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# GRE<sup>\*</sup>/GMAT<sup>\*</sup>

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## MATH workbook

Third Edition

**by David Stuart  
and  
the Staff of Kaplan, Inc.**

**Simon & Schuster**

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Project Editor: Déa E. Alessandro

Production Artist: Hugh Haggerty

Editorial Coordinator: Déa E. Alessandro

Executive Editor: Del Franz

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## **ABOUT THE AUTHOR**

**David Stuart**, Kaplan's National Associate GRE Director, graduated from the University of Adelaide with a degree in geophysics. He worked as a seismologist and later as a geologist in oil fields worldwide. Since joining Kaplan in 1990, he has worked extensively on developing new strategies and techniques to master the CAT.

# How To Use This Book

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Kaplan has prepared students to take standardized tests for more than 50 years; longer than the GRE and GMAT have even been around. Our team of researchers and editors know more about preparation for the GRE and GMAT than anyone else, and you'll find their accumulated knowledge and experience throughout this book.

The GRE and GMAT are standardized tests, and so, while every test is not identical, every test covers the same content in roughly the same way. This is good news for you; it means that the best preparation you can have will focus on the sort of questions you are likely to see on test day. All the exercises in this book are made up of such questions.

The main focus of this book is on reviewing the math concepts you need to get a good score on the GRE or the GMAT. Strategic reviews, exercises, and practice tests with explanations will help you brush up on any math skills you have forgotten since high school. The math concepts tested on the GRE and GMAT are almost identical, so the bulk of the material we cover is applicable to both tests. The special math question formats that appear on each test are covered in part three of this book.

If possible, work through this book a little at a time over the course of several weeks. There is a lot of math to absorb, and it's hard to do it all at once. Cramming just before the test is not a good idea—you probably won't absorb much information if you pack it in at the last minute.

## **STEP ONE: CHECK OUT THE BASICS**

The first thing you need to do is find out exactly what is on the math sections of the GMAT and GRE. In part one of this book, "Getting Started," we'll provide you with background information on the quantitative sections of the tests, what they cover, and how they're organized. We'll also explain how the computerized versions of the GMAT and the GRE differ from the more traditional paper-and-pencil GRE.

## **STEP TWO: REVIEW MATH CONTENT**

Once you have the big picture, focus on the content. Part two of this book, "Math Content Review," does just that. It gives you a complete tour of the math that you will see on test day. There's a chapter for each of the four major content areas—arithmetic, algebra, word problems, and geometry. Since each chapter builds on the material in earlier chapters, you should go over them in order.

While all the math appearing in this book appears on both tests, certain content areas are more prevalent on one test than the other. If you're studying for the GMAT, concentrate on arithmetic, algebra, and word problems—chapters two, three, and four. Geometry does not account for a great deal of the GMAT, so you can skim chapter five, the geometry chapter.

If you're studying for the GRE, concentrate on arithmetic, algebra, and geometry—chapters two, three, and five. Since there are fewer word problems on the GRE than the GMAT, you can spend less time on chapter four, the word problems chapter.

The material in the math content review is divided into particular subjects. Each subject begins with a review, followed by practice questions organized by level of difficulty. First, there's an exercise covering the basics of the subject. Then there's a practice test with basic, intermediate, and advanced questions in a testlike format. This structure makes it easy for you to pinpoint the math concepts you need to review and quickly get your skills up to speed.

We suggest that you quickly skim the content review that introduces a section and then try the exercise. If you find the exercise difficult, go back to the content review before moving on. If you do well on the exercise, try the basic problem set that follows it. Once you are satisfied you have a good grasp on the basics of this subject, you should try the intermediate and advanced problem sets. Answers and explanations for the practice problems follow the chapter. Read the explanations to all the questions, even those you got right. Often the explanations will contain strategies that show you how you could have gotten to the answer more quickly and efficiently.

### **STEP THREE: BECOME FAMILIAR WITH SPECIAL FORMATS ON THE GRE AND GMAT**

While the content tested on the GRE and GMAT is very similar, both tests contain a number of special format questions. Part three of this book covers these. Read these chapters and try the questions that follow them after you are comfortable with the math content. If you are taking the GRE, work through chapters six and seven; if you are taking the GMAT, skip ahead to chapter eight. Be sure to read through the explanations that follow each chapter. Your focus here should be to familiarize yourself with the question types, so you won't get bogged down trying to figure out how to approach them on test day.

Now you're ready to begin preparing for the math sections of the GRE and GMAT. Good luck!

# GRADUATE SCHOOL in THE UNITED STATES

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## A Special Note for International Students

About a quarter million international students pursue advanced academic degrees at the master's or Ph.D. level at U.S. universities each year. This trend of pursuing higher education in the United States, particularly at the graduate level, is expected to continue. Business, management, engineering, and the physical and life sciences are popular areas of study for students coming to the United States from other countries. If you are an international student planning on applying to a graduate program in the United States, you will want to consider the following.

- If English is not your first language, you will probably need to take the Test of English as a Foreign Language (TOEFL) or show some other evidence that you're proficient in English prior to gaining admission to a graduate program. Graduate programs will vary on what is an acceptable TOEFL score. For degrees in business, journalism, management, or the humanities, a minimum TOEFL score of 600 (250 on the computer-based TOEFL) or better is expected. For the hard sciences and computer technology, a TOEFL score of 550 (213 on the computer-based TOEFL) is a common minimum requirement.
- You may also need to take the Graduate Record Exam (GRE) or the Graduate Management Admission Test (GMAT) as part of the admission process.
- Since admission to many graduate programs and business schools is quite competitive, you may want to select three or four programs you would like to attend and complete applications for each program.
- Selecting the correct graduate school is very different from selecting a suitable undergraduate institution. You should research the qualifications and interests of faculty members teaching and doing research in your chosen field. Look for professors who share your specialty. Also, select a program that meets your current or future employment needs, rather than simply a program with a big name.
- You need to begin the application process at least a year in advance. Be aware that many programs offer only August or September start dates. Find out application deadlines and plan accordingly.
- Finally, you will need to obtain an I-20 Certificate of Eligibility in order to obtain an F-1 Student Visa to study in the United States.

## KAPLAN INTERNATIONAL PROGRAMS

If you need more help with the complex process of graduate school admissions, or assistance preparing for the TOEFL, GRE, or GMAT, you may be interested in Kaplan's programs for international students. Kaplan International Programs were designed to help students and professionals from outside the United States meet their educational and career goals. At locations throughout the United States, international students take advantage of Kaplan's programs to help them improve their academic and conversational English skills, raise their scores on the TOEFL, GRE, GMAT, and other standardized exams, and gain admission to top programs. Our staff and instructors give international students the individualized instruction they need to succeed. Here is a brief description of some of Kaplan's programs for international students:



### **General Intensive English**

Kaplan's General Intensive English classes are designed to help you improve your skills in all areas of English and to increase your fluency in spoken and written English. Classes are available for beginning to advanced students, and the average class size is 12 students.

### **TOEFL and Academic English**

This course provides you with the skills you need to improve your TOEFL score and succeed in an American university or graduate program. It includes advanced reading, writing, listening, grammar, and conversational English. You will also receive training for the TOEFL using Kaplan's exclusive computer-based practice materials.

### **GRE Test Preparation Course**

The Graduate Record Exam (GRE) is required for admission to many graduate programs in the United States. Nearly one-half million people take the GRE each year. A high score can help you stand out from other test takers. This course includes the skills you need to succeed on each section of the GRE, as well as access to Kaplan's exclusive computer-based practice materials.

### **GMAT Test Preparation Course**

The Graduate Management Admissions Test (GMAT) is required for admission to many graduate programs in business in the United States. Hundreds of thousands of American students have taken this course to prepare for the GMAT. This course includes the skills you need to succeed on each section of the GMAT, as well as access to Kaplan's exclusive computer-based practice materials.

### **Other Kaplan Programs**

Since 1938, more than 3 million students have come to Kaplan to advance their studies, prepare for entry to American universities, and further their careers. In addition to the above programs, Kaplan offers courses to prepare for the SAT, LSAT, MCAT, DAT, USMLE, NCLEX, and other standardized exams at locations throughout the United States.

## **APPLYING TO KAPLAN INTERNATIONAL PROGRAMS**

To get more information, or to apply for admission to any of Kaplan's programs for international students and professionals, contact us at:

Kaplan International Programs  
700 South Flower, Suite 2900  
Los Angeles, CA 90017, USA  
Phone (if calling from within the United States): 800-818-9128  
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*GMAT 800*

*Graduate School Admissions Adviser*

*GRE*

*GRE with CD-ROM*

*GRE Biology*

*GRE Verbal Workbook*

*M.B.A. Part-Time: An Insider's Guide*

This book was designed for self-study only and is not authorized for classroom use. For information on Kaplan courses, which expand on the techniques offered here and are taught only by highly trained Kaplan instructors, please call 1-800-KAP-TEST.

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part one

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# GETTING STARTED



# INTRODUCTION TO GRADUATE MATH

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## chapter one

*Been there, done that.* If you're considering applying to graduate school or business school, then you've already seen all the math you need for both the GRE and the GMAT. You would have covered the relevant math content in junior high. In fact, the math that appears on the GRE and GMAT is almost identical to the math tested on the SAT or ACT. You don't need to know trigonometry. You don't need to know calculus. No surprises—it's all material you've seen before. The only problem is, you may not have seen it lately. When was the last time you had to add a bunch of fractions without a calculator?

No matter how much your memories of junior high algebra classes have dimmed, don't panic. The GRE and the GMAT test a limited number of core math concepts in predictable ways. Certain topics come up in every test, and, chances are, these topics will be expressed in much the same way; even some of the words and phrases appearing in the questions are predictable. Since the tests are so formulaic, we can show you the math you're bound to encounter. Some practice on testlike questions, such as those in the following chapters, will ready you for the questions you will see on the actual test.

Here is a checklist of core math concepts you'll need for the GRE and GMAT. These concepts are vital, not only because they are tested directly on every GRE and GMAT, but also because you need to know how to perform these simpler operations in order to perform more complicated tasks. For instance, you won't be able to find the volume of a cylinder if you can't find the area of a circle. We know the math operations on the following list are pretty basic, but make sure you know how to do them.

### **GRE AND GMAT MATH BASICS**

- Add, subtract, multiply and divide fractions. (Chapter 2)
- Convert fractions to decimals, and vice versa. (Chapter 2)
- Add, subtract, multiply, and divide signed numbers. (Chapter 2)
- Plug numbers into algebraic expressions. (Chapter 3)
- Solve a simple algebraic equation. (Chapter 3)
- Find a percent using the percent formula. (Chapter 2)
- Find an average. (Chapter 2)
- Find the areas of rectangles, triangles, and circles. (Chapter 5)

**HOW MATH IS SCORED ON THE GMAT**

The GMAT will give you a scaled quantitative score from 0 to 60. (The average score is 30.) This score reflects your performance on the math portion of the test compared to all other GMAT test takers.

You will also receive an overall score that reflects your performance on both the math and the verbal portions of the test. This is a scaled score from 200 to 800.

**HOW MATH IS SCORED ON THE GRE**

The GRE will give you a scaled quantitative score from 200 to 800. (The average score is 500.) This score reflects your performance on the math portion of the GRE compared to all other GRE test takers.

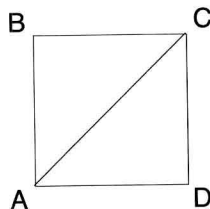
**TEST OVERVIEW**

The GRE and the GMAT are pretty similar in terms of the math they test. However, there are significant differences in the way the tests are administered. The GMAT and GRE are now available only as a Computer Adaptive Test, or CAT. You take this test on a computer at special centers. Here's a quick overview of the math sections of the GRE and GMAT CAT.

**Problem Solving Questions on the GRE and GMAT**

Problem Solving questions are the simplest you will see on either test. You are given a question (and sometimes an accompanying chart or diagram) and asked to choose the correct answer from a list of five answer choices. Here's a sample Problem Solving question.

**Example:**



If the perimeter of the square  $ABCD$  is 8, what is the area of triangle  $ACD$ ?

- ☐ 1
- ☐ 2
- ☐ 4
- ☐ 6
- ☐ 8

**Answer:** If the perimeter of square  $ABCD$  is 8, each side must be  $8 \div 4 = 2$ . The area of the square is then  $2 \times 2 = 4$ . The area of the triangle is half of this, or 2.

### Quantitative Comparison Questions on the GRE

Quantitative Comparisons are found only on the GRE. You are given two quantities, one in Column A, and one in Column B, and you must decide if one in particular is larger, whether they are the same size, or whether you need more information to make the comparison. There are four answer choices, which are the same for every Quantitative Comparison question. Sometimes you will be given additional information about the quantities being compared. This will be centered above the columns.

Here's a sample Quantitative Comparison question.

**Example:** Compare the quantity in Column A with Column B.

$x$  and  $y$  are positive.

$$\frac{x}{y} = \frac{2}{3}$$

Column A

Column B

$x$

$y$

- ☐ The quantity in Column A is greater than the quantity in Column B.
- ☐ The quantity in Column B is greater than the quantity in Column A.
- ☐ The quantities in Column A and Column B are equal.
- ☐ There is not enough information provided to determine the relationship between the quantities.

Since  $x$  and  $y$  are positive, and  $3x = 2y$ ,  $x$  must be less than  $y$ , and, in this case, the quantity in Column B is greater. So choice 2 is correct.

The Quantitative Comparisons chapter has more information on these questions.

### Data Sufficiency Questions on the GMAT

Data Sufficiency questions are found only on the GMAT. In Data Sufficiency, a question is followed by two statements containing certain data. Your task is to determine whether the data provided by the statements are sufficient to answer the question. All Data Sufficiency questions have the same five answer choices.

Here's a sample Data Sufficiency question.



**Example:** Is  $x$  even?

- (1)  $X$  is a multiple of 6.
- (2)  $X$  is a multiple of 5.

- ☐ Statement (1) by itself is sufficient to answer the question, but statement (2) by itself is not.
- ☐ Statement (2) is by itself is sufficient to answer the question, but statement (1) by itself is not.
- ☐ Statements (1) and (2) taken together are sufficient to answer the question, even though neither statement by itself is sufficient.
- ☐ Either statement by itself is sufficient to answer the question.
- ☐ Both statements (1) and (2) taken together are not sufficient to answer the question in the stem.

**Answer:** Since all multiples of 6 are even, but multiples of 5 may or may not be even, statement (1) is BY ITSELF sufficient to answer the question, but statement (2) by itself is not in this case. So the answer is choice 1.

The Data Sufficiency chapter has more examples of those questions.

### Math on the GMAT CAT

One Quantitative section:

There are 37 questions to be done in 75 minutes.

Approximately two-thirds of the questions will be in the Problem Solving format, and the remaining questions will be in the Data Sufficiency format.

About 10 of the questions in the GMAT CAT math section will be experimental questions. These are questions that are being tested for use in future tests, and are not scored. However, there is no way of telling the experimental questions from the scored questions around them, and so you should treat all questions as if they are scored.

### Math on the GRE CAT

One Quantitative section:

There are 28 questions to be done in 45 minutes.

Approximately half of the questions will be in the Quantitative Comparison format and the remaining questions will be in the Problem Solving format. About a quarter of the Problem Solving questions will ask you to interpret a set of charts or graphs.