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BARRON'S

GRE Math Workbook

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GRE® 数学

备考策略与模拟试题

[美] Blair Madore
[美] David Freeling 编著

- 全面介绍 GRE 数学测试部分的考查内容、题目类型、评分方式等
- 分类详解 GRE 数学基本概念，并辅以大量练习和详细解析
- 针对 GRE 数学常考题型，提供实用高效的解题策略
- 精编 2 套数学模拟题，便于考生诊断自测，查漏补缺

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边卫红 译

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To the Student

亲爱的考生，

相信现在的你一定有些兴奋！你已经或者即将取得学士学位，并正在考虑进入更高阶段的学习——攻读研究生无疑是一段令人兴奋的、高要求、高回报的学习经历。

或许此时，你还没有准备好去迎接另一场考试，但你的GRE成绩将是影响你进入理想学校的关键因素之一；更为重要的是，它还决定了你就读期间可能获得的奖学金。因此，花一点时间用心准备GRE考试绝对是明智的选择。

我们建议要以严肃认真的态度对待GRE考试，并且每周都安排时间进行备考训练。每周花几个小时学习远比考试前临时突击20个小时更有效。如果你需要激励或者额外的帮助，不妨报名参加附近的GRE培训班。对很多考生来说，能和其他考生一起学习，且有老师指点，复习的过程会更容易。

每个考生的情况都不相同。你可能是个物理专业的高手，只需再稍微完善一下数学技能就达到理想学校所要求的165分。你也可能是个心理学专业的学生，高中之后就没再接触过数学，必须努力提高数学水平，才能达到理想学校所要求的155分。为避免不必要的失望，以及为自己设定合理的目标，建议考生提前联系打算申请的学校，咨询录取所需的分数标准（你甚至可以咨询获得一等奖学金所需的分数）。

本书将帮助你复习GRE数学必考内容。鉴于整个高中阶段的数学知识都在考试范围之内，本书并不能完全取代高中数学教材。不过不要担心，即使你对数学不自信，也会在复习过程中逐渐回忆起那些最基本的数学概念。因此，本书将带你回顾那些学过的数学知识，并告诉你考试中最常见的考点。

祝学习开心、考试顺利！

编　者

Guide to Using This Book

本书第一章介绍了GRE考试数量推理（Quantitative Reasoning）部分的考试形式。考生将了解考试结构、各题型的分析和例题、得分标准以及屏幕计算器的使用技巧等相关信息。第二章展示了针对不同题型的解题策略。这两章都包含了GRE风格的练习题和解析，便于考生训练新学的解题技巧。

第三到六章介绍了攻克GRE数量推理部分所需的数学技能。这些章节的每个部分都包含了基础习题（Basic problems）和GRE习题（GRE problems），供考生练习。基础习题重点考查考生在每部分学到的知识点；在一些情况下，这些问题不太可能出现在实际的GRE考试中。GRE习题更有难度，且更接近实际的考试，考查内容也不局限于考生在本部分学到的技能。每章最后都附有对所有题目的详细解析。

第七章包含两套数量推理模拟测试题，并附有答案解析。通过进行模拟训练，并对照答案进行评估，考生可以找到学习中的不足，并将这些不足作为未来复习的重点。

附录部分列出了一系列数学常识，如简分数及其对应小数、常见无理数平方根及其对应小数、不等式和代数式等，建议考生铭记于心。

Choose the Study Plan that is Right for You

不管对自己的数学水平是否有信心，制订复习计划都是非常重要的，这个复习计划应该可以帮你充分利用学习时间，并能满足你的个人需求。

如果你对自己的数学能力有信心，则可以：

- √ 阅读第一、二章，重点关注其中提到的解题策略。这些策略能提高你的答题速度，并帮助你处理那些无法很快知道如何求解的问题。
- √ 阅读第三到六章，重点关注每章出现的“TIPS”，以及更具难度的例题。做完所有的GRE习题，遇到不熟悉的考点就回过头复习相应章节中的知识点。
- √ 阅读附录部分，并将你尚未记住的数学常识铭记于心。
- √ 利用第七章的模拟题进行模拟练习，并对照答案核对每道题。标记那些没有顺利求解的问题，并带着问题复习书中相应的章节。

此为试读，需要完整PDF请访问：www.ertongbook.com

如果你对自己的数学能力没有信心，那么：

√ 阅读第一章，熟悉GRE数学的考试题型。

√ 阅读第三到六章，重点关注其中的基本技巧和例题。使用基础习题进行练习，碰到问题就复习相应的章节。

√ 阅读第二章，重点关注其中提到的解题策略。这些策略能提高你的答题速度，并帮助你处理那些无法很快知道如何求解的问题。

√ 重读第三到六章，重点关注每章中的提到的“TIPS”和更具难度的问题。仔细解答每道GRE习题。

√ 阅读附录部分，将你尚未记住的数学常识铭记于心。

√ 利用第七章的模拟题进行模拟练习，并对照答案核对每道题。标记那些你没有顺利求解的问题，并带着问题复习书中相应的章节。

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CHAPTER 1

The GRE General Math Exam

GRE普通考试包含文字推理（Verbal Reasoning）、数量推理（Quantitative Reasoning）和分析性写作（Analytical Writing）三大部分。本书涉及的是考查考生数学能力的数量推理部分。

更多有关GRE考试的一般性信息，如考试注册、考试日期等，请访问*www.ets.org*或向当地考试中心咨询。

GRE考试的数量推理部分考查考生的算术、基础代数、几何、初等概率和统计学知识。考查内容都是小学、初中和高中学过的知识，不包括微积分和高等数学。GRE考试重点考查考生逻辑推理的能力。

虽然考试范围均是大学前学习的内容，但考生应通过GRE考试展示自己作为一名高校毕业生（或准毕业生）所必备的逻辑推理能力。GRE数学考试对每个人来说都有难度，因此理工科专业的考生也不能掉以轻心。而对于多年没有接触数学的文科生来说，也没有必要高估这部分考试的难度——通过练习，任何具备基本逻辑推理的考生都有机会得高分。

EXAM STRUCTURE

大多数考生将参加机考形式的GRE考试，这就能让考生以任意顺序回答每部分的问题，自由跳过和回到某个题目，并能随时修改已做出的答案。考生可以“标记”一些题目，以便在本部分所给时间内重新回到这些题目。屏幕上方有计算器标志，供考生在数量推理部分使用。实际考试中，考生需要完成两部分计分的数量推理测试，每部分包含20道考题，考试时长35分钟。考生还有可能被要求完成另外一组“试验性”的数量推理加试题。加试部分的目的是测试新题型。鉴于考生无法知道哪个部分是加试，因此必须以同样态度对待每部分考题。

在无法进行机考的地区，考生将以纸笔考试的形式进行GRE考试。考生可以直接将答案填写在答题册而不是单独的答题卡上。考试期间，考场将向考生提供专用的ETS计算器。考生不能使用自带的计算器。

QUESTION TYPES

GRE数量推理部分共有四种题型，分别是：单项选择题（Multiple-Choice）、数量比较题（Quantitative Comparison）、不定项选择题（Multiple-Answer）和数字填空题（Numeric-Entry）。

Multiple-Choice Questions

大多数考生都对单项选择题非常熟悉。题目给出一个问题和五个答案，考生需要选出其中的最佳答案。为了表述方便，本书将五个答案选项分别用A、B、C、D、E来表示。实际考生中，考生只需点击正确答案旁边的椭圆形即可。

Example 1

You are given two circles with radii r and R, respectively. The second circle has twice the area of the first. What is the relationship between the radii?

(A) $2r = R$
(B) $r = 2R$
(C) $r^2 = 2R^2$
(D) $2r^2 = R^2$
(E) $r = \sqrt{2}R$

Solution: The area of the first is πr^2 and the area of the second is πR^2. Since the area of the second is twice the first, $\pi R^2 = 2\pi r^2$. We cancel π from each side and see that $R^2 = 2r^2$. Choose **D**. If we take the square root of both sides, we see that $R = \sqrt{2}\ r$, an alternate solution, but not one of the choices.

之所以说要选择“最佳”答案，是因为在很多情况下，考生得出的答案可能和给出的五个选项都不尽相同。造成这种情况的原因可能是考生犯了错误，也可能考生是正确的，只是计算过程中的四舍五入使得出的答案无法与选项答案完全匹配。如果你的答案和某个选项接近，但又不是完全相同，那么这个选项很有可能就是正确答案。但如果你的答案正好介于两个选项之间，那就需要返回检查了（如果时间有限，则只能凭感觉猜）。

Example 2

Which number is closest to $\sqrt{3} \times \sqrt{13} \times \sqrt{5}$?

(A) 12
(B) 13
(C) 14
(D) 15
(E) 16

Solution: Typing this on the calculator shows a number between 13 and 14, but look carefully at the digits to the right of the decimal: 13.96 is much closer to 14 than to 13. Choose **C**. One important note: It is easier and faster to enter this on the calculator by first typing $3 \times 13 \times 5 = 195$, and then pressing the square-root button just once. This shortcut is valid because $\sqrt{ab} = \sqrt{a} \cdot \sqrt{b}$, for all positive numbers, a and b.

此为试读，需要完整PDF请访问：www.ertongbook.com

Multiple-Answer Questions

不定项选择题要求考生选择所有正确的答案。正确答案可能是一个，也可能是全部选项。少选或多选均不得分。不定项选择题的选项用方框表示，以区别于常规单选题的椭圆形圈。记住，必须点击所有正确的选项。

Example 3

Ann's salary is more than 75 percent of Bob's salary but less than 80 percent of Claire's salary. If Bob's salary is $35 per hour and Claire's is $40 per hour, which of the following could be Ann's salary, per hour?

Indicate *all* that apply.

- [A] $25
- [B] $26
- [C] $27
- [D] $30
- [E] $32
- [F] $35

Solution: Seventy-five percent of $35 equals $.75 \times 35 = \$26.25$, while 80 percent of 40 equals $.8 \times 40 = \$32$. This means that Ann earned between $26.25 and $32 per hour. Choose **C** and **D**. Note that choice E, 32, is not less than 32.

Quantitative Comparison Questions

通常，只有GRE（或者其他标准考试）才会出现数量比较题。因此，考生非常有必要熟悉这类题型以及相应的解题技巧。数量比较题包含两组数值：Quantity A和Quantity B。考生需要判断两组数值之间的大小关系。每道题均有以下四个选项供选择：

- Ⓐ Quantity A is greater.
- Ⓑ Quantity B is greater.
- Ⓒ The two quantities are equal.
- Ⓓ It is impossible to determine which quantity is greater.

Example 4

Quantity A	Quantity B
$\left(3+\frac{1}{5}\right)\left(3-\frac{1}{5}\right)$	$\left(3+\frac{1}{4}\right)\left(3-\frac{1}{4}\right)$

Solution: You could just calculate both quantities as fractions and compare but this is tedious at best. If you remember your rule for difference of squares, then Quantity A is $3^2 - \left(\frac{1}{5}\right)^2 = 9 - \frac{1}{25}$ while Quantity B is $3^2 - \left(\frac{1}{4}\right)^2 = 9 - \frac{1}{16}$. Since $\frac{1}{25} < \frac{1}{16}$, $9 - \frac{1}{25} > 9 - \frac{1}{16}$. Choose **A**, since Quantity A is larger than Quantity B. Notice that here knowing your math is much faster than trying to type all these fractions on the simple GRE calculator that you are given.

Example 5

Quantity A	Quantity B
$(3 + x)(3 - x)$	$(x + 3)(x - 3)$

Solution: Using difference of squares (see Chapter 4) to expand, we discover that Quantity A is $9 - x^2$ while Quantity B is $x^2 - 9$. Which is larger? It will depend on the value of x. When $x = 0$, Quantity A is 9, and Quantity B is -9. When $x = 4$, Quantity A is -7, and Quantity B is 7. So sometimes Quantity A is larger and sometimes Quantity B is larger. Choose **D**, it cannot be determined (without knowing more about x).

Numeric Entry Questions

数字填空题要求考生填写一个小数或分数作为题目答案。如果答案是分数，则考生需要分别填入分子和分母。这类题型重点考查考生独立求解的能力。

Example 6

The town council charges each residence for services including $2 each week for trash pickup, $10 a month for water hookup plus $0.002 per gallon of water used, and $25 each fall for leaf removal. Bills are calculated annually but paid in quarterly installments. Kareem's family used 125,000 gallons of water last year. What did they pay each quarter?

$ ☐

Solution: They paid

52 weeks × $2/week	= $104 for trash
12 months × $10/month	= $120 for water hookup
125,000 gallons × $0.002/gallon	= $250 for water used
	$25 for leaf collection
Total	$499
So each quarter they paid $499/4	= $124.75.

Example 7

In a school with 240 boys and 210 girls, there are 8 right-handed students for every 1 left-handed student. How many students at the school are left-handed?

☐

Solution: First note that there are $240 + 210 = 450$ total students at the school. There are 8 "righties" for every 1 "lefty" for every $8 + 1 = 9$ students. Therefore, lefties make up $\frac{1}{9}$ of all students. $\frac{1}{9} \times 450 = \frac{450}{9} = \mathbf{50}$.

TOPICS AND SCORING

GRE数学测试涵盖了多种类型的数量推理，包括关于整数、分数、变化率、比例、度量、小数、根数、指数、最大公约数、最小公倍数、质数、提取公因子、多项式、求解方程和不等式、函数、百分数、平均数、图表和图形、概率、计数、三角形、四边形、圆、勾股定理、周长、面积、表面积和体积的运算。大多数考题都涉及两个或两个以上的知识点。GRE考试通常涵盖了以上提到的全部知识点。每个知识点考查的频率相当，因此以上考点都同等重要。了解每个知识点的基本内容非常重要，但GRE考试更关注考生的推理能力，而不是仅仅死记硬背某个数学常识或公式。因此，应对GRE考试，练习并提高自己的推理技能最为重要。

GRE数量推理测试和文字推理测试的评分区间是130到170。考生的成绩主要取决于答对题的数量。答错题不扣分，因此务必答完所有的问题。漏答题和答错题一样不能得分。

数量推理测试的分数可以通过以下方法进行估算：将每部分答错的题目数量进行平均，结果乘以2，得到的结果用170去减。例如，每部分的20道题你都答错了5道，那么你的分数则大约是170 – （5 × 2）= 160。如果每部分都只错了一道，那么你的得分大约是170 – （1 × 2）= 168。168分已经相当不错了——当然前提是其他所有答案都正确。

但是还有大量复杂的因素将影响考生的最终得分，这些因素和每道题的难度有关。

TIP

鉴于每道题目分值相同，且考生可以以任意顺序答题，建议先解答简单的问题。当然，每个考生对简单的定义各不相同，但通常大多数考生都认为数据分析题更有难度。因此，把这类题放到最后做不失为明智的做法。

近期，ETS针对机考增加了一项名为*ScoreSelect*的新服务。通过该服务，考生可以选择自己满意的成绩并寄送给要申请的院校。考试当天在考试中心查询成绩时，考生可以：

1. *ScoreSelect* ***Most Recent*** —— 免费寄送四份最近一次的GRE考试成绩；
2. *ScoreSelect* ***All*** —— 免费寄送四份五年内所有GRE考试成绩。

若考生需要在考试日之后寄送GRE成绩，则有以下三种选择：

1. *ScoreSelect* ***Most Recent*** —— 免费寄送四份最近一次的GRE考试成绩；
2. *ScoreSelect* ***All*** —— 免费寄送四份五年内所有GRE考试成绩；
3. *ScoreSelect* ***Any*** —— 免费寄送四份五年内任何一次或多次的GRE考试成绩。

考生每隔30天便可参加一次GRE考试，但一年内的考试次数不能超过5次。

更多关于*ScoreSelect*服务的最新信息和关于多次报考的规定，请访问：*www.ets.org/gre*。

CALCULATOR USE

通过点击屏幕上方的计算器图标，考生可以随时使用屏幕计算器。要注意，屏幕计算器只具备五种基本运算功能：+、−、×、÷、√。打开屏幕计算器后，应将其移动到不影响阅读的位置。注意，“Transfer”按钮只适用于数字输入题。通过使用此功能，考生可以将最后一次通过计算器得出的数值直接转移到答题框中。

计算器可以节省考生通过心算或笔算处理单调数学运算的时间，但是要知道计算器未必在任何情况下都能节省时间。通常，进行运算前最好先通过逻辑推理找到答题方法。

Example 8

Jose earns $12 on every day of the year.
Raul earns $367 in every month of the year.

Quantity A	Quantity B
Jose's earnings in one full year beginning January 1.	Raul's earnings in one full year beginning January 1.

Solution: There are 365 days in a year, so Quantity A is 365×12 (or at most 366×12 in a leap year). There are 12 months in a year, so Quantity B is 367×12. Don't waste time typing these values blindly on the calculator. It should be obvious that $367 \times 12 > 365 \times 12$. Choose **B**.

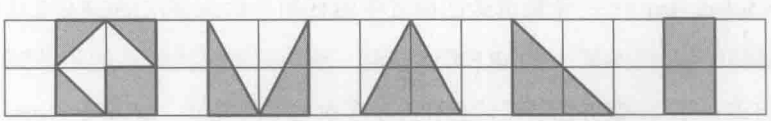
接下来将介绍一些有用的计算方法。由于可以使用计算器，因此这些方法并不是必须要掌握的。然而，鉴于接下来的问题在实际考试中经常出现，学习这些计算方法既可以帮你节省时间，又能提高你的数量推理能力。

- *Reason. Don't calculate.* Part of the reason you can sometimes do better without a calculator is that many situations do not actually require one. Multiple-choice questions like "In which year was the percentage of blank highest?" or "Which has the largest area?" may not require you to calculate anything. Try to determine answers with comparisons and not calculation. Many quantitative comparison questions can be approached this way.

Example 9

Which of the five following figures has the largest shaded area?

Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ



Solution: You do not need to calculate the area of any of these figures to solve the problem. If we divide C with a vertical line you'll see it is made of two shapes congruent to B. If you flip one of the triangles vertically, those two triangles could be combined to form the rectangle in E. Hence B, C, and E all have the same area. If you think of D as a square and

two small triangles, you can rotate and move the bottom left small triangle beside the top one to make a 2 × 1 rectangle. So D and E have the same area. Finally, A is comprised of one small square and three small triangles, while D has one square and two small triangles. A has more area than D. So B, C, D, and E have the same area while A has more. Choose **A**.

- *Memorize some basic facts that help make calculations quicker and easier.* We presume you know your times tables. It is also helpful to know the perfect squares like $12^2 = 144$, $13^2 = 169$, . . . , $20^2 = 400$ (or even more). The most common fractions that appear are $\frac{1}{2}$, $\frac{1}{3}$, and $\frac{2}{3}$. It is helpful to know that $\frac{2}{3} - \frac{1}{2} = \frac{1}{6}$ and other related facts like $\frac{1}{2} + \frac{1}{6} = \frac{2}{3}$, $\frac{1}{2} - \frac{1}{3} = \frac{1}{6}$, and $\frac{1}{2} + \frac{1}{3} = \frac{5}{6}$. The appendix gives a list of facts to memorize.
- *Use the distributive property.* Instead of multiplying 42×30, we can use the distributive property to break this into pieces you can multiply in your head.

  $$42 \times 30 = (40 + 2) \times 30 = 40 \times 30 + 2 \times 30 = 1{,}200 + 60 = 1{,}260$$

  This also works well with subtraction.

  $$38 \times 25 = (40 - 2) \times 25 = (40 \times 25) - (2 \times 25) = 1{,}000 - 50 = 950$$
- *Find the difference of squares.* You may know this as a rule of algebra, $A^2 - B^2 = (A - B)(A + B)$, but it can be useful for some calculations. To find $77^2 - 23^2$, instead of calculating each square, we find $(77 - 23)(77 + 23)$. The first factor is easy to subtract $77 - 23 = 54$, and the second factor is easy to add $77 + 23 = 100$. Their product $54 \times 100 = 5{,}400$ is also easy. This whole computation could even be done in your head and quickly!
- *Cancel before you calculate.* Always try to cancel factors before you calculate. This reduces the size of the numbers you have to work with. To simplify $\frac{3}{7} \times \frac{10}{33} \times \frac{14}{26}$, we factor the terms first and then use cancellation $\frac{\cancel{3}}{\cancel{7}} \times \frac{\cancel{2} \times 5}{\cancel{3} \times 11} \times \frac{2 \times \cancel{7}}{\cancel{2} \times 13}$. Now it is easy to see the answer is $\frac{5 \times 2}{13 \times 11}$, which equals 10/143. The toughest part of this problem was multiplying 13 by 11, which is not so tough if you do $13 \times 10 + 13 \times 1 = 130 + 13 = 143$.
- *Estimate, don't calculate.* Which is larger $137 \times 2{,}185$ or $89 \times 5{,}856$? It would be time consuming to calculate these even with the on-screen calculator, but a rough estimate will give us the answer. We approximate $137 \times 2{,}185$ as $100 \times 2{,}000$, which equals 200,000. We approximate $89 \times 5{,}856$ as $90 \times 5{,}000$, which equals 450,000. Even allowing for some serious error in our approximation, we can be certain the second product is larger than the first.

Problems

Remember, for quantitative comparison questions choose:

Ⓐ If Quantity A is greater.
Ⓑ If Quantity B is greater.
Ⓒ If the two quantities are equal.
Ⓓ If it is impossible to determine which quantity is greater.

	Quantity A	Quantity B
1.	$20^2 - 10^2$	$11^2 + 13^2$

	Quantity A	Quantity B
2.	$x^2 - y^3$	$x^2 + y^3$

	Quantity A	Quantity B
3.	$(9x + 1)(9x - 1)$	$81x^2$

$p > q > 0$

	Quantity A	Quantity B
4.	$52p \times 48q$	$51p \times 49q$

	Quantity A	Quantity B
5.	$\dfrac{20 \times 18 \times 16}{9 \times 8 \times 7}$	$\dfrac{12 \times 10 \times 8}{4 \times 3 \times 2}$

$x \neq 5$

	Quantity A	Quantity B
6.	$\dfrac{1}{x - 5}$	$x + 5$

	Quantity A	Quantity B
7.	$5^{-5}(9 \times 7 \times 5 \times 3 \times 1)$	$6^{-5}(10 \times 8 \times 6 \times 4 \times 2)$

8. Which of the following values is closest to $\sqrt[3]{40}$?

Ⓐ 2
Ⓑ 3
Ⓒ 3.5
Ⓓ 4
Ⓔ 11

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