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Volume 1

Official

GRE[®]

QUANTITATIVE REASONING

Practice Questions

150 *real* test questions with explanations
— straight from the maker of the GRE[®] revised General Test



Welcome to

Official GRE® Quantitative Reasoning Practice Questions, Volume 1

The book you are holding offers 150 real GRE practice questions directly from the maker of the GRE® revised General Test. This book is specially created to give you in-depth practice and accurate test preparation for the Quantitative Reasoning measure.

Here's what you will find inside:

- **Authentic GRE Quantitative Reasoning test questions** arranged by content and question type—to help you build your test-taking skills. Plus, mixed practice sets.
- **Answers and explanations** for every question!
- **ETS's own test-taking strategies.** Learn valuable hints and tips that can help you get your best score.
- **GRE Math Review** covering math topics you need to know for the test.
- **Official information on the GRE Quantitative Reasoning measure.** Get the facts about the test content, structure, scoring, and more—straight from ETS.

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IMPORTANT

ETS makes available free test preparation materials for individuals planning to take a GRE test. *POWERPREP® II* software is available for individuals planning to take the computer-delivered GRE revised General Test, and the *Practice Book for the Paper-based GRE revised General Test*,

Second edition, is available for individuals planning to take the paper-delivered test. The information about how to prepare for the Quantitative Reasoning measure of the GRE revised General Test, including test-taking strategies, question strategies, etc., that is included in the free test preparation is also included in this publication. This publication also provides you with 150 brand new practice questions with answers and explanations.

For more information about the GRE revised General Test, free and low-cost GRE test preparation materials, and other GRE products and services, please visit the GRE website at:

www.ets.org/gre



Inquiries concerning the practice test questions in this book should be sent to the GRE testing program at:

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Volume 1

Official

GRE[®]

**QUANTITATIVE
REASONING**

Practice Questions



New York | Chicago | San Francisco | Athens | London | Madrid
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ISBN: 978-0-07-183431-5

MHID: 0-07-183431-1

The material in this eBook also appears in the print version of this title: ISBN: 978-0-07-183432-2,
MHID: 0-07-183432-X.

eBook conversion by codeMantra
Version 1.0

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1

Overview of the *GRE*[®] Quantitative Reasoning Measure

Your goal for this chapter

⇒ Review basic information on the structure of the *GRE*[®] Quantitative Reasoning measure, test-taking strategies, and scoring

Introduction to the *GRE*[®] revised General Test

The *GRE*[®] revised General Test—the most widely accepted graduate admissions test worldwide—measures verbal reasoning, quantitative reasoning, critical thinking, and analytical writing skills that are necessary for success in graduate and business school.

Prospective graduate and business school applicants from all around the world take the *GRE* revised General Test. Although applicants come from varying educational and cultural backgrounds, the *GRE* revised General Test provides a common measure for comparing candidates' qualifications. *GRE* scores are used by admissions committees and fellowship panels to supplement undergraduate records, recommendation letters, and other qualifications for graduate-level study.

The *GRE* revised General Test is available at test centers in more than 160 countries. In most regions of the world, the computer-delivered test is available on a continuous basis throughout the year. In areas of the world where computer-delivered testing is not available, the test is administered in a paper-delivered format up to three times a year.

Before taking the *GRE* revised General Test, it is important to become familiar with the content and structure of the test, and with each of the three measures—Verbal Reasoning, Quantitative Reasoning, and Analytical Writing. This book provides a close look at the *GRE* Quantitative Reasoning measure. Chapter 1 provides an overview of the structure and scoring of the Quantitative Reasoning measure. In Chapters 2 through 7, you will find information specific to the content of the Quantitative Reasoning measure. You can use the information in this publication to help you understand the type of material on which you will be tested. For the most up-to-date information about the *GRE* revised General Test, visit the *GRE* website at www.ets.org/gre.

The Quantitative Reasoning Measure of the Computer-delivered GRE revised General Test

Structure of the Quantitative Reasoning Measure

<i>Measure</i>	<i>Number of Questions</i>	<i>Allotted Time</i>
Quantitative Reasoning (Two sections)	20 questions per section	35 minutes per section

The Quantitative Reasoning sections may appear anytime in the test after section 1. The directions at the beginning of each Quantitative Reasoning section specify the total number of questions in the section and the time allowed for the section.

Test Design Features

The Quantitative Reasoning measure of the computer-delivered GRE revised General Test is section-level adaptive. This means the computer selects the second section of a measure based on your performance on the first section.

The advanced adaptive design also means you can freely move forward and backward throughout an entire section. Specific features include:

- Preview and review capabilities within a section
- “Mark” and “Review” features to tag questions, so you can skip them and return later if you have time remaining in the section
- The ability to change/edit answers within a section
- An on-screen calculator (More information about the calculator is given in Chapter 2.)

Test-taking Strategies

The questions in the Quantitative Reasoning measure are presented in a variety of formats. Some require you to select a single answer choice, others require you to select one or more answer choices, and yet others require you to enter a numeric answer. Make sure when answering a question that you understand what response is required. An on-screen calculator will be provided at the test center for use during the Quantitative Reasoning sections.

When taking the Quantitative Reasoning measure of the computer-delivered GRE revised General Test, you are free to skip questions that you might have difficulty answering within a section. The testing software has a “Mark” feature that enables you to mark questions you would like to revisit during the time provided to work on that section. The testing software also has a “Review” feature that lets you view a complete list of all the questions in the section on which you are working, that indicates whether you have answered each question, and that identifies the questions you have marked for review. Additionally, you can review questions you have already answered and change your answers, provided you still have time remaining to work on that section.

A sample review screen appears below. The review screen is intended to help you keep track of your progress on the test. Do not spend too much time on the review screen, as this will take away from the time allotted to read and answer the questions on the test.

GRE® General Test Section 4 of 6

ETS INFO EXIT NEXT

Question 16 of 20

Return Go To Question

Hide Time 00 : 27 : 55

Below is the list of questions in the current section. The question you were on is highlighted. Questions you have seen are labeled **Answered**, **Incomplete**, or **Not Answered**. A question is labeled **Incomplete** if the question requires you to select a certain number of answer choices and you have selected more or fewer than that number. Questions you have marked are indicated with a ✓.

To return to the question you were on, click **Return**.

To go to a different question, click on that question to highlight it, then click **Go To Question**.

Question Number	Status	Marked
1	Answered	
2	Answered	
3	Answered	
4	Answered	
5	Answered	
6	Incomplete	
7	Answered	✓
8	Answered	
9	Answered	
10	Answered	

Question Number	Status	Marked
11	Answered	
12	Incomplete	
13	Incomplete	
14	Incomplete	✓
15	Incomplete	✓
16	Answered	
17	Answered	
18	Answered	✓
19	Not seen	
20	Not seen	

Your Quantitative Reasoning score will be determined by the number of questions you answer correctly. Nothing is subtracted from a score if you answer a question incorrectly. Therefore, to maximize your scores on the Quantitative Reasoning measure, it is best to answer every question.

Work as rapidly as you can without being careless. Since no question carries greater weight than any other, do not waste time pondering individual questions you find extremely difficult or unfamiliar.

You may want to go through each of the Quantitative Reasoning sections rapidly first, stopping only to answer questions you can answer with certainty. Then go back and answer the questions that require greater thought, concluding with the difficult questions if you have time.

During the actual administration of the revised General Test, you may work only on one section at a time and only for the time allowed. Once you have completed a section, you may not go back to it.

Scratch Paper

You will receive a supply of scratch paper before you begin the test. You can replenish your supply of scratch paper as necessary throughout the test by asking the test administrator.

How the Quantitative Reasoning Measure Is Scored

The Quantitative Reasoning measure is section-level adaptive. This means the computer selects the second section of a measure based on your performance on the first section. Within each section, all questions contribute equally to the final score. First a raw score is computed. The raw score is the number of questions you answered correctly. The raw score is then converted to a scaled score through a process known as equating. The equating process accounts for minor variations in difficulty from test to test as well as the differences introduced by the section-level adaptation. Thus a given scaled score reflects the same level of performance regardless of which second section was selected and when the test was taken.

The Quantitative Reasoning Measure of the Paper-delivered GRE revised General Test

Structure of the Quantitative Reasoning Measure

<i>Measure</i>	<i>Number of Questions</i>	<i>Allotted Time</i>
Quantitative Reasoning (Two sections)	25 questions per section	40 minutes per section

The Quantitative Reasoning sections may appear in any order after section 2. The directions at the beginning of each section specify the total number of questions in the section and the time allowed for the section.

Test Design Features

- You are free, within any section, to skip questions and come back to them later or change the answer to a question.
- Answers are entered in the test book, rather than a separate answer sheet.
- You will be provided with an ETS calculator to use during the Quantitative Reasoning section; you may not use your own calculator.

Test-taking Strategies

The questions in the Quantitative Reasoning measure have a variety of formats. Some require you to select a single answer choice, others require you to select one or more answer choices, and yet others require you to enter a numeric answer. Make sure when answering a question that you understand what response is required. A calculator will be provided at the test center for use during the Quantitative Reasoning sections.

When taking a Quantitative Reasoning section, you are free, within that section, to skip questions that you might have difficulty answering and come back to them later during the time provided to work on that section. Also during that time you may change the answer to any question in that section by erasing it completely and filling in an

alternative answer. Be careful not to leave any stray marks in the answer area, as they may be interpreted as incorrect responses. You can, however, safely make notes or perform calculations on other parts of the page. No additional scratch paper will be provided.

Your Quantitative Reasoning score will be determined by the number of questions you answer correctly. Nothing is subtracted from a score if you answer a question incorrectly. Therefore, to maximize your score on the Quantitative Reasoning measure, it is best to answer every question.

Work as rapidly as you can without being careless. Since no question carries greater weight than any other, do not waste time pondering individual questions you find extremely difficult or unfamiliar.

You may want to go through each of the Quantitative Reasoning sections rapidly first, stopping only to answer questions you can answer with certainty. Then go back and answer the questions that require greater thought, concluding with the difficult questions if you have time.

During the actual administration of the revised General Test, you may work only on the section the test center supervisor designates and only for the time allowed. You may *not* go back to an earlier section of the test after the supervisor announces, “Please stop work” for that section. The supervisor is authorized to dismiss you from the center for doing so.

All answers must be recorded in the test book.

How the Quantitative Reasoning Measure Is Scored

Scoring of the Quantitative Reasoning measure is essentially a two-step process. First a raw score is computed. The raw score is the number of questions answered correctly in the two sections for the measure. The raw score is then converted to a scaled score through a process known as equating. The equating process accounts for minor variations in difficulty among the different test editions. Thus a given scaled score reflects the same level of performance regardless of which edition of the test was taken.

Score Reporting

A Quantitative Reasoning score is reported on a 130–170 score scale, in 1-point increments. If you do not answer any questions at all for the measure, you will receive a No Score (NS) for that measure.

The ScoreSelect® Option

The ScoreSelect® option is available for both the GRE revised General Test and GRE Subject Tests and can be used by anyone with reportable scores from the last five years. This option lets you send institutions your best scores. For your four free score reports, you can send scores from your *Most Recent* test administration or scores from *All* test administrations in your reportable history. After test day, you can send scores from your *Most Recent*, *All*, or *Any* specific test administration(s) for a fee when ordering

Additional Score Reports. Just remember, scores for a test administration must be reported in their entirety. For more information, visit www.ets.org/gre/scoreselect.

Score Reporting Time Frames

Scores from computer-delivered GRE revised General Test administrations are reported approximately 10 to 15 days after the test date. Scores from paper-delivered administrations are reported within six weeks after the test date. If you are applying to a graduate or business school program, be sure to review the appropriate admissions deadlines and plan to take the test in time for your scores to reach the institution.

For more information on score reporting, visit the GRE website at www.ets.org/gre/scores/get.

2 Test Content

Your goals for this chapter

- ⇒ Learn general problem-solving steps and strategies
- ⇒ Learn the four types of *GRE*® Quantitative Reasoning questions and get tips for answering each question type
- ⇒ Study sample Quantitative Reasoning questions with solutions
- ⇒ Learn how to use the on-screen calculator

Overview of the Quantitative Reasoning Measure

The Quantitative Reasoning measure of the GRE revised General Test assesses your:

- basic mathematical skills
- understanding of elementary mathematical concepts
- ability to reason quantitatively and to model and solve problems with quantitative methods

Some of the Quantitative Reasoning questions are posed in real-life settings, while others are posed in purely mathematical settings. Many of the questions are “word problems,” which must be translated and modeled mathematically. The skills, concepts, and abilities are assessed in the four content areas below.

Arithmetic topics include properties and types of integers, such as divisibility, factorization, prime numbers, remainders, and odd and even integers; arithmetic operations, exponents, and roots; and concepts such as estimation, percent, ratio, rate, absolute value, the number line, decimal representation, and sequences of numbers.

Algebra topics include operations with exponents; factoring and simplifying algebraic expressions; relations, functions, equations, and inequalities; solving linear and quadratic equations and inequalities; solving simultaneous equations and inequalities; setting up equations to solve word problems; and coordinate geometry, including graphs of functions, equations, and inequalities, intercepts, and slopes of lines.

Geometry topics include parallel and perpendicular lines, circles, triangles—including isosceles, equilateral, and 30° - 60° - 90° triangles—quadrilaterals, other polygons, congruent and similar figures, three-dimensional figures, area, perimeter, volume, the Pythagorean theorem, and angle measurement in degrees. The ability to construct proofs is not tested.

Data analysis topics include basic descriptive statistics, such as mean, median, mode, range, standard deviation, interquartile range, quartiles, and percentiles; interpretation of data in tables and graphs, such as line graphs, bar graphs, circle graphs, boxplots, scatterplots, and frequency distributions; elementary probability, such as probabilities of compound events and independent events; random variables and probability distributions, including normal distributions; and counting methods, such as combinations, permutations, and Venn diagrams. These topics are typically taught in high school algebra courses or introductory statistics courses. Inferential statistics is not tested.

The content in these areas includes high school mathematics and statistics at a level that is generally no higher than a second course in algebra; it does not include trigonometry, calculus, or other higher-level mathematics. The publication *Math Review for the GRE revised General Test*, which is available in Appendix A, provides detailed information about the content of the Quantitative Reasoning measure.

The mathematical symbols, terminology, and conventions used in the Quantitative Reasoning measure are those that are standard at the high school level. For example, the positive direction of a number line is to the right, distances are nonnegative, and prime numbers are greater than 1. Whenever nonstandard notation is used in a question, it is explicitly introduced in the question.

In addition to conventions, there are some important assumptions about numbers and figures that are listed in the Quantitative Reasoning section directions:

- All numbers used are real numbers.
- All figures are assumed to lie in a plane unless otherwise indicated.
- Geometric figures, such as lines, circles, triangles, and quadrilaterals, **are not necessarily** drawn to scale. That is, you should **not** assume that quantities such as lengths and angle measures are as they appear in a figure. You should assume, however, that lines shown as straight are actually straight, points on a line are in the order shown, and more generally, all geometric objects are in the relative positions shown. For questions with geometric figures, you should base your answers on geometric reasoning, not on estimating or comparing quantities by sight or by measurement.
- Coordinate systems, such as xy -planes and number lines, **are** drawn to scale; therefore, you can read, estimate, or compare quantities in such figures by sight or by measurement.
- Graphical data presentations, such as bar graphs, circle graphs, and line graphs, **are** drawn to scale; therefore, you can read, estimate, or compare data values by sight or by measurement.

More about conventions and assumptions appears in the publication *Mathematical Conventions for the GRE revised General Test*, which is available in Appendix B.

General Problem-solving Steps

Questions in the Quantitative Reasoning measure ask you to model and solve problems using quantitative, or mathematical, methods. Generally, there are three basic steps in solving a mathematics problem:

Step 1: Understand the problem

Step 2: Carry out a strategy for solving the problem

Step 3: Check your answer

Here is a description of the three steps, followed by a list of useful strategies for solving mathematics problems.

Step 1: Understand the Problem

The first step is to read the statement of the problem carefully to make sure you understand the information given and the problem you are being asked to solve.

Some information may describe certain quantities. Quantitative information may be given in words or mathematical expressions, or a combination of both. Also, in some problems you may need to read and understand quantitative information in data presentations, geometric figures, or coordinate systems. Other information may take the form of formulas, definitions, or conditions that must be satisfied by the quantities. For example, the conditions may be equations or inequalities, or may be words that can be translated into equations or inequalities.

In addition to understanding the information you are given, it is important to understand what you need to accomplish in order to solve the problem. For example, what unknown quantities must be found? In what form must they be expressed?

Step 2: Carry Out a Strategy for Solving the Problem

Solving a mathematics problem requires more than understanding a description of the problem, that is, more than understanding the quantities, the data, the conditions, the unknowns, and all other mathematical facts related to the problem. It requires determining *what* mathematical facts to use and *when* and *how* to use those facts to develop a solution to the problem. It requires a strategy.

Mathematics problems are solved by using a wide variety of strategies. Also, there may be different ways to solve a given problem. Therefore, you should develop a repertoire of problem-solving strategies, as well as a sense of which strategies are likely to work best in solving particular problems. Attempting to solve a problem without a strategy may lead to a lot of work without producing a correct solution.

After you determine a strategy, you must carry it out. If you get stuck, check your work to see if you made an error in your solution. It is important to have a flexible, open mind-set. If you check your solution and cannot find an error or if your solution strategy is simply not working, look for a different strategy.

Step 3: Check Your Answer

When you arrive at an answer, you should check that it is reasonable and computationally correct.

- Have you answered the question that was asked?
- Is your answer reasonable in the context of the question? Checking that an answer is reasonable can be as simple as recalling a basic mathematical fact and checking whether your answer is consistent with that fact. For example, the probability of an event must be between 0 and 1, inclusive, and the area of a geometric figure must be positive. In other cases, you can use estimation to check that your answer is reasonable. For example, if your solution involves adding three numbers, each of which is between 100 and 200, estimating the sum tells you that the sum must be between 300 and 600.
- Did you make a computational mistake in arriving at your answer? A key-entry error using the calculator? You can check for errors in each step in your solution. Or you may be able to check directly that your solution is correct. For example, if you solved the equation $7(3x - 2) + 4 = 95$ for x and got the answer $x = 5$, you can check your answer by substituting $x = 5$ into the equation to see that $7(3(5) - 2) + 4 = 95$.

Strategies

There are no set rules—applicable to all mathematics problems—to determine the best strategy. The ability to determine a strategy that will work grows as you solve more and more problems. What follows are brief descriptions of useful strategies, along with references to questions in this chapter that you can answer with the help of particular strategies. These strategies do not form a complete list, and, aside from grouping the first four strategies together, they are not presented in any particular order.

The first four strategies are translation strategies, where one representation of a mathematics problem is translated into another.

Strategy 1: Translate from Words to an Arithmetic or Algebraic Representation

Word problems are often solved by translating textual information into an arithmetic or algebraic representation. For example, an “odd integer” can be represented by the expression $2n + 1$, where n is an integer; and the statement “the cost of a taxi trip is \$3.00, plus \$1.25 for each mile” can be represented by the expression $c = 3 + 1.25m$. More generally, translation occurs when you understand a word problem in mathematical terms in order to model the problem mathematically.

- See question 4 on page 27 and question 5 on page 35.

Strategy 2: Translate from Words to a Figure or Diagram

To solve a problem in which a figure is described but not shown, draw your own figure. Draw the figure as accurately as possible, labeling as many parts as possible, including any unknowns.