding of argument structure. After all, the authors of the GMAT do take care to add the term “reasoning” to the end of each question type (e.g., Quantitative Reasoning section).

The Greek philosopher Aristotle (384–322 BC) first posited the notion that a tool could be used to argue convincingly. His study included grammar, rhetoric, and logic, and he built his teaching of logic upon what he calls a syllogism, a three-sentence structure in which the truth of the first two sentences guarantees the truth of the third:

All men are mortal. ← Premise

Socrates is a man. ← Premise

Socrates is mortal. ← Conclusion

A syllogism works if the two premises (which are always treated as facts) are related to each other logically and then prove the third statement. Here, since the second premise (Socrates is a man) directly relates to the first (all men are mortal), the two work together to produce a third statement that must be true.

In other arguments, and certainly in many not-necessarily true GMAT arguments, the two premises are not properly linked, so the argument draws a conclusion that is not guaranteed. Consider the syllogism:

All men are mortal.

Socrates is a dog.

Therefore, Socrates is mortal.

That argument is clearly flawed. Why? Because the second premise is not logically connected to the first. To believe this argument, one would need to assume that “what is true of men is true for dogs.” Much of your role with GMAT arguments will involve recognizing these logical gaps between premises and conclusions. Similarly, think about this argument:

All men are mortal.

Socrates is mortal.

Therefore, Socrates is a man.

Is this argument valid? It’s not. In the first premise, you learn that being mortal is a necessary condition of being a man—that is, every single man is mortal. However, being mortal is not sufficient to prove that you are a man. In other words, there are many other living things that could be mortal. In the second premise, you learn that Socrates is mortal, but that is not sufficient to prove that he is a man. As you just saw in the previous syllogism, perhaps Socrates is a dog, or any other of the mortal plant or animals.

You will more closely look at flaws in arguments shortly, but for now let’s further break down the roles that certain statements play in an argument. As you’ve seen, arguments are constructed of premises (facts) and conclusions (drawn from facts).

They also involve context, a topic that the GMAT will employ to round out syllogisms into paragraphs (and to force you to process more information). An example of context would be:

I was thinking about Socrates the other day and noticed something interesting.
(Context)

Socrates is a man. (Premise)

And all men are mortal. (Premise)

So Socrates must be mortal. (Conclusion, based on the premises)



Conclusions Are King

When it comes to GMAT arguments, conclusions are the most important portion. Most Critical Reasoning questions will ask you to strengthen or weaken a conclusion, so it is imperative to know which portion is the conclusion. Then you can archive the context in your mind, and check the logic between the premises and the conclusion to look for flaws.

Because finding the conclusion is the most critical part of assessing GMAT-style logic, it is crucial that you know how to find a conclusion. Three language clues in an argument can lead you to the conclusion:

1. Conclusion Language

Clues: keywords such as *therefore, thus, in conclusion, or so*

Example: Therefore, we should invest in a new auditorium for the school.

2. Call for Action

Clues: some action that should be taken, based upon premises. Key phrases include *we should, they must, it is important that we, etc.*

Examples: Like above, "Therefore, we should invest..."

or: "Because of this revelation, they need to retract their statement immediately."

3. Premise Words

The only reason to indicate a premise is if the conclusion is nearby. If you are merely listing facts (premises) then there is no need to use a premise word. Consider the following: "The quantitative section precedes the verbal section. Photo ID is required of all test takers. The scoring range is from 200 to 800." These are all stated as facts and do not require any signal words. However, if a conclusion is added, then a premise word becomes necessary. For example, "Because the GMAT is a very long test, you should take advantage of both of the available breaks." Now the word "because" is needed in order to show that the premise is not the conclusion. That is the purpose of a premise word: to indicate that a phrase is not the conclusion. This is usually only done if the conclusion is very near. So when you see a premise word, look for the conclusion to precede or follow the premise that the premise word signals.

The cause/effect technique begs a further explanation of how premises and conclusions are offered. **Any conclusion that comes in a GMAT argument will have to come with a reason why.** This is necessary because conclusions must be based on something. A stand-alone statement is not a conclusion in a GMAT argument; it must be accompanied by at least one premise. So you can use this function of logic to use the "Why?" test for conclusions.

4. The “Why?” Test

If a statement is made without a reason why, it is not the conclusion. If a statement depends logically upon something else—if there is a reason why—then it could be the conclusion. Try it with this statement:

It is raining, so the parade will be canceled.

Why is it raining? The sentence doesn’t say. That’s a premise.

Why is the parade canceled? Because it’s raining. The statement offers a reason why, so “the parade will be canceled” is the conclusion.

Now, note this: Rarely an argument may have multiple conclusions, but will only have one main conclusion. Consider this:

It is raining, so the parade will be canceled. Therefore, the Rotary Club will need to find a new fundraiser this year.

Here, the “main conclusion” is that the Rotary Club will need to find a new fundraiser. Why does the club need a new fundraiser? Because the parade will be canceled. Why is the parade canceled? Because it’s raining. The premises and the subordinate conclusion all lead to the main conclusion: The Rotary Club will need to find a new fundraiser.



Deconstructing Arguments

Consider a few examples. What are the roles of the sentences in boldface?

1. In the United States, nearly half of the whole blood received by blood banks is acquired by buying blood from “donors.” This is a dangerous practice. **It increases the risk of hepatitis for recipients,** because people who have the disease and who are desperate for money may lie in order to sell their blood. The practice is also demonstrably inefficient, because the people willing to sell blood may not have the blood types needed. Finally, it commercializes what can be a beautifully rewarding act.
2. **It can safely be inferred that there are at least as many trees in Ithaca as there are in Hanover.** More trees were planted in Ithaca in the past two years than in Hanover.
3. The brain loses sensitivity to the painkilling effects of narcotic medicines taken regularly over a long period of time. This occurs because the flow of medication is controlled by the selective permeability of a barrier found in the tiniest of blood vessels. **This barrier, which surrounds the brain and spinal tissues, determines which substances—ranging in size from molecules to viruses and bacteria—will pass from the blood into the cells and fluids of the brain.**
4. **Arbor Day was founded in 1872 to promote the planting and growth of trees in the United States.** Proponents of Arbor Day argue that the large-scale planting of trees would be beneficial for the environment. Trees reduce erosion, provide homes for animals, and draw harmful pollutants out of the atmosphere. As a result, they advocate that land should be set aside to plant millions of acres of trees.
5. **The Lions will win the Super Bowl,** because their quarterback, wide receivers, and defensive tackles are the best in football, and the rest of the team is up-and-coming. With this dominant team, fans are excited again and attendance is up, so we need to immediately start making plans for the Super Bowl victory parade.

Solutions: 1. Premise; 2. Conclusion; 3. Premise; 4. Context; 5. Premise

Precision in Language

Another important component in logic, and perhaps one of the most important components on the GMAT, is precision in wording. You must precisely and accurately digest every word that is used on this test. In many arguments, a logical flaw hinges on misinterpretation of several words.

Consider a few examples. Is the logic valid?

I support the Lakers.

Kobe plays for the Lakers.

Therefore, I support Kobe.

All linebackers play dirty.

Some linebackers are Raiders.

Therefore, some Raiders play dirty.

All widgets are steel.

Some widgets are red.

Therefore, some steel widgets are not red.



LEARNING BY DOING

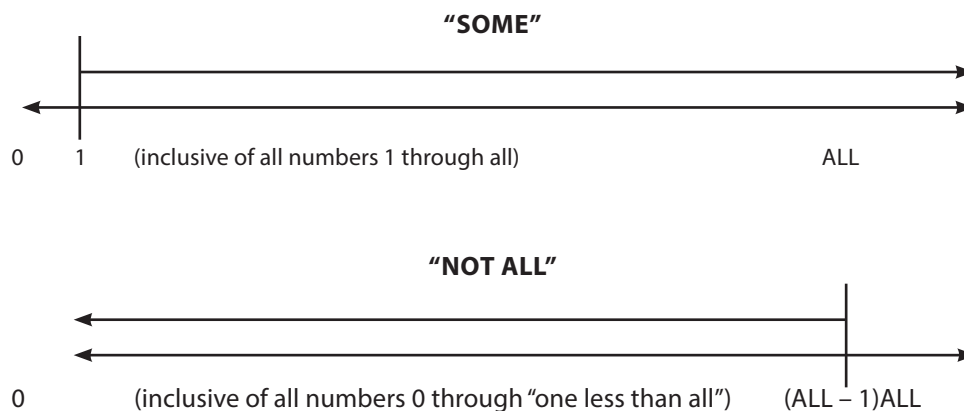
Read Carefully

On the previous page, you saw several examples of flawed logic. The first one is classic wordplay. Just because you support a team does not mean you support every member of a team. They simply do not mean the same thing. If the first premise was “I support every member of the Lakers,” then it would be a valid argument.

The second example is valid and generally easy for students. All linebackers play dirty and if some linebackers are Raiders, then at least one linebacker is a Raider. You are then sure that at least one Raider plays dirty, so the conclusion must be true.

The third example showcases another important element of wordplay. “Some” does not mean the same thing as “not all,” even though colloquially most will use them as synonyms. If all widgets are steel and some widgets are red, it is still logically possible that all widgets are steel and red. Thus the conclusion is not “must be true.”

Look around your classroom right now (or if you’re outside the classroom, think of your network of pre-MBA colleagues). Is it safe to say that “some of my GMAT colleagues would like to achieve a high score on the test”? It is. You may not have interviewed each classmate to gauge their goals, but those with whom you’ve spoken have probably all reported lofty goals. So some of your classmates—those you’ve talked to—want a high score, it’s safe to say. Well, it probably turns out that all of them do, but that doesn’t make you wrong for saying that “some” do. “Some” literally means “not none” or “at least one, possibly all.” “Not all” literally means “not all” (anything but all). The two have quite a bit of overlap on the number line, but they do have distinct differences. “Some” potentially means anything from 1 to all, inclusive. “Not all” potentially means anything from 0 to (all – 1), inclusive.



Logical Opposites

So far, you have learned the importance of deconstructing arguments and precision in wording. Many difficult GMAT questions also use convoluted wording that requires an understanding of logical opposites. If the wording of an argument rules something out, look for what must be true given the exclusion. For example, if an argument (in some fashion) ruled out “all,” what can we correctly infer to be true: some, not all, or none?

If “all” is not true, “some” could be true, but is not necessarily true. “None” could be true, but is not necessarily true. (“Some” could be true.) “Not all” must be true; this correct logical opposite allows for all possibilities.

The logical opposite is not the complete opposite, but the logical complement—what must be true given the exclusion. To correctly infer the logical opposite, we must avoid embedding any assumptions (for example, in the case above, an assumption about existence or non-existence). Here are some other examples:

- “Must be true” vs. “not necessarily true”
- “Could be true” vs. “cannot be true”
- “Cannot be false” vs. “Could be false”
- “Not necessarily false” vs. “must be false”
- “All” vs. “not all”
- “Some” vs. “none”
- “Always” vs. “not always”
- “Sometimes” vs. “never”
- “Everywhere” vs. “not everywhere”
- “Somewhere” vs. “nowhere”

On the GMAT, the logical opposite of hot is:

- (A) Cold
- (B) Not hot

Solution: Most people would tell you that the opposite of hot is “cold,” because hot and cold are polar opposites. On the GMAT, however, you must look for the logical opposite, which is “not hot.”



APPLYING LOGICAL PRINCIPLES TO GMAT PROBLEMS

To this point you have deconstructed arguments to identify premises, conclusions, and context, and you have learned how important it is to focus on precision in wording and logical opposites. Why is this all so important? With the following selection of problems you will see how these logical principles are applied to several different types of GMAT questions. Clearly, logic is most important for Critical Reasoning problems, but it also plays a huge role in all other GMAT question types. To start, let's look at how important it is to properly deconstruct arguments in one type of Critical Reasoning question.

Critical Reasoning: Strengthen Questions

The most common mistake that befalls GMAT students on Critical Reasoning problems in which you are inserting a premise (Strengthen or Weaken questions) is that they do not properly assess conclusions. They may fail to identify the proper conclusion, they may miss important language within the conclusion, or they may simply hijack that conclusion—in other words, make the conclusion what they want it to be or what their preconceived notions expect it to be. Consider these two examples of Strengthen questions, in which you insert a premise to improve the quality of the argument:

6. In Europe, schoolchildren devote time during each school day to calisthenics. North American schools rarely offer a daily calisthenics program. Tests prove that North American children are weaker, slower, and shorter-winded than European children. We must conclude that North American children can be made physically fit only if they participate in school calisthenics on a daily basis.

Which of the following is an assumption required by the argument above?

- (A) Physical fitness is a compelling national priority worthy of taxpayer resources.
- (B) School calisthenics programs are an indispensable factor in European student fitness.
- (C) All children can be made equally physically fit.
- (D) European schoolchildren enjoy physical activities more than do American children.
- (E) American physical education teachers are capable of designing a successful calisthenics program.

7. **Paretan newspaper editor:** David Salino assails as distorted our quotation of remarks on Paretan values by the Qinkoan prime minister and bemoans what he sees as the likely consequences for Paretan-Qinkoan relations. Those consequences will not be our fault, however, since officials at the Qinkoan embassy and scholars at the Institute of Qinkoan Studies have all confirmed that, as printed, our quotation was an acceptable translation of the prime minister's remarks. No newspaper can fairly be blamed for the consequences of its reporting when that reporting is accurate.

Which one of the following is an assumption on which the editor's argument depends?

- (A) The confirmation that the translation is acceptable is sufficient to show that the prime minister's remarks were accurately reported.
- (B) Newspapers ought not to consider the consequences of their coverage in deciding what to report.
- (C) If the newspaper's rendering of the prime minister's remarks was not distorted, then there is no reason to fear adverse consequences from reporting the remarks.
- (D) If David Salino was prepared to praise the newspaper for any favorable consequences of quoting the prime minister's remarks, he could then hold the newspaper to blame for adverse consequences.
- (E) Only scholars or people with official standing are in a position to pass judgment on whether a translation of Qinkoan into Paretan is acceptable.

**LEARNING BY DOING***The Importance of Conclusions*

The first example (#6) presents a conclusion with incredibly strong language: We must conclude that they can be made physically fit only if.... Clearly the evidence presented does not support such a strong conclusion. In the Critical Reasoning lesson, you will learn more about some important logical fallacies: generalization, correlation vs. causation, statistical flaws, etc. This argument suffers from the following flaw: Just because superior fitness is correlated with a daily calisthenics program in Europe and a lack of one in this country, that does not mean it is the reason why this is true. It could be that North American children are weaker, slower, and shorter-winded than European children because of dietary differences or air pollution or any other number of reasons. Also, even if you prove that the reason is the presence of school calisthenics, are you sure that the only way you could fix the problem is with in-school calisthenics? Maybe an at-home fitness program could be instituted that would be just as effective at promoting fitness as the in-school programs. The bottom line is this: The language of the conclusion makes this argument incredibly weak. To strengthen it, you will need to insert a strongly worded premise that corrects one or both of these glaring flaws. Answer choice B does just that; it helps to show why this program is the only way to gain fitness similar to the Europeans by stating that the school exercise program in Europe is an indispensable factor in their superior fitness. Also in this problem, be careful that you do not “hijack” the conclusion and make it what you think it is or what you want it to be. If you misread the conclusion as “we should implement a daily school calisthenics program,” then you might be tempted with answer choice A. In reality, answer choice A is irrelevant to the given conclusion; what taxpayers think does not change how to make children fit.

The second example (#7) provides a trickier path to the conclusion. Many students will gravitate to the last line (“no newspaper can fairly be blamed...”) as the conclusion, but that line gives none of the above conclusion signals. If you ask “why?” you won’t find a reason. The appropriate conclusion is actually:

“Those consequences will not be our fault.”

Why? Well, because officials have said that the translation is accurate. Because there’s a reason behind the statement, we can determine it to be the conclusion. With that as a conclusion, our argument is constructed as follows:

- We cannot be blamed if our reporting is accurate.
- Our reporting was properly translated.
- Therefore, the consequences are not our fault, as we cannot be blamed.

The gap here is that simply admitting that the translation is accurate does not mean that the reporting is accurate. Accordingly, answer choice A must be true in order to link the facts to reach that conclusion. Had you selected the wrong conclusion to support from the outset, you would have been extremely far afield as you tried to assess the answer choices.

Note also, here, the role of context in crafting a longer argument. With the bulleted list of premise-premise-conclusion above, the argument flows quickly. But when “David Salino assails as distorted...,” setting the scene, the argument becomes much longer and more difficult to process. You know what you’re responsible for in these questions and what has been added simply to lengthen the argument and create confusion. Quickly processing the conclusion and the relevant facts to support it can make your job much more efficient and straightforward.



SKILLS MEET STRATEGY

Precision in Wording

In each of these examples, you see not only the importance of picking out the proper conclusion, but also the need to read and digest every word carefully. In the first, strong words like “must” and “only” drastically change the complexity of the argument. In the second, if you casually treat “properly translated” and “accurately reported” as meaning the same thing, then you are left hopelessly looking for some flaw or gap in the argument. The gap, of course, is that if something is properly translated, it is not necessarily accurately reported! Precision in wording is one of the key skills in Critical Reasoning and for the GMAT test as a whole.



Critical Reasoning: Inference Questions

In addition to questions that will ask you to assess the validity of an existing conclusion, the GMAT will also ask questions that ask you to draw a proper conclusion. These questions often hinge directly on the type of wording interpretation, wording tricks, and understanding of logical opposites that you were exposed to in the last section. The standard for a valid conclusion on the GMAT is that, much like in Aristotle's syllogisms, the premises must guarantee the conclusion. In other words, a valid conclusion on the GMAT **must be true**. Consider an example:

8. All sports cars are fast.

Most sports cars have a manual transmission.

Sports cars with a manual transmission are fun to drive.

Which one of the following conclusions can be drawn from the statements above?

- (A) Sports cars without manual transmissions are not real sports cars.
- (B) Sports cars that are fun to drive are among those that are fast.
- (C) Sports cars without manual transmissions are exceptions to the rule that all sports cars are fast.
- (D) Manual transmission is the only thing that makes a sports car fun.
- (E) All sports cars that are fast are also fun.

LEARNING BY DOING

Must Be True

While the previous question may not have been heroically difficult, it models two important thought processes regarding the GMAT. First, the correct answer when you are asked to draw a conclusion must be true—but it need not be particularly compelling or unique. Beware your natural tendency toward wanting to provide more information than is really there. In life we're often rewarded for hunches that turn out to be good ones. You'd like to say here that "there's an exception to the rule," as that provides new value to the situation, but on the GMAT you cannot contradict a premise. And since the premise says "all sports cars are fast", the word all prohibits any exceptions to the rule.



THINK LIKE THE TESTMAKER

Selling the Wrong Answer

As you study it's often just as useful to learn from the wrong answers and how they were constructed as it is to learn what the right answer is. Here, both choices A and C use that "you want to add new information" bait to try to draw you away from the correct-but-not-terribly-exciting answer choice B. As you study for the GMAT, pay attention to your rationale for choosing or just being unable to eliminate incorrect answer choices. Often there is a systematic reason that a wrong answer choice looks good to you, and learning to sniff out those situations can vastly increase your chances of avoiding them on test day.



APPLYING LOGICAL PRINCIPLES TO GMAT PROBLEMS

Critical Reasoning: Inference Questions



9. The U.S. Department of Agriculture divides the North American continent into “hardiness zones.” These zones are based on the average winter temperature and are used to determine what types of plants will likely survive in a given area. Zone 1 represents the coldest average winter temperature and zone 13 the warmest. The zones are closely correlated with, but do not exactly match another set of eleven zones that indicate the length of the growing season. Minneapolis is in hardiness zone 4 and Denver is in hardiness zone 6.

Which of the following statements is most supported by the information above?

- (A) During the coming winter, the lowest recorded temperature in Minneapolis will be lower than the lowest recorded temperature in Denver.
- (B) The growing season in Denver is much longer than the growing season in Minneapolis.
- (C) A greater variety of plants can be grown in Denver, due to the warmer average winter low.
- (D) Factors other than average winter temperature affect the length of the growing season.
- (E) At least one U.S. city has a colder average winter temperature than does Minneapolis.

LEARNING BY DOING

Not Necessarily True

In the previous question, it is quite likely that, as answer choice A states, Minneapolis will have a lower extreme temperature than will Denver. Similarly, it is likely true that Denver has a much longer growing season. But neither is necessarily true. Denver has a higher average temperature, but that could be a result of shorter, colder winters and a quicker jump back to spring. Regarding answer choice B, the zones “do not exactly match” the length of the growing season, and Denver or Minneapolis might be one of those exceptions. The authors of the GMAT are quite adept at providing you with answer choices that very well could be true but that are not necessarily true. Answer choice D, however, can be proven: If the zones are not identical, then there must be another factor that accounts for the difference between hardiness zone and length of the growing season.



SKILLS MEET STRATEGY

Play Devil's Advocate

More broadly, the previous question illustrates a crucial logical principle: In order to show that an answer choice is incorrect on a “must be true” question, you do not need to show that it is “certainly not true”; all you have to do is play devil’s advocate and come up with one example (which is often quite difficult) in which the conclusion is not true. On Inference questions, it is unlikely that you will pick a “must be false” answer when you are asked for something that “must be true.” However, as you saw on the previous question, it is entirely possible that you will pick something that is likely to be true but not guaranteed to be true. Thinking skeptically and playing devil’s advocate are two of the most important approaches for success on the GMAT.



Data Sufficiency Questions

In Data Sufficiency, syllogism logic and “must be true” versus “not necessarily true” logic are very important. As you learned in the Data Sufficiency introduction, the goal on any Data Sufficiency question is to create a “must be true” conclusion to the question at hand. For *Yes or No* questions, that is either a “must be yes” or “must be no”; for *What Is the Value?* questions, that is an answer of “must be one exact value.” If a statement gives you one of those answers, it is sufficient. In assessing statements that appear to be sufficient, all you need to do is find one case that will give you a “maybe” answer (for *Yes or No*) or more than one value (for *What Is the Value?*) and you’ve shown it is not sufficient. First consider an example without math:

10. Are there more trees in Tompkins than in Ithaca?

- (1) Tompkins is the region in which Ithaca is located.
 - (2) There exists at least one tree in Tompkins that is not located within Ithaca.
-
- (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.

LEARNING BY DOING*Statements Are Premises*

In the Data Sufficiency construct, the two statements represent premises upon which you are trying to build a valid conclusion. In this example, if you take the first premise (statement (1)), you learn that Ithaca is located inside of Tompkins. (Note the difficult wording in that statement; it is very easy to misinterpret that information and think Tompkins is inside of Ithaca!) This means that there are at least as many trees in Tompkins as there are in Ithaca, because every tree in Ithaca is also in Tompkins. However, this statement is not sufficient, as they could have exactly the same number of trees. The conclusion “there are more trees in Tompkins than there are in Ithaca” is not valid because it is not necessarily true. Statement (2) is also not sufficient (remember not to carry any information from statement (1) to statement (2)), as it tells you nothing about the number of trees in each region. While there is at least one tree in Tompkins that is not shared with Ithaca, you do not know anything about which one has more trees. However, when you take both statements together, then you are sure that “there are more trees in Tompkins than there are in Ithaca,” because at a minimum Tompkins has one more tree than Ithaca. The correct answer choice is C.



APPLYING LOGICAL PRINCIPLES TO GMAT PROBLEMS

Data Sufficiency Questions



11. Is $x > 4$?

(1) $x^2 = 25$

(2) $5x < 0$

- (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.

LEARNING BY DOING

Data Sufficiency Logic

This question requires you to determine if you have enough information to know whether or not x is greater than 4. In a Yes or No Data Sufficiency question like this, your job is to make sure that you guarantee the same answer every time. Here, statement 1 allows for two values of x : 5 and -5 . If it's 5, the answer is "Yes, x is greater than 4"; if it's -5 , then the answer is "No, x is not greater than 4." Because the statement leads to two different answers, it's insufficient, as you are not getting a definitive and valid conclusion.

Note the role of statement 1. It is a fact; it is a premise. It reads as an either/or fact, though: x is either 5 or it's -5 . Many a premise will take on this exact form: It will tell you something about a number, but not everything about it. Its job is to give you clues about the number (or situation), and you need to analyze those clues to determine whether they always point to the same conclusion.

Statement 2 here is sufficient; it proves that x is less than 0, which means that it certainly is not greater than 4. So the correct answer choice is B.



SKILLS MEET STRATEGY

Understand the Data Sufficiency Answer Choices

You might look at this problem and say, "Well, both together are sufficient, too," citing that if we know that x is negative, then statement 1 can only allow for x to be -5 . While that is true, look back at answer choice C, a two-part statement: BOTH statements TOGETHER are sufficient (check!), but NEITHER statement ALONE is sufficient (not true: Statement 2 alone *is* sufficient). As you will see throughout your Data Sufficiency homework, the authors of the GMAT like to bait you into using both statements when one alone will suffice. The wording of each answer choice is precise for a reason; you must know exactly when you can prove a conclusion.



APPLYING LOGICAL PRINCIPLES TO GMAT PROBLEMS

Problem Solving Questions



Problem Solving Questions

While Data Sufficiency questions all use a logical construct, many Problem Solving questions also employ logical structure as part of the problem. Consider this example:

12. If $ab = b$, which of the following **MUST** be true?

- (A) $a = 1$
- (B) $b = 0$
- (C) $a = 1$ and $b = 0$
- (D) $a = 1$ or $b = 1$
- (E) $a = 1$ or $b = 0$

LEARNING BY DOING

Precision in Language

Note, again, the precision in wording required on this problem and the all-important difference between the words *and* and *or*. Either A or B could be true, but neither must be true. If b is not 0, that's fine—as long as a is 1. And if a is not 1, as long as b is 0, then the equation is satisfied. Algebraically, the equation factors to:

$$ab = b$$

$$ab - b = 0$$

$$b(a - 1) = 0$$

$$b = 0 \text{ or } a = 1$$

That “or” is critical. Answer choice C, again, could be true, but is not required. They do not BOTH have to be true, and the word *and* means they both must. Answer choice E is airtight; one of those statements must be true, but either will do.

SKILLS MEET STRATEGY

Do the Algebra

By just simplifying the equation with some algebraic manipulation, you will not fall into the trap of improperly back-solving. **Whenever you can change an algebraic expression or equation into a more convenient form, it is essential that you do it on the GMAT.** While you still must understand the difference between “must be true” and “could be true” to get this problem correct (regardless of whether you do the algebra), it is much easier after you have done some manipulation.



THINK LIKE THE TESTMAKER

Selling the Wrong Answer

Why do so many students miss this problem? Because they try to back-solve instead of doing some algebra and thinking about the problem logically. If you plug in answer choice A it seems to work, so people pick it. But if you plug in the values from answer choices B and C, they seem to work as well.

While back-solving is an important problem-solving strategy, it is never a substitute for logic and conceptual understanding. Testmakers punish rote back-solving, and this is a perfect example of how they do it. The reason that back-solving does not work here is that the question asks for what must be true, not what could be true. Just because some value makes it true, it does mean it must be true.



GETTING THE MOST OUT OF YOUR COURSE

The Veritas Prep course is designed to optimize the time that you spend studying, and to blend content, conceptual understanding, and strategy to provide you with a comprehensive program to prepare for the GMAT. To ensure that you get the most out of your course:

- 1. Read and complete the Skillbuilder sections of each lesson before class begins.** Particularly for the Arithmetic, Algebra, Geometry, and Sentence Correction lessons, the GMAT tests a wide enough scope of information—information that you have largely already learned much earlier in your academic career—that to try to teach all of it from the ground up would take significantly longer than most students can stomach. Your in-class time will cover many of these skills, but its emphasis will be on using the skills to employ strategy and build deeper conceptual understanding.
- 2. Complete at least half of the homework problems for each lesson within the week that class takes place.** A major educational philosophy behind this curriculum is “Learning by Doing.” By taking what you learn and applying it directly to homework problems, you will build deep knowledge and the ability to effectively employ strategies.
- 3. Think conceptually.** The GMAT tests many of its skills and concepts in ways that reward you for understanding the entire topic, and that by that same token punish the rote memorization of simply “one way to do it.” The GMAT is a test not of what you know, but of how you think, so remember to think your way through problems as you practice and not simply look up formulas or rules, as you won’t have that option on test day.
- 4. Do not mistake activity for achievement; do not mistake memorization for knowledge.** Many of us have successfully navigated higher education to this point by cramming for tests, grinding out papers, and counting on attendance and participation grades to round out our scores. The GMAT is a different animal, and many students are frustrated by putting in time and effort but not seeing results. To succeed on this test you need to hold yourself accountable for what you learn and not just what you do. Repetition and memorization have their place, but only if they are building blocks toward deeper conceptual and strategic understanding.

5. Do not be discouraged by incorrect answers in class or in homework.

These lessons are designed to focus primarily on problems with above-average difficulty and beyond, using incorrect answers to reveal important takeaways. You should be challenged in each lesson, and to get the most out of this course you should find pride in learning from mistakes.

6. Know that help is just a step away. Visit your TrueTrack account for information on Veritas Prep Live Online Office Hours, Recorded Video Explanations for homework questions, and other Homework Help resources.



HOMEWORK: GETTING THE MOST OUT OF THIS LESSON

Your homework for this lesson is to set yourself up for success on the lessons to follow. The Skillbuilder sections of the beginning math lessons are, for most students, the most critical homework assignments of the course, as successful completion of them allows students to maximize the value of their classroom time for the rest of the course. With that in mind, your homework from this lesson is not a collection of GMAT problems as it will be for future books, but rather:

1. Complete the Arithmetic Skillbuilder lesson prior to the Arithmetic lesson.
2. Use this week's homework time to get ahead on the Critical Reasoning and Algebra Skillbuilder lessons for next week's classes.
3. Log into your TrueTrack account and familiarize yourself with the online resources at your disposal: the Veritas Prep On Demand recorded lessons; the Homework Help service; the practice tests; and a variety of other resources at your fingertips.



////////////////// **ANSWER KEY** //////////////////////////////////////

1. D
2. D
3. C
4. E
5. C
6. B
7. A
8. B
9. D
10. C
11. B
12. E

