

Conquering the New

GRE 数学 Math



- Test-smart strategies for answering every question type
- 3 practice GRE math tests with solutions
- Drills to strengthen your weak areas

【美】Robert E. Moyer 编著

按照新GRE考试要求编写，洞悉新GRE考试出题思路
方法与内容的完美结合，考生备考新GRE的必备参考用书
全面系统地梳理、归纳并精析考点，分题型全面破解

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PART I

INTRODUCTION

研究生院和专业院校（如医学院、法学院）在录取申请者的时候会考虑一系列因素。包括教育背景、工作经历、教师的推荐信、个人文章以及面试表现等。通常，决定因素之一是申请者的标准化考试成绩。研究生入学最为普通的考试之一是Graduate Record Examination（研究生入学考试，简称GRE）。

GRE考试由Educational Testing Service（教育考试服务中心，简称ETS）设计和执行。有九种考试都可以被称为GRE考试，包括GRE General Test（GRE一般能力考试）以及八种GRE Subject Tests（GRE学科专项考试）。本书中提到的GRE考试仅仅指GRE一般能力考试，其他八种学科专项考试不在本书讲解范围之内。

GRE一般能力考试主要包括三部分：Verbal Reasoning（文字推理，即词汇），Quantitative Reasoning（数量推理，即数学）以及Analytical Writing（分析性写作）。该考试衡量的并不是考生在某一特定领域深入学习的情况，而是考生多年来积累的基本知识和学习技巧。大多数知识和技巧是在普通高中的课程学习中储备的。

ETS时常改革GRE一般能力考试。本书收录了2011年秋季最新发布的考试版本。该版本具有以下特征：

- 更加便捷的考试界面：考生可以跳过（暂时不会做的）题目；在一类题目当中可以返回到之前的问题，可以更改答案；还可以使用屏幕上的计算器。
- 更加体现研究生推理技巧的题目设置：包括数据解释和现实情境；可能有一个以上的答案。
- 评分体制：让相关机构更容易地对申请者的GRE分数进行比较。

本书旨在帮助考生准备新改革的GRE考试。主要内容包括三大部分，分别是GRE数学考试中问题类型的归类和分析，相关数学概念的讲解与练习，以及GRE数学考试模拟练习题。

欲了解关于GRE考试报名及其他相关信息，请访问ETS官方网站www.ets.com，或者GRE考试官方网站，www.gre.org。

CHAPTER 1

THE GRE QUANTITATIVE REASONING SECTIONS

The GRE is given as a computer-based test in the United States. (In some other countries, a paper-based version is used.) On the computer-based GRE General Test there are two 35-minute Quantitative Reasoning sections. The test uses a modified computer-adaptive process in which the computer selects the difficulty of your second section based on how well you scored on the first section. In other words, if you do well on the first section, you will get a harder second section (and a higher score). If you do poorly on the first section, you will get an easier second section (and a lower score). Since you must answer 20 questions in 35 minutes, you need to answer a question approximately every minute and a half. Within a section, you may skip a question and return to it later in order to maximize your efficiency. You need to finish each section in the allotted time. There is an on-screen calculator that you may use to aid in your calculations.

The questions in the Quantitative Reasoning sections assess your ability to solve problems using mathematical and logical reasoning and basic mathematical concepts and skills. The mathematics content on the GRE General Test does not go beyond what is generally taught in high schools. It includes arithmetic, algebra, geometry, and data analysis. The mathematics content, based on GRE sample tests provided by ETS, comes from the following areas:

- ▶ Number properties: approximately 22%
- ▶ Arithmetic (often graph-related): approximately 18%
- ▶ Algebra: approximately 18%
- ▶ Plane and solid geometry: approximately 14%
- ▶ Probability and statistics: approximately 8%
- ▶ Algebra word problems: approximately 6%
- ▶ Arithmetic ratios: approximately 6%
- ▶ Coordinate geometry: approximately 4%
- ▶ Tables: approximately 4%

There is no guarantee that the questions on each Quantitative Reasoning section on a given GRE test will be divided among the content areas according to these exact percentages, but the total Quantitative Reasoning part of the GRE will be spread among the content areas in approximately this way, based on the sample test materials provided by ETS.

In the revised GRE introduced in 2011, two new question formats have been added. These new question types allow some questions to be asked and answered in more natural and complex ways than the older formats permitted. The types of questions in the Quantitative Reasoning sections of

the GRE General Test may now include the following:

- Quantitative Comparisons
- Multiple Choice
- Numeric Entry
- Multiple Response

Quantitative Comparison questions present two mathematical quantities. You must determine whether the first quantity is larger, the second is larger, the two quantities are equal, or if it is impossible to determine the relationship based on the given information.

Multiple Choice questions are questions for which you are to select a single answer from a list of choices. These are the traditional multiple choice questions with five possible answers that most test-takers will be familiar with from other standardized examinations.

In **Numeric Entry questions**, you are asked to type in the answer to the problem from the keyboard, rather than choosing from answers provided to you. For example, if the answer to the question is 8.2, you click on the answer box and then type in the number 8.2.

Multiple Response questions are similar to multiple choice questions, but you may select more than one of the five choices, if appropriate.

To be successful on the GRE Quantitative Reasoning section, you need to be familiar with the types of questions you will be asked as well as the relevant mathematical concepts. Later chapters will go into more detail about the different question types and how to approach answering each of them.

CHAPTER 2

THE MATHEMATICS YOU NEED TO REVIEW

The GRE is taken by people with a wide variety of educational backgrounds and undergraduate majors. For that reason, the GRE Quantitative Reasoning section tests mathematical skills and concepts that are assumed to be common for all test-takers. The test questions require you to know arithmetic, algebra, geometry, and basic probability and statistics. You will be expected to apply basic mathematical skills, understand elementary mathematical concepts, reason quantitatively, apply problem-solving skills, recognize what information is relevant to a problem, determine what relationship, if any, exists between two quantities, and interpret tables and graphs.

The GRE does not attempt to assess how much mathematics you know. It seeks to determine whether you can use the mathematics frequently needed by graduate students, and whether you can use quantitative reasoning to solve problems. Specialized or advanced mathematical knowledge is not needed to be successful on the Quantitative Reasoning section of the GRE. You will **NOT** be expected to know advanced statistics, trigonometry, or calculus, and you will not be required to write a proof.

In general, the mathematical knowledge and skills needed to be successful on the GRE do not extend beyond what is usually covered in the average high school mathematics curriculum. The broad areas of mathematical knowledge needed for success are number properties, arithmetic computation, algebra, and geometry.

Number properties include such concepts as even and odd numbers, prime numbers, divisibility, rounding, and signed (positive and negative) numbers.

In **arithmetic computation**, order of operations, fractions (including computation with fractions), decimals, and averages will be tested. You may also be asked to solve word problems using arithmetic concepts.

The **algebra** needed on the GRE includes linear equations, operations with algebraic expressions, powers and roots, standard deviation, inequalities, quadratic equations, systems of equations, and radicals. Again, algebra concepts may be part of a word problem you are asked to solve.

In **geometry**, concepts tested include the properties of points, lines, planes, and polygons. You may be asked to calculate area, perimeter, and volume, or explore coordinate geometry.

You will be expected to recognize standard symbols for mathematical relationships, such as $=$ (equal), \neq (not equal), $<$ (less than), $>$ (greater than), \parallel (parallel), and \perp (perpendicular). All numbers used will be real numbers. Fractions, decimals, and percentages may be used.

When units of measure are used, they may be in English (or customary) or metric units. If you need to convert between units of measure, the conversion relationship will be given, except for common ones such as converting minutes to hours, inches to feet, or centimeters to meters.

GRE word problems usually focus on doing something or deciding something. The mathematics is only a tool to help you get the necessary result. When answering a question on the GRE, you first need to read the question carefully to see what is being asked. Then, recall the mathematical concepts needed to relate the information you are given in a way that will enable you to solve the problem.

If you have completed the average high school mathematics program, you have been taught the mathematics you need for the GRE. The review of arithmetic, algebra, and geometry provided in this book will help you refresh your memory of the mathematical skills and knowledge you previously learned.

If you are not satisfied with your existing mathematics knowledge in a given area, then review the material provided on that topic in more detail, making sure that you fully understand each section before going on to the next one.

PART II

TYPES OF GRE MATH QUESTIONS

在2007年之前，GRE数学部分的题目类型仅仅是Quantitative Comparison（数量比较）和Multiple Choice（单项选择）。自2007年开始，ETS开发Numeric Entry（数字输入）题型并开始试验。改版后的GRE一般能力考试包括这三类考试题型，同时还外加一种Multiple Response（多项选择）题型。在基于计算机的考试版本当中，每一个数学部分都由如下四部分构成：

题目类型	题目数量
单项选择题	约10个
数量比较题	约8个
数字输入题	约1个
多项选择题	约1个
总计：	20

单项选择题的形式是一个问题附加五个选项，考生要从中选择一个最佳答案。GRE数学部分几乎一半的题目都是这种题型。数量比较题的数量略小于一半，通常这类题目的四个选项是同一个模式，考生需要比较两个量（A和B），四个选项分别是：A大于B；B大于A；A和B相等；A和B之间的关系不确定。只有少部分题目是两种新题型，即数字输入题和多项选择题。数字输入题没有选项，考生需要计算出自己的答案并把其输入到指定区域。多项选择题可能有一个以上的正确答案。

复习GRE考试当中可能涉及的数学概念是十分重要的，同时，想要成功通过考试的考生也需要熟悉真实考试当中的出题方式。本部分的几个章节将会详细介绍GRE考试数学部分的题目形式，针对每一类问题提出一些解答策略，并提供典型例子和练习题目。

CHAPTER 3

GRE QUANTITATIVE COMPARISON QUESTIONS

QUANTITATIVE COMPARISON ITEM FORMAT

Quantitative Comparison questions are designed to measure your ability to determine the relative sizes of two quantities or to realize that more information is needed to make the comparison. To succeed in answering these questions, you need to make quick decisions about the relative sizes of the two given quantities.

The first quantity appears on the left as “Quantity A.” The second quantity appears on the right as “Quantity B.” There are only four answer choices for this type of question, and they are always the same:

- A. Quantity A is greater.
- B. Quantity B is greater.
- C. The two quantities are equal.
- D. The relationship cannot be determined from the information given.

You are not expected to find precise values for A and B, and in fact, you may not be able to do so. You are merely asked to compare the relative values. If you see that under some conditions A is greater, but under other conditions B is greater, then the relationship cannot be determined, and the correct answer is choice D.

A symbol or other information that appears more than once in a question has the same meaning everywhere in the question. You will sometimes be given general information to be used in determining the relationship; this information will be above and centered between Quantity A and Quantity B.

In some countries, under some circumstances, the GRE may be given in a paper-based format, rather than as a computer-based test. When the test is given in a print format, the answer sheets always have five answer choices: A, B, C, D, and E. For Quantitative Comparison questions, there are only four answer choices: A, B, C, and D. If you are taking the paper-based GRE, never mark E for a Quantitative Comparison question.

EXAMPLES

Directions: Examples 1–5 each provide two quantities, Quantity A and Quantity B. Compare the two quantities, then choose one of the following answer choices:

- (A) Quantity A is greater.
- (B) Quantity B is greater.
- (C) The two quantities are equal.
- (D) The relationship cannot be determined from the information given.

Example 1:

Quantity A	Quantity B	Answer
n	$\frac{1}{n}$	(A) (B) (C) (D)

Solution:

For $n = 2$, $\frac{1}{n} = \frac{1}{2}$. Because $n > \frac{1}{n}$, A is the greater quantity.

For $n = \frac{1}{4}$, $\frac{1}{n} = 4$. Because $n < \frac{1}{n}$, B is the greater quantity.

Thus the relationship cannot be determined, and the correct answer is choice D.

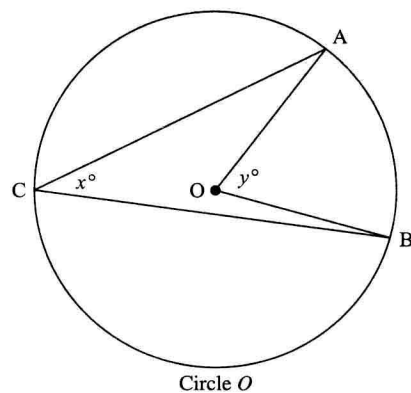
Example 2:

n is a real number greater than 1.

Quantity A	Quantity B	Answer
n	\sqrt{n}	(A) (B) (C) (D)

Solution:

By the definition of \sqrt{n} , $\sqrt{n} \times \sqrt{n} = n$. If $n > 1$, then $\sqrt{n} > 1$. $\sqrt{n} \times \sqrt{n} > 1 \times \sqrt{n}$, so $n > \sqrt{n}$, and choice A is the correct answer.

Example 3:

Quantity A	Quantity B	Answer
x°	y°	(A) (B) (C) (D)

Solution:

In circle O, the central angle, $\angle AOB$, is equal in degrees to arc AB. In circle O, the inscribed angle, $\angle ACB$, is equal in degrees to $\frac{1}{2}(\text{arc AB})$. Thus, $m\angle AOB > \angle ACB$, so $y^\circ > x^\circ$, and the correct answer is choice B.