

Fundamentals of
Mathematics



Barker Rogers Van Dyke

sixth edition

INSTRUCTOR'S ANNOTATED EDITION

Instructor's Annotated Edition

Fundamentals *of* Mathematics

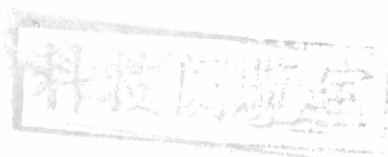
Sixth Edition

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TO THE STUDENT

Fundamentals of Mathematics will help you review basic concepts of mathematics so that you are prepared for proficiency exams or for further college mathematics courses, like basic algebra.

The Challenge and the Reward

Learning mathematics may be challenging, but it is also rewarding: As an adult, you know the many ways we use mathematics in daily modern life — from balancing a checkbook to negotiating a car deal. Not a day goes by that you aren't using math skills. The better your skills, the easier modern life becomes.

The System for Success

Like any challenging activity, succeeding in mathematics happens when you set a goal and make a commitment. It happens when you adopt a system, a routine, for achieving your goal. For instance, if you want to learn karate, you set a goal and make a commitment. You arrange your life so that you can practice regularly, doing the exercises your karate instructor recommends, working hard, and focusing on your goal.

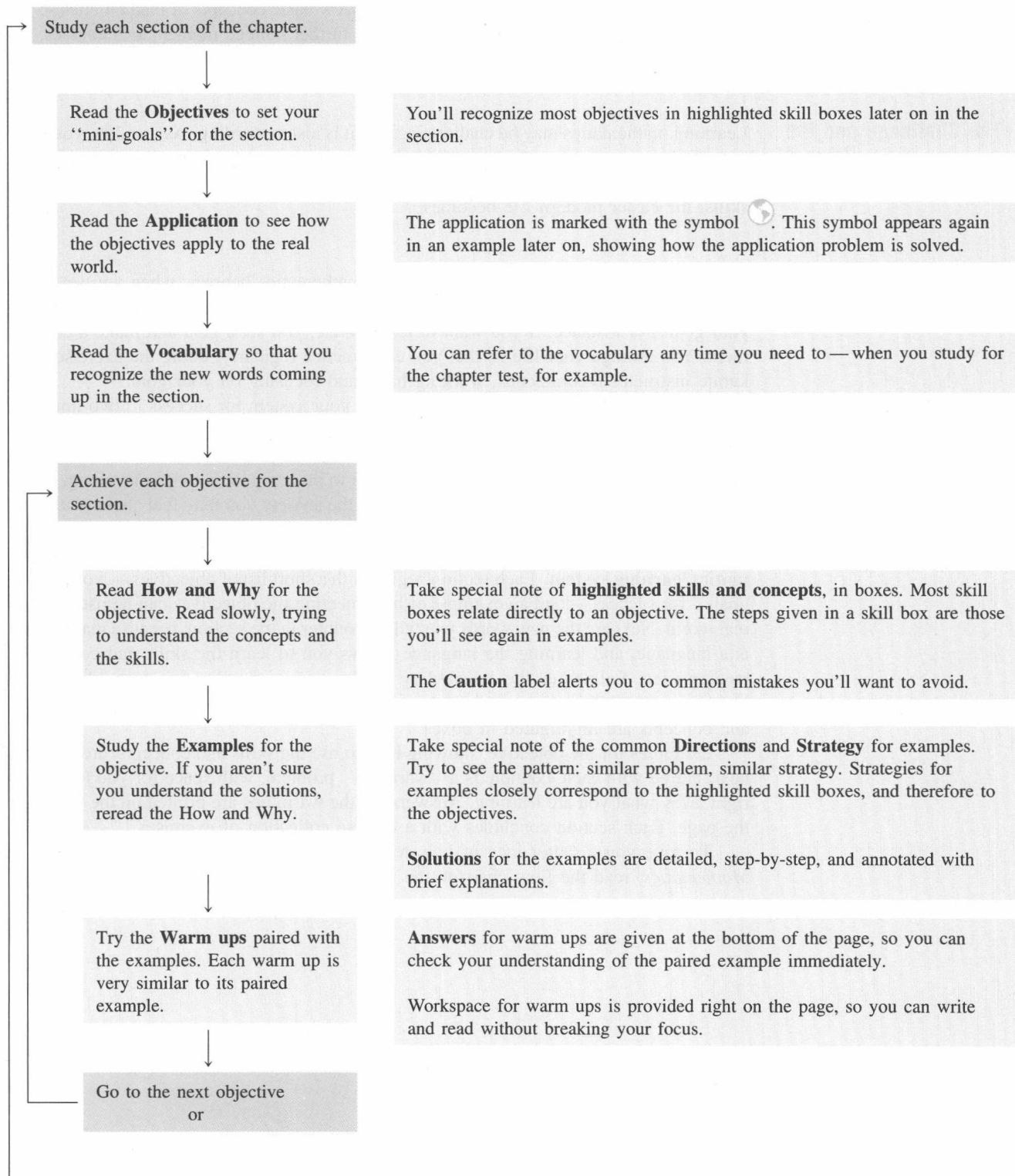
Fundamentals of Mathematics encourages your system for success in two important ways. First, the opening pages for each chapter describe a **mathematics study system** that has proven effective for thousands of students. You may want to read all these opening pages before starting your course, and then refer to them regularly as you go along. Part of the system includes techniques for overcoming the anxiety you may feel about mathematics. Additional study resources are suggested in Appendix B.

Second, each section of *Fundamentals of Mathematics* is organized around a **mathematics learning system**. Each section begins with a short list of objectives — your “mini-goals” for success — and an example of how meeting the objectives can be useful in the real world. Next are the new words you will encounter in the section, because mathematics is a language, and learning the language allows you to learn the skills and concepts of mathematics. Following the vocabulary is the how and why for each objective — explaining the skills and the concepts you need to learn to meet the objective. Key skills and concepts are highlighted in boxes.

Examples for the objective, showing how to use the skills and concepts, are provided next. Paired with each example is a “warm up” problem, with space for you to practice right away what you are learning. Answers for the warm ups are printed on the bottom of the page. Each section concludes with a diverse collection of exercises.

To give you a better idea of how to use the learning system in *Fundamentals of Mathematics*, read the flow chart on the next page. Then go with the flow!

Your Learning System for Success, Chapter by Chapter



Try the **Exercises** for the section. If you have trouble, return to the paired examples and warm ups.

Use the **Support Materials** that accompany the book.

Go to the next section
or

Try the **Concept Review** for the chapter to help you prepare for the chapter test. If you have trouble, go back and review the content.

Take the **Test** for the chapter, timing yourself just as though it were a classroom test. If you do well, then congratulations! Your system for success worked!

Answers for all odd-numbered exercises are in the back of the book. Exercises are paired, odd with even, so that if you are working the odd exercises correctly, you should be able to work the even exercises correctly, too.

Exercises come in categories. **Categories A, B, and C** are basic skills of progressive difficulty. You should be able to work category A mentally, and your instructor may allow you to use a calculator to work category C.

You'll want to work problems in the **Applications** category, and you may want to try problems in the **Challenge** category. Don't skip the **State Your Understanding** category (because when you can say it, you can do it!) or the **Maintain Your Skills** category (because you'll need to keep doing it!).

If your school has a computer lab or video resources, get additional help from **MathCue™ Interactive Software** or the collection of **videotapes** that accompany the book. You might also consider getting the **Student's Solutions Manual**.

Answers for all Concept Review questions are in the back of the book. These are true-false questions. False statements need to be rewritten so that they are true.

Answers for all test questions are in the back of the book, keyed to objectives so that you'll know whether you've reached your "mini-goals" (and, if you haven't, which objectives to study again).

Support Materials

An excellent collection of support materials for *Fundamentals of Mathematics* is available to you. In printed, electronic, and video formats, these materials can be an important part of your system for success.

Student's Solutions Manual Detailed, annotated, step-by-step solutions are provided for every other odd-numbered exercise in the section exercise sets and for every exercise in the Chapter Concept Reviews and Chapter Tests.

Videotapes An outstanding section-by-section video review features on-location segments to illustrate applications. Each tape covers one chapter, with roughly 15 minutes per section. Experienced video teacher Loretta Palmer from Utah Valley State College reviews examples from the book and explains key concepts, weaving into the presentation real-life footage, movie clips, and interviews with diverse, real-world users of mathematics. Study skills and math anxiety are covered as well.

MathCue™ Interactive Software Available in IBM and Macintosh formats, *MathCue™ Interactive Software* helps you learn, review, and practice skills, discover and explore concepts, and pinpoint and correct weak areas of understanding. *MathCue™* is designed by George W. Bergeman of Northern Virginia Community College and comprises a variety of interactive tools:

Tailored to every section of the book, **MathCue™ Tutorial** gives you problems to solve and tutors you with annotated, step-by-step solutions, each step shown one at a time. *Tutorial* keeps track of your progress and you can check your progress at any time. You can back up to review missed problems or print out your scores. If you miss problems, *Tutorial* tells you which section in the book you should look at again.

MathCue™ Practice helps you focus on solving particular types of problems. From a collection of sample problems, you choose which types and how many of each type you want to practice. If you want, you can get immediate feedback after you work each problem, or you can work in test mode, getting feedback only when you end your practice session. When you start a new session, *Practice* remembers which problem types you have worked on previously, or you can choose other types. *Practice* scores your performance for each problem type, referring you to specific places in the book if you need more help. *Practice* also saves your scores from session to session.

Based on an expert system (a branch of artificial intelligence), **MathCue™ Solution Finder** lets you pose your own problems and get annotated, step-by-step solutions in return. *Solution Finder* tracks your progress, tells you which sections in the book to refer to when appropriate, and prints your scores.

Also available, though only to your instructor, are a collection of tests for each chapter of the book. You might ask your instructor to give you a copy of a chapter test *before* you begin the chapter. Answers for the test include a reference to specific objectives. If your answer is not correct, you will know which objectives to focus especially hard on when you study the chapter.

Standardized Tests

If you are studying *Fundamentals of Mathematics* to prepare for the California Mathematical Skills (ELM) exam, the Texas Academic Skills Program (TASP) exam, or the Florida College Level Academic Skills Test (CLAST), you may find the tables on the following pages helpful. The tables correspond topics covered on the standardized tests with sections or chapters of the book.

CLAST Skills and Their Locations in the Book

Skill	Location in Book
1A1a Add and subtract rational numbers	Sections 3.6–3.9
1A1b Multiply and divide rational numbers	Sections 3.3, 3.4
1A2a Add and subtract rational numbers in decimal form	Sections 4.4, 4.5
1A2b Multiply and divide rational numbers in decimal form	Sections 4.6–4.9
1A3 Calculate percent increase and decrease	Section 6.8
2A1 Recognize the meaning of exponents	Sections 1.7, 2.3, 2.5
2A2 Recognize the role of the base number in determining place value in the base-ten numeration system and in systems that are patterned after it	Sections 1.1, 1.2, 4.1
2A3 Identify equivalent forms of positive rational numbers	Sections 6.2–6.6
2A4 Determine the order relation between magnitudes	Sections 1.2, 3.5, 4.2
4A1 Solve real-world problems which do not require the use of variables and which do not require the use of percent.	Chapters 1, 2, 3, 4, 5
4A2 Solve real-world problems that require the use of percent	Section 6.8
4A3 Solve problems that involve the structure and logic of arithmetic	Throughout
1B1 Round measurements to the nearest given unit of the measuring device	Section 4.3
1B2a Calculate distances	Section 7.4
1B2b Calculate area	Sections 7.5, 7.6
1B2c Calculate volume	Section 7.7
2B2 Classify simple plane figures by recognizing their properties	Chapter 7
3B1 Infer formulas for measuring geometric figures	Chapter 7
3B2 Identify applicable formulas for computing measures of geometric figures	Chapter 7
4B1 Solve real-world problems involving perimeter, area, and volume of geometric figures	Sections 7.4–7.7
1C1a Add and subtract real numbers	Sections 8.2, 8.3
1C1b Multiply and divide real numbers	Sections 8.4, 8.5
1C2 Apply the order of operations agreement to computations involving numbers and variables	Section 8.6
1C4 Solve linear equations and inequalities	Sections 1.4, 1.6, 1.8, 3.4, 3.9, 4.5, 4.8, 4.10, 8.7
1C5 Use given formulas to compute results when geometric measurements are not involved	Throughout
2C3 Recognize statements and conditions of proportionality and variation	Chapter 5
1D1 Identify information contained in a bar, line, and circle graph	Section 6.9
4D1 Interpret real-world data from tables and charts	Section 6.10

ELM Skills and Their Locations in the Book

Skill	Location in Book
Whole numbers and their operations	Chapter 1
Fractions and their operations	Chapter 3
Decimals and their operations	Chapter 4
Exponentiation and square roots	Sections 1.7, 2.3, 2.5
Fraction–decimal conversion	Sections 4.2, 4.9
Applications (averages, percents)	Sections 1.9, 3.10, 4.10, 6.8
Ratio, proportion, and variance	Chapter 5
Reading data from graphs and charts	Sections 6.9, 6.10
Perimeters and areas of triangles, squares, rectangles, and parallelograms	Sections 7.4–7.6
Circumferences and areas of circles	Sections 7.5, 7.6
Volumes of cubes, cylinders, rectangular solids, and spheres	Section 7.7

TASP Skills and Their Locations in the Book

Skill	Location in Book
Use number concepts and computation skills	Throughout
Solve word problems involving integers, fractions, or decimals (including percents, ratios, and proportions)	Chapters 3–6, 8
Solve one- and two-variable equations	Sections 1.4, 1.6, 1.8, 3.4, 3.9, 4.5, 4.8, 4.10, 8.7
Solve problems involving geometric figures	Chapter 7

TO THE INSTRUCTOR

Fundamentals of Mathematics, 6th edition, is a worktext for college students who need to review the basic skills and concepts of arithmetic in order to pass competency or placement exams, or prepare for courses such as business mathematics or elementary algebra. The text is accompanied by a complete system of ancillaries in a variety of media, affording great flexibility for individual instructors and students.

A Textbook for Adult Students

Though the mathematical content of *Fundamentals of Mathematics* is elementary, students using the text are most often mature adults, bringing with them to the course adult attitudes and experiences and a broad range of abilities. Teaching elementary content to these students, therefore, is effective when it accounts for their distinct and diverse adult needs. As you read about and examine the features of *Fundamentals of Mathematics* and its ancillaries, you will see how they especially meet these three needs of your students:

Students must establish good study habits and overcome math anxiety.

Students must see connections between mathematics and the modern, day-to-day world of adult activities.

Students must be paced and challenged according to their individual level of understanding.

A Textbook for Many Course Formats


Fundamentals of Mathematics is suitable for individual study or for a variety of course formats: lab, both supervised and self-paced; lecture; group; or combined formats. For a lecture-based course, for example, each section is designed to be covered in a standard 50-minute class. The lecture can be interrupted periodically so that students individually can work the warm up exercises, or work in small groups on the group activities. In a self-paced lab course, warm up exercises give students a chance to practice while they learn, and get immediate feedback since warm up answers are printed on the bottom of each page.

Using the text's ancillaries, instructors and students have even more options available to them. Computer users, for example, can take advantage of complete electronic tutorial and testing systems, fully coordinated with the text. A detailed description of each print, video, and computer ancillary is found on page xii.

Teaching Methodology

As you peruse the 6th edition of *Fundamentals of Mathematics*, you will see distinctive format and pedagogy, reflecting these aspects of teaching methodology:

Teaching by objective Each section focuses on a short list of objectives, stated at the beginning of the section. The objectives correspond to the sequence of exposition and tie together other pedagogy, including the highlighted content, the examples, and the exercises.

Teaching by application An opening application, marked by the symbol , is featured at the beginning of each section and is solved as an example within the section. Other applications also may appear as examples, and exercise sets most often include a collection of applications. Applications cover a diverse range of fields, demonstrating the utility of the content in business and science and in daily life as well.

Stressing language New words for each section are explained in the vocabulary segment that precedes the exposition. Exercise sets include questions requiring verbal responses.

Stressing skill, concept, and problem solving Each section covers concepts *and* skills, fully explained and demonstrated in the exposition for each objective. Carefully constructed examples for each objective are connected by a common strategy that reinforces both the skill and the underlying concepts. Skills are not treated as isolated feats of memorization but as the practical result of conceptual understanding: Skills are strategies for solving related problems. Students learn to see the connections among problems and their common solutions.

Topics and Sequence

Chapter 1 begins with the numeration system including the concepts of place value, word name, expanded form, rounding, and inequality; so the student will have a thorough understanding of the concepts of “number” prior to performing operations. The basic operations of addition, subtraction, multiplication, and division of whole numbers are reviewed. The student is introduced to estimating when doing different operations. The ability to estimate gives one a feeling of assurance with respect to whether or not the problem has been done correctly. Following Section 1.4, we introduce the concept of solving equations with whole-number solutions. This Getting Ready for Algebra section is followed by others immediately after Sections 1.6, 1.8, and throughout the text to help the student prepare for the study of algebra. Exponents and powers of ten are examined so that they can be used in the order of operations with whole numbers and for writing the prime factors of a whole number in Chapter 2. The chapter finishes with order of operations and average. Order of operations shows the importance of rules in finding the correct answers and is an important step in the study of mathematics. Average is applied to real-life situations.

Chapter 2 starts with the divisibility tests which will be helpful in prime factoring a number and in reducing fractions. Whole number classifications of multiples, divisors, factors, primes, and composites follow and give the student needed practice with multiplication and division. The chapter finishes with prime factorization and least common multiple, two concepts that will play an important role in the chapter on fractions.

Chapter 3 begins with a discussion of the meaning of a fraction, using shaded-unit regions and rulers to model the concept. This visual presentation backs the mathematical concept. Operations on fractions and mixed numbers are covered. Building and reducing fractions utilize the concepts and skills acquired in Chapter 2. In adding fractions, the concept of least common denominator flows from the Chapter 2 presentation of least common multiple. The chapter concludes with a presentation of the order of operations and average. Getting Ready for Algebra topics follow Sections 3.4 and 3.9.

Chapter 4 covers decimals, following an approach parallel to the presentation of whole numbers. The concepts of place value, word names, expanded form, rounding, and inequality are extended to decimals. The basic operations are covered. A special section on multiplying and dividing by powers of ten is included and uses the exponent skills developed in Chapter 1. Conversions between fractions and decimals are given to show the relationship between the two ways of writing a rational number. The fact that not all fractions have an exact decimal representation demonstrates the need for fractions and the practical use of rounding. The chapter ends with a review of the order of operations and average. Getting Ready for Algebra topics follow Sections 4.5, 4.8, and 4.10.

Chapter 5 discusses ratios, rates, and proportions. Each of these concepts leads to useful applications of mathematics to practical situations. The student is introduced to the formal process of translating from a written statement of facts to a mathematical statement that can be solved. This skill is reinforced in the next two chapters. Solving a proportion is related to solving an equation in algebra.

Chapter 6 presents percent as a useful way of describing a numerical comparison. Students practice changing from percents to decimals to fractions so that they can see the relationship of percent to the different numbers. Students become skilled at expressing a number in any one of the forms. Solutions of percent problems are covered using either

ratios or the formula $R\%$ of $A = B$. The formula $R\%$ of $A = B$ is presented in the form of a triangle for quick recall. A special section on applications is included that contains business, environmental issues, and other topics. The chapter ends with sections on graphs and charts and tables. Students are given the chance to draw conclusions from visual displays and to construct similar displays. Information is extracted from charts using material commonly seen in magazines and newspapers.

Chapter 7 covers both English and metric measurements. Conversions within one system and between the systems are investigated. The metric system gives a student a skill that can be used in science courses and, increasingly, in everyday activities. Measurement is applied to geometric figures covering perimeter, area, and volume. Compound figures are used for area and volume.

Chapter 8 expands the number system to include signed numbers. Operations on signed numbers include absolute value, opposites, addition, subtraction, multiplication, and division. Order of operations and the solution of equations with signed numbers conclude the chapter. This chapter together with previous sections on Getting Ready for Algebra serve as a bridge for the student's future study of algebra.

Special Content

Special content focuses on study skills and math anxiety, calculators, and simple algebraic equations.

Good Advice for Studying begins each chapter. Written by the instructor/counselor team of Dorette Long and Sylvia Thomas, Rogue Community College, these essays address the unique study problems that students of *Fundamentals of Mathematics* experience. Students learn not only general study skills, but study skills specific to mathematics and to the pedagogy and ancillaries of *Fundamentals of Mathematics*. Special techniques are described to overcome the pervasive problem of math anxiety.

Accompanying each essay is a photo of people engaged in a rewarding, though challenging, activity—from long-distance running to preparing haute cuisine. Captions for the photos reinforce goal-setting, consistency, positive attitude, and other techniques described in the essays.

Though one essay begins each chapter, students may profit by reading all the essays at once, then returning to them as the need arises. A fuller description of how to learn from these essays appears in To the Student.

Calculator examples, marked by the symbol \blacksquare , demonstrate how to use a scientific calculator, though the use of a calculator is left to the discretion of the instructor. Nowhere is the use of a calculator required.

In addition to the specially marked examples, Category C exercises for each section may provide calculator drill. Appendix 1 reviews the basics of operating a standard scientific calculator.

Getting Ready for Algebra segments follow sections 1.4, 1.6, 1.8, 3.4, 3.9, 4.5, 4.8, and 4.10, where operations lend themselves to solving simple algebraic equations. Though completely optional, each Getting Ready for Algebra segment includes its own exposition, examples and warm ups, and exercises. Instructors can cover these segments as part of the normal curriculum or assign them to individual students showing readiness.

Students' photos are sprinkled throughout the text. Featured are math students from across the country, and some of the winners of the Barker/Rogers/Van Dyke Problem Posing Project. These winning students wrote original applications of developmental mathematics. (For more information about the project, see the *Instructor's Manual*.)

Special Pedagogy

The pedagogical system of *Fundamentals of Mathematics* meets two important criteria: coordinated purpose and consistency of presentation.

Each section begins with numbered **Objectives**, followed by a relevant **Application** and definitions of new **Vocabulary** to be encountered in the section. Following the vocabulary, **How and Why** segments, numbered to correspond to the objectives, explain and demonstrate concepts and skills. Throughout the How and Why segments, **skill boxes** clearly identify and outline skills in step-by-step form. Skill box titles closely correspond to the objectives. Also throughout the How and Why segments, **concept boxes** highlight important properties, formulas, and theoretical facts underlying the skills. Concept boxes are often summaries of related material. Following each How and Why segment are **Examples and Warm Ups**. Each example is paired with a warm up, with workspace provided. Answers for warm ups are given at the bottom of the page, affording immediate feedback.

Examples similar to one another are linked by a common **Direction** and a common **Strategy** for solution. Directions and strategies are closely related to the skill boxes. Examples include detailed annotations, showing how the strategy is specifically applied. Connecting examples by a common solution helps students recognize the similarity of problems and their solutions, despite their specific differences. In this way, students may improve their problem-solving skills.

Both in the How and Why segments and in the examples, **Caution** remarks help to avert common mistakes.

Exercises, Reviews, Tests

Thorough, varied, properly paced, and well chosen exercises are a hallmark of *Fundamentals of Mathematics*. Exercise sets are provided at the end of each section and at the end of each chapter. Necessary workspace is provided for all exercises, and each exercise set can be torn out and handed in without disturbing any other part of the book.

Section Exercises Exercises for each section are paired so that each odd-numbered exercise has an even-numbered exercise that is equivalent in type and difficulty. Since answers for odd-numbered section exercises are in the back of the book, students can use odd-numbered exercises for practice, and instructors can assign even-numbered exercises for homework.

Section exercises are categorized to satisfy teaching and learning purposes. Exercises for estimation/mental, pencil and paper, application, and calculator skills are provided, as well as opportunities for students to challenge their abilities and to master communication and group problem solving.

Category A exercises are those that students should be able to solve mentally, without paper and pencil and without a calculator. Mentally working problems improves students' estimating abilities. **Category B** exercises and **Category C** exercises are similar except for the level of difficulty: All students should be able to master category B, while category C contains more difficult exercises. At the discretion of the instructor, category C exercises may also provide calculator practice and reinforce the need for estimating.

Application exercises comprise a great variety, drawn from business, health, environment, consumer, and science fields. Both professional and daily-life uses of mathematics are encountered.

State Your Understanding exercises require a verbal response, usually no more than two or three sentences. These exercises are suitable for group discussion as well as individual assignment.

Challenge exercises stretch the content and are more demanding, both computationally and conceptually.

Group Activity exercises offer specific opportunities for small groups of students to work together to solve problems. While each student needs to develop independent problem solving ability, group problem solving challenges students to communicate effectively and learn from each other.

Maintain Your Skills exercises continually reinforce mastery of skills and concepts from previous sections. The reinforced section is referenced so students can return to the section as needed.

Chapter Exercises At the conclusion of each chapter are two sets of exercises, one designed to focus on understanding concepts, the other on mastering skills and preparing for the classroom exam. Answers for all chapter exercises are in the back of the book.

Chapter Concept Review exercises require students to judge whether a statement is true or false and, if false, to rewrite the sentence to make it true. Students evaluate their understanding of concepts and also gain experience using the vocabulary of mathematics.

Chapter Test exercises follow the Concept Review. Written to imitate a 50-minute exam, each Chapter Test covers all the chapter content. Students can use the Chapter Test as a self-test before the classroom test. Answers to test items, in the back of the book, reference the relevant section objective.

Ancillaries

Three major media — print, electronic, and video — are utilized in the Barker/Rogers/Van Dyke ancillary package. Coordinated use of the ancillaries greatly increases the effectiveness and flexibility of the text, both for the instructor and the student.

Instructor's Manual Instructor-appropriate solutions are provided for every other odd-numbered exercise and all even-numbered exercises in the section exercise sets. Solutions for all other exercises are provided in the *Student Solutions Manual* (see next page). The *Instructor's Manual* also contains essays on teaching problem solving, teaching estimation, incorporating writing into the curriculum, using group activities, and integrating technology.

The *Instructor's Manual* concludes with a description of the Barker/Rogers/Van Dyke Problem Posing Project, designed by Phyllis Leonard of Chemeketa Community College. The purpose of the project is to encourage students to identify situations, particularly from their own lives, that involve mathematical concepts, and to work in groups to pose, and solve, problems. As part of the project, Saunders College Publishing sponsored a contest among students in the fall of 1993. Students who submitted the best problems were awarded money to defray the costs of textbooks. Winning problems are printed in the *Instructor's Manual*.

Prepared Tests In ready-to-duplicate form, six tests for each chapter and six final exams are provided. Half the tests are free-response; half are multiple-choice. One third of the tests are easier (the ratio of easier, average, and harder items is 40/50/10); one third of the tests are average (the ratio is 25/50/25), and one third of the tests are harder (the ratio is 10/50/40). Each test includes skill, concept, and application test items in a 70/15/15 ratio. Answer keys are provided, and each answer references a section objective.

ExaMaster+™ A flexible, powerful testing system, *ExaMaster+™* offers teachers a wide range of integrated testing options and features:

Using **ExaMaster+™ Computer Testbank**, in either IBM or Macintosh format, teachers can select, edit, or create not only test items but algorithms for test items as well. Using algorithms, teachers can generate virtually an unlimited number of test items. For each chapter, 200 test items are provided, each of which can be selected with or without multiple-choice distractors. Teachers can select test items according to a variety of other criteria, including section, objective, focus (skill, concept, or application), and difficulty (easier, medium, or harder). Teachers can scramble the order of test items, administer tests on-line,

and print objective-referenced answer keys. Teachers can use *ExaMaster+*[™] to create extra practice worksheets as well. *ExaMaster+*[™] also includes full-function gradebook and graphing features.

In printed form, **ExaMaster+**[™] **Printed Testbank** arranges *ExaMaster+*[™] data-bank test items by chapter, section, objective, focus, and difficulty. Answers are displayed with each test item.

Using **ExaMaster+**[™] **RequesTest**[™], teachers can select *ExaMaster+*[™] test items, or specify criteria for test items, then call the Saunders Software Support Department (1-800-447-9457) who will generate, print, and mail or fax the *ExaMaster+*[™] test within 48 hours.

Student's Solutions Manual Detailed, annotated, step-by-step solutions are provided for every other odd-numbered exercise in the section exercise sets and for every exercise in the Concept Reviews and Tests.

Videotapes An outstanding section-by-section video review features on-location segments to illustrate applications. Each tape covers one chapter, with roughly 15 minutes per section. Experienced video teacher Loretta Palmer from Utah Valley State College reviews examples from the book and explains key concepts, weaving into the presentation real-life footage, movie clips, and interviews with diverse, real-world users of mathematics. Study skills and math anxiety are covered as well.

MathCue[™] **Interactive Software** Available in IBM and Macintosh formats, *MathCue*[™] *Interactive Software* for students affords opportunities for learning, reviewing, and practicing skills, discovering and exploring concepts, and pinpointing and correcting weak areas of understanding. *MathCue*[™] is designed by George W. Bergeman of Northern Virginia Community College and comprises a variety of interactive tools:

Tailored to every section of the book, **MathCue**[™] **Tutorial** presents students with problems to solve and tutors students by displaying annotated, step-by-step solutions. Students may view partial solutions to get started on a problem, see a continuous record of progress, and back up to review missed problems. Student scores can also be printed.

Based on an expert system, **MathCue**[™] **Solution Finder** lets students pose their own problems and get annotated, step-by-step solutions in return. *Solution Finder* tracks student progress, refers students to specific sections in the book when appropriate, and prints student scores.

An algorithm-based software, **MathCue**[™] **Practice** allows students to generate large numbers of practice problems keyed to problem types from each section of the book. *Practice* scores students' performance, and saves students' scores session to session.

Changes in the Sixth Edition

Instructors who have used previous editions of *Fundamentals of Mathematics* will see changes in format, pedagogy, exercises, and the sectioning of content. The primary focus of revision has been to improve the pedagogy, broaden the variety of applications, shorten the book without compromising important content, and give renewed emphasis to the teaching and learning methods espoused by the National Council of Teachers of Mathematics.

Changes in Content The text has been reduced from 71 to 62 sections by combining sections 3.1–2, 3.4–5, 3.7–8, 3.9–10, 4.1–2, 4.3–4, 6.8–9, and 7.1–2, and by deleting section 7.9 on reasoning. For instructors who want to include reasoning in their course, this material is available through custom publishing. The text has been further reduced by

deleting Appendix V covering plain geometry, which also is still available through custom publishing.

Chapter 2 Primes and Multiples now begins with Divisibility Tests rather than with Multiples. Chapter 3 Fractions and Mixed Numbers now includes calculator examples, where appropriate. Section 5.1 Ratio and Rate now distinguishes more clearly between ratio and rate. Section 6.7 Solving Percent Problems now includes three methods, rather than two, for solving percent problems.

New to the sixth edition are the chapter-opening essays Good Advice for Studying (see “Special Content,” previously).

Changes in Exercises, Reviews, and Tests A greater distinction is made in the level of difficulty for Categories A, B, and C exercises. Category D exercises are now more meaningfully labeled as Application exercises, and their variety, realism, and relevance have been improved. New categories of section exercises are now included: State Your Understanding, Challenge, and Group Activity (see “Exercises, Reviews, Tests”). Chapter Pre-Tests have been eliminated, and chapter Tests now more closely resemble a 50-minute test. Test questions no longer reference section objectives; instead these references are given with the answers in the back of the book.

Changes in Format and Pedagogy In the fifth edition, a section contained one How and Why, followed by one set of Model Problem Solving examples. In the sixth edition, a section may contain more than one How and Why, each one numbered to correspond to a numbered objective, and each followed by its own set of examples and warm ups. The main reason for these changes is to more closely connect objectives, exposition, and examples.

In the fifth edition, examples and warm ups were paired vertically. In the sixth edition, examples and warm ups are paired horizontally: examples in one column, warm ups in another. The main reason for this change is to use space more efficiently, and to keep the flow of examples going.

In the fifth edition, each example had a separate direction, even when the preceding example had the same direction. In the sixth edition, several examples may share a common, general direction, much the same way section exercises may share a common, general direction. Furthermore, examples sharing a common direction also share a common strategy for solution. The main reason for these changes is to help students recognize the similarity of problems and their solutions, despite their specific differences. In this way, students may improve their problem-solving skills.

In the fifth edition, highlighted material was labeled as Rule, Property, Procedure, Formula, and Caution, but was otherwise untitled. In the sixth, only the Caution label remains. For all other highlighted material, the label has been replaced by a title reflecting content. The main reasons for these changes are to highlight material more meaningfully, and to eliminate the sometimes arbitrary distinction between property, rule, and so on.

Step-by-step skills, for example, are consistently titled as To Add Fractions, To Multiply Whole Numbers, and so on, often repeating the objective statement. Further, steps are consistently repeated in the strategy for the related examples. In this way, strong connections are made between objectives, skills, and solving common problems.

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