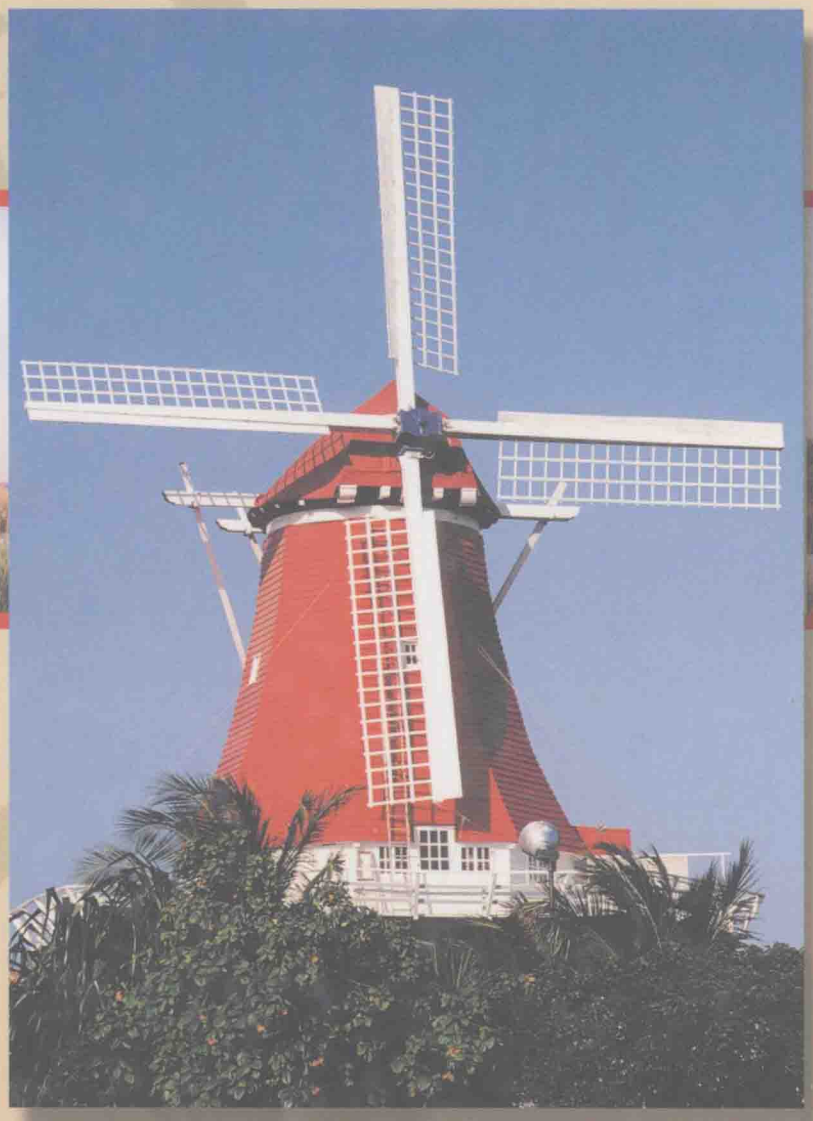
Basic College Mathematics

Sixth Edition



Lial • Salzman • Hestwood

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Sixth Edition

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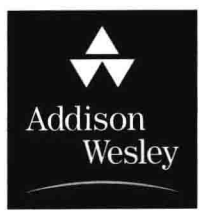

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Preface

The sixth edition of *Basic College Mathematics* continues our ongoing commitment to provide the best possible text and supplements package that will help instructors teach and students succeed. To that end, we have addressed the diverse needs of today's students through an attractive design, updated applications and graphs, helpful features, careful explanation of concepts, and an expanded package of supplements and study aids. We have also responded to the suggestions of users and reviewers and have added many new examples and exercises based on their feedback.

The text is designed to help students achieve success in a developmental mathematics program. It provides the necessary review and coverage of whole numbers, fractions, decimals, ratio and proportion, percent, and measurement, as well as an introduction to algebra and geometry, and a preview of statistics. This text is part of a series that also includes the following books:

- *Essential Mathematics* by Lial and Salzman
- *Prealgebra,* Second Edition, by Lial and Hestwood
- *Introductory Algebra,* Seventh Edition, by Lial, Hornsby, and McGinnis
- *Intermediate Algebra with Early Functions and Graphing,* Seventh Edition, by Lial, Hornsby, and McGinnis
- *Introductory and Intermediate Algebra,* Second Edition, by Lial, Hornsby, and McGinnis.

What's New in This Edition?

We believe students and instructors will welcome the following new features.

New Real-Life Applications We are always on the lookout for interesting data to use in real-life applications. As a result, we have included many new or updated examples and exercises throughout the text that focus on real-life applications of mathematics. Students are often asked to find data in a table, chart, graph, or advertisement. (See pp. 79, 143, and 269.) These applied problems provide an up-to-date flavor that will appeal to and motivate students. A comprehensive List of Applications appears at the beginning of the text.

New Figures and Photos Today's students are more visually oriented than ever. Thus, we have made a concerted effort to add mathematical figures, diagrams, tables, and graphs whenever possible. (See pp. 82, 208, and 319.) Many of the graphs use a style similar to that seen by students in today's print and electronic media. Photos have been incorporated to enhance applications in examples and exercises. (See pp. 104, 287, and 302.)

Increased Emphasis on Problem Solving Introduced at the end of Chapter 1, our six-step process for solving application problems has been refined and integrated throughout the text. The six steps, *Read*, *Plan*, *Estimate*, *Solve*, *State the Answer*, and *Check*, are emphasized in boldface type and repeated in specific problem-solving examples in Chapters 2, 3, 5, 6, 7, and 9. (See pp. 85, 145, and 167.)

Study Skills Component Poor study skills are a major reason why students do not succeed in math. A few generic tips sprinkled here and there are not enough to help students change their behavior. So, in this text, a desk-light icon at key points in the text directs students to a separate *Study Skills Workbook* containing carefully designed activities that correlate directly to the text. (See p. 241.) This unique workbook explains *how* the brain actually learns and remembers so students understand *why* the study skills activities will help them succeed in the course. Students are introduced to the workbook in a new To the Student section at the beginning of the text.

Focus on Real-Data Applications Each one-page activity presents a relevant and in-depth look at how mathematics is used in the real world. Designed to help instructors answer the often-asked question, "When will I ever use this stuff?," these activities ask students to read and interpret data from newspaper articles, the Internet, and other familiar, real-world sources. (See pp. 62, 168, and 354.) The activities are well-suited to collaborative work or they can be completed by individuals or used for open-ended class discussions. Instructor teaching notes and activity extensions are provided in the *Printed Test Bank and Instructor's Resource Guide*.

Diagnostic Pretest A diagnostic pretest is now included on p. xxiii of the text and covers all the material in the book, much like a sample final exam. This pretest can be used to facilitate student placement in the correct chapter according to skill level. The pretest also exposes students to the scope of the course content.

Chapter Openers New chapter openers feature real-world applications of mathematics that are relevant to students and tied to specific material within the chapters. Examples of topics include finding the best buy on cell phone service, home improvements, recipes, medical tests, fishing, and work/career applications. (See pp. 107, 185, and 311—Chapters 2, 3, and 5.)

Calculator Tips These optional tips, marked with a calculator icon, offer basic information and instruction for students using calculators in the course. (See pp. 252, 268, and 323.) In addition, an Introduction to Calculators is included as an appendix.

Test Your Word Power This new feature, incorporated into each chapter summary, helps students understand and master mathematical vocabulary. Key terms from the chapter are presented along with four possible definitions in a multiple-choice format. Answers and examples illustrating each term are provided. (See pp. 94, 231, and 349.)

What Familiar Features Have Been Retained?

We have retained the popular features of previous editions of the text, including the following:

Learning Objectives Each section begins with clearly stated, numbered objectives, and the material within sections is keyed to these objectives so that students know exactly what concepts are covered. (See pp. 129, 163, and 321.)

Cautions and Notes These color-coded and boxed comments, one of the most popular features of previous editions, warn students about common errors and emphasize important ideas throughout the exposition. (See pp. 66, 153, and 155.) There are more of these in the sixth edition than in the fifth, and the new text design makes them easier to spot; Cautions are highlighted in bright yellow and Notes are highlighted in green.

Margin Problems Margin problems, with answers immediately available on the bottom of the page, are found in every section of the text. (See pp. 79, 186, and 321.) This key feature allows students to immediately practice the material covered in the examples

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in preparation for the exercise sets. Based on reviewer feedback, we have added more margin exercises to the sixth edition.

Ample and Varied Exercise Sets The text contains a wealth of exercises to provide students with opportunities to practice, apply, connect, and extend the skills they are learning. Numerous illustrations, tables, graphs, and photos have been added to the exercise sets to help students visualize the problems they are solving. Problem types include skill building, writing, estimation, and calculator exercises as well as applications and correct-the-error problems. In the *Annotated Instructor's Edition* of the text, the writing and estimation exercises are marked with icons for writing and for estimation ≈ so that instructors may assign these problems at their discretion. Exercises suitable for calculator work are marked in both the student and instructor editions with a calculator icon . (See pp. 26, 70, and 253–256.)

Relating Concepts Exercises These sets of exercises help students tie concepts together and develop higher level problem-solving skills as they compare and contrast ideas, identify and describe patterns, and extend concepts to new situations. (See pp. 72, 162, and 256.) These exercises make great collaborative activities for pairs or small groups of students.

Summary Exercises There are four sets of in-chapter summary exercises: fractions, percent, geometry concepts, and operations with signed numbers. These exercises provide students with the all-important *mixed* practice they need at these critical points in their skill development. (See pp. 229, 435, 569, and 651.)

Ample Opportunity for Review Each chapter ends with a Chapter Summary featuring: Key Terms with definitions and helpful graphics, New Formulas, Test Your Word Power, and a Quick Review of each section's content with additional examples. Also included is a comprehensive set of Chapter Review Exercises keyed to individual sections, a set of Mixed Review Exercises, and a Chapter Test. Beginning with Chapter 2, each chapter concludes with a set of Cumulative Review Exercises. (See pp. 231–246, 297–310, and 445–464.)

What Content Changes Have Been Made?

We have worked hard to fine-tune and polish presentations of topics throughout the text based on user and reviewer feedback. Some of the content changes include the following:

- In Chapter 1, Whole Numbers, reading and understanding tables is now introduced in the first section, and a new section (1.9, Reading Pictographs, Bar Graphs, and Line Graphs) contributes additional application skills early in the course.
- In Chapter 4, Decimals, the sections on adding and subtracting decimals have been combined to provide more interesting options for application exercises.
- In Chapter 6, Percent, shortcuts for finding 200%, 300%, 10%, and 1% have been added to the shortcuts for finding 100% and 50%. The topics of percent proportion and identifying the parts in a percent problem are now treated in one section (6.3) rather than two sections so that students have an easier time relating these concepts.
- In Chapter 7, Measurement, Section 7.1 on English measurement now focuses on solving application problems as well as converting among units.

What Supplements Are Available?

Our extensive supplements package includes an *Annotated Instructor's Edition,* testing materials, solutions manuals, tutorial software, videotapes, and a state-of-the-art Web site. For more information about any of the following supplement descriptions, please contact your Addison-Wesley sales consultant.

For the Student

***Student's Solutions Manual* (ISBN 0-321-09061-6)** The *Student's Solutions Manual* provides detailed solutions to the odd-numbered section exercises and to all margin, Relating Concepts, Summary, Chapter Review, Chapter Test, and Cumulative Review exercises.

***Study Skills Workbook* (ISBN 0-321-09185-X)** A desk-light icon at key points in the text directs students to correlated activities in this unique workbook by Diana Hestwood and Linda Russell. The activities in the workbook teach students how to use the textbook effectively, plan their homework, take notes, make mind maps and study cards, manage study time, review a chapter, prepare for and take tests, evaluate test results, and prepare for a final exam. Students find out *how* their brains actually learn and remember, and what research tells us about ways to study effectively. A new To the Student section at the beginning of the text introduces students to the *Study Skills Workbook*.

Addison-Wesley Math Tutor Center The Addison-Wesley Math Tutor Center is staffed by qualified college mathematics instructors who tutor students on examples and exercises from their textbook. Tutoring is provided via toll-free telephone, toll-free fax, e-mail, and the Internet. White Board technology allows tutors and students to actually see problems being worked while they "talk" in real time over the Internet during tutoring sessions. The Math Tutor Center is accessed through a registration number that may be bundled free with a new textbook or purchased separately.

***Web Site:* www.MyMathLab.com** Ideal for lecture-based, lab-based, and on-line courses, MyMathLab.com provides students with a centralized point of access to the wide variety of on-line resources available with this text. The pages of the actual book are loaded into MyMathLab.com, and as students work through a section of the on-line text, they can link directly from the pages to supplementary resources (such as tutorial software, interactive animations, and audio and video clips) that provide instruction, exploration, and practice beyond what is offered in the printed book. MyMathLab.com generates personalized study plans for students and allows instructors to track all student work on tutorials, quizzes, and tests.

***InterAct Math® Tutorial Software* (ISBN 0-321-09056-X)** This interactive tutorial software provides algorithmically generated practice exercises that are correlated at the objective level to the content of the text. Every exercise in the program is accompanied by an example and a guided solution designed to involve students in the solution process. For Windows users, selected problems also include a video clip to help students visualize concepts. The software tracks student activity and scores and can generate printed summaries of students' progress. Instructors can use the InterAct Math® Plus course-management software to create, administer, and track tests and monitor student performance during practice sessions. (See For the Instructor.)

***InterAct MathXL:* www.mathxl.com** InterAct MathXL is a Web-based tutorial system that enables students to take practice tests and receive personalized study plans based on their results. Practice tests are correlated directly to the section objectives in the text, and once a student has taken a practice test, the software scores the test and generates a study plan that identifies strengths, pinpoints topics where more review is needed, and links directly to InterAct Math® tutorial software for additional practice and review. A course-management feature allows instructors to create and administer tests and view students' test results, study plans, and practice work. Students gain access to the InterAct MathXL Web site through a password-protected subscription, which can either be bundled free with a new copy of the text or purchased separately with a used book.

***Real-to-Reel Videotape Series* (ISBN 0-321-09088-8)** This series of videotapes, created specifically for *Basic College Mathematics*, Sixth Edition, features an engaging team of math instructors who provide comprehensive lectures on every objective in the text. The videos include a stop-the-tape feature that encourages students to pause the video, work the presented example on their own, and then resume play to watch the video instructor go over the solution.

Digital Video Tutor **(ISBN 0-321-09089-6)** This supplement provides the entire set of Real-to-Reel videotapes for the text in digital format on CD-ROM, making it easy and convenient for students to watch video segments from a computer, either at home or on campus. Available for purchase with the text at minimal cost, the Digital Video Tutor is ideal for distance learning and supplemental instruction.

FOR THE INSTRUCTOR

Annotated Instructor's Edition **(ISBN 0-321-06241-8)** The *Annotated Instructor's Edition* provides immediate access to the answers for all text exercises by printing them in color next to the corresponding problems. To assist instructors in assigning homework problems, icons identify writing, estimation $\approx$, and calculator exercises.

Instructor's Solutions Manual **(ISBN 0-321-09060-8)** The *Instructor's Solutions Manual* provides complete solutions to all even-numbered section exercises.

Answer Book **(ISBN 0-321-09058-6)** The *Answer Book* provides answers to all the exercises in the text.

Printed Test Bank and Instructor's Resource Guide **(ISBN 0-321-09059-4)** The *Printed Test Bank* portion of this manual contains two diagnostic pretests, six free-response and two multiple-choice test forms per chapter, and two final exams. The *Instructor's Resource Guide* portion of the manual contains teaching suggestions for each chapter, additional practice exercises for every objective of every section, a correlation guide from the fifth to the sixth edition, phonetic spellings for all key terms in the text, and teaching notes and extensions for the Focus on Real-Data Applications pages in the text.

TestGen-EQ with QuizMaster EQ **(ISBN 0-321-09057-8)** This fully networkable software enables instructors to create, edit, and administer tests using a computerized test bank of questions organized according to the chapter content of the text. Six question formats are available, and a built-in question editor allows the user to create graphs, import graphics, and insert mathematical symbols and templates, variable numbers, or text. An "Export to HTML" feature allows practice tests to be posted to the Internet, and instructors can use QuizMaster-EQ to post quizzes to a local computer network so that students can take them on-line and have their results tracked automatically.

InterAct Math® Plus **(ISBN 0-201-72140-6)** This networkable software provides course-management capabilities and network-based test administration for Addison-Wesley's InterAct Math® tutorial software. (See For the Student.) InterAct Math® Plus enables instructors to create and administer tests, summarize students' results, and monitor students' progress in the tutorial software, providing an invaluable teaching and tracking resource.

MathPass MathPass helps students succeed in their developmental mathematics courses by creating customized study plans based on diagnostic test results from ACT, Inc.'s Computer-Adaptive Placement Assessment and Support System (COMPASS®). MathPass pinpoints topics where the student needs in-depth study or targeted review and correlates these topics with the student's textbook and related supplements. The study plan can be saved as an HTML file that, when viewed on the Internet, links directly to text-specific, on-line resources. Instructors can add their own custom Web links to the HTML study plan. The MathPass learning system provides diagnostic assessment, focused instruction, and exit placement all in one package.

Web Site: **www.MyMathLab.com** In addition to providing a wealth of resources for lecture-based courses, MyMathLab.com gives instructors a quick and easy way to create a complete on-line course based on *Basic College Mathematics*, Sixth Edition. MyMathLab.com is hosted nationally at no cost to instructors, students, or schools, and it provides access to an interactive learning environment where all content is keyed directly to the text. Using a customized version of Blackboard™ as the course-management platform, MyMathLab.com lets instructors administer preexisting tests and quizzes or create their own, and it provides detailed tracking of all student work as well as a wide array of communication

tools for course participants. Within MyMathLab.com, students link directly from on-line pages of their text to supplementary resources such as tutorial software, interactive animations, and audio and video clips.

ACKNOWLEDGMENTS

The comments, criticisms, and suggestions of users, nonusers, instructors, and students have positively shaped this textbook over the years, and we are most grateful for the many responses we have received. The feedback gathered for this revision of the text was particularly helpful, and we especially wish to thank the following individuals who provided invaluable suggestions:

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Donna Foster, *Piedmont Technical College*
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Rose Kaniper, *Burlington County College*
Douglas Lewis, *Yakima Valley Community College*
Wayne Miller, *Lee College*
Thea Philliou, *College of Santa Fe*
Richard D. Rupp, *Del Mar College*
Ellen Sawyer, *College of DuPage*
Lois Schuppig, *College of Mount St. Joseph*
Mary Lee Seitz, *Erie Community College—City Campus*
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Sven Trenholm, *North Country Community College*
Bettie A. Truitt, *Black Hawk College*
Jackie Wing, *Angelina College*

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The ultimate measure of this textbook's success is whether it helps students master basic skills, develop problem-solving techniques, and increase their confidence in learning and using mathematics. In order for us, as authors, to know what to keep and what to improve for the next edition, we need to hear from you, the instructor, and you, the student. Please tell us what you like and where you need additional help by sending an e-mail to math@awl.com. We appreciate your feedback.

In appreciation of your lasting support and never-ending enthusiasm: family, colleagues, and more than a generation of motivated students.

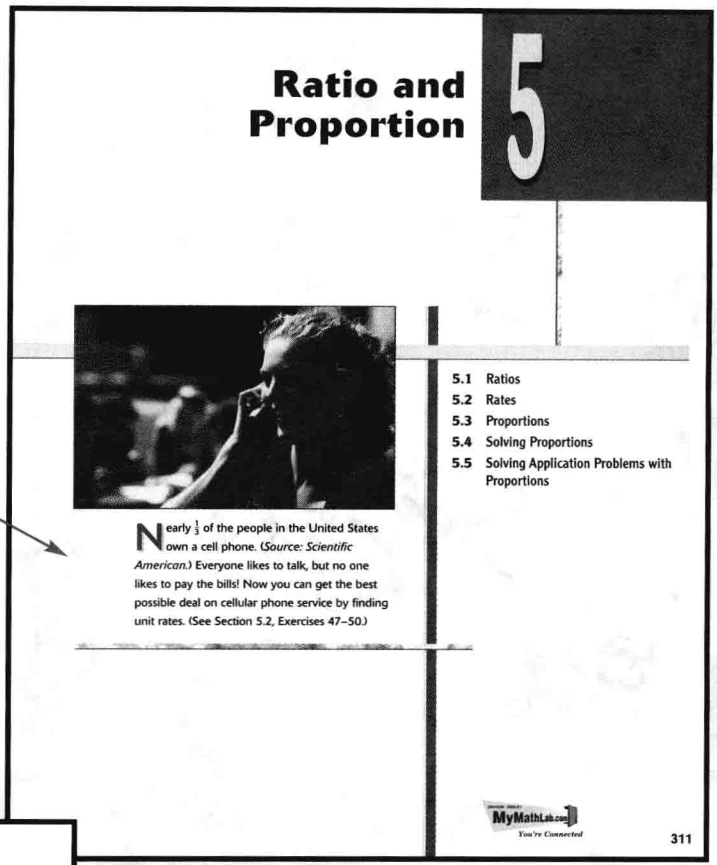
Stan Salzman

This book is dedicated to my dad, who always told me when I was young that girls could learn math, and to my students at Minneapolis Community and Technical College, who keep me in touch with the real world.

Diana L. Hestwood

Feature Walk-Through

New! Chapter Openers New chapter openers feature real-world applications of mathematics that are relevant to students and tied to specific material within the chapters.



5

Ratio and Proportion

5.1 Ratios
5.2 Rates
5.3 Proportions
5.4 Solving Proportions
5.5 Solving Application Problems with Proportions

Nearly $\frac{1}{3}$ of the people in the United States own a cell phone. (*Source: Scientific American.*) Everyone likes to talk, but no one likes to pay the bills! Now you can get the best possible deal on cellular phone service by finding unit rates. (See Section 5.2, Exercises 47–50.)

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311

❷ Use the bar graph to find the approximate number of fans who picked each sport as their favorite.

(a) Pro football

(b) Pro baseball

(c) Pro basketball

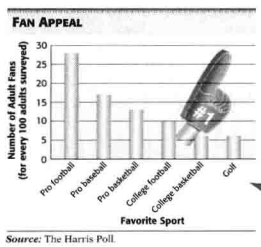
(d) College basketball

(e) Golf

❸ Use the line graph to find the predicted population of the United States for each year.

(a) 2050

(b) 2075



Source: The Harris Poll.

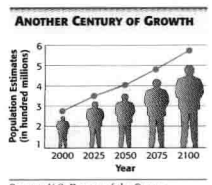
Example 2 Using a Bar Graph

Use the bar graph to find the number of fans who picked college football as their favorite sport.

Use a ruler or straight edge to line up the top of the bar labeled "College Football," with the numbers on the left edge of the graph, labeled "Number of Adults Fans." We see that 10 out of 100 adult fans picked college football as their favorite sport.

Work Problem ❷ at the Side.

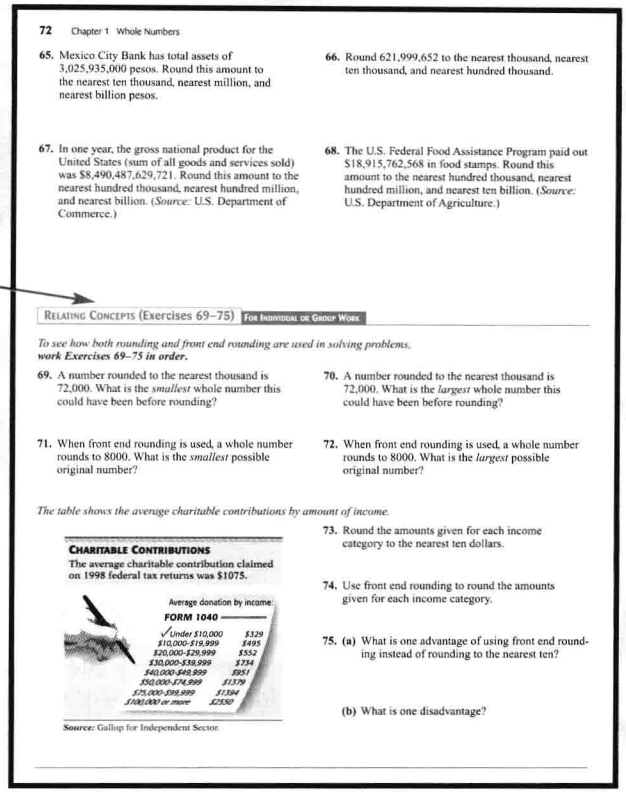
3 **Read and understand a line graph.** A **line graph** is often used for showing a trend. The following line graph shows the U.S. Bureau of the Census predictions for U.S. population growth to the year 2100.



Source: U.S. Bureau of the Census.

Figures and Photos Today's students are more visually oriented than ever. Thus, a concerted effort has been made to add mathematical figures, diagrams, tables, and graphs whenever possible. Many of the graphs use a style similar to that seen by students in today's print and electronic media. Photos have been incorporated to enhance applications in examples and exercises.

New! Relating Concepts These sets of exercises help students tie together topics and develop problem-solving skills as they compare and contrast ideas, identify and describe patterns, and extend concepts to new situations. These exercises make great collaborative activities for pairs or small groups of students.



72 Chapter 1 Whole Numbers

65. Mexico City Bank has total assets of 3,025,935,000 pesos. Round this amount to the nearest ten thousand, nearest million, and nearest billion pesos.

66. Round 621,999,652 to the nearest thousand, nearest ten thousand, and nearest hundred thousand.

67. In one year, the gross national product for the United States (sum of all goods and services sold) was $8,490,487,629,721. Round this amount to the nearest hundred thousand, nearest hundred million, and nearest billion. (*Source:* U.S. Department of Commerce.)

68. The U.S. Federal Food Assistance Program paid out $18,915,762,568 in food stamps. Round this amount to the nearest hundred thousand, nearest hundred million, and nearest ten billion. (*Source:* U.S. Department of Agriculture.)

RELATING CONCEPTS (Exercises 69–75) FOR INDIVIDUAL OR GROUP WORK

*To see how both rounding and front end rounding are used in solving problems, **work Exercises 69–75 in order.***

69. A number rounded to the nearest thousand is 72,000. What is the *smallest* whole number this could have been before rounding?

70. A number rounded to the nearest thousand is 72,000. What is the *largest* whole number this could have been before rounding?

71. When front end rounding is used, a whole number rounds to 8000. What is the *smallest* possible original number?

72. When front end rounding is used, a whole number rounds to 8000. What is the *largest* possible original number?

The table shows the average charitable contributions by amount of income.

CHARITABLE CONTRIBUTIONS
The average charitable contribution claimed on 1998 federal tax returns was $1075.

Average donation by income:
FORM 1040

✓Under $10,000	$329
$10,000-$19,999	$495
$20,000-$29,999	$552
$30,000-$39,999	$734
$40,000-$49,999	$951
$50,000-$74,999	$1179
$75,000-$99,999	$1594
$100,000 or more	$2530

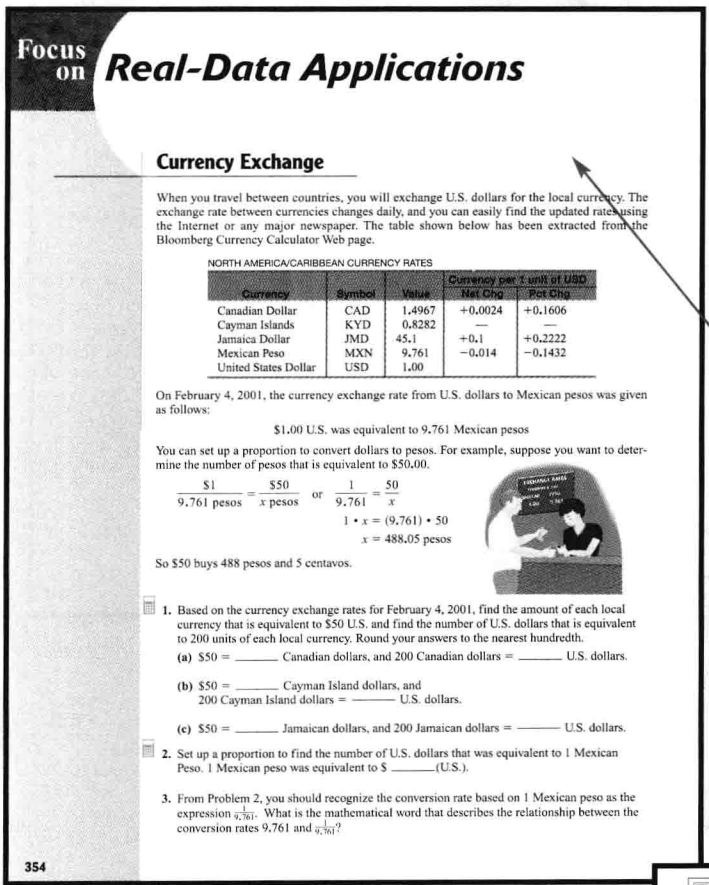
Source: Gallup for Independent Sector.

73. Round the amounts given for each income category to the nearest ten dollars.

74. Use front end rounding to round the amounts given for each income category.

75. (a) What is one advantage of using front end rounding instead of rounding to the nearest ten?

(b) What is one disadvantage?



Focus on **Real-Data Applications**

Currency Exchange

When you travel between countries, you will exchange U.S. dollars for the local currency. The exchange rate between currencies changes daily, and you can easily find the updated rates using the Internet or any major newspaper. The table shown below has been extracted from the Bloomberg Currency Calculator Web page.

NORTH AMERICA/CARIBBEAN CURRENCY RATES

Currency	Symbol	Value	Currency per 1 unit of USD: Net Chg	Pct Chg
Canadian Dollar	CAD	1.4967	+0.0024	+0.1606
Cayman Islands	KYD	0.8282	—	—
Jamaica Dollar	JMD	45.1	+0.1	+0.2222
Mexican Peso	MXN	9.761	−0.014	−0.1432
United States Dollar	USD	1.00		

On February 4, 2001, the currency exchange rate from U.S. dollars to Mexican pesos was given as follows:

$1.00 U.S. was equivalent to 9.761 Mexican pesos

You can set up a proportion to convert dollars to pesos. For example, suppose you want to determine the number of pesos that is equivalent to $50.00.

$$\frac{\$1}{9.761 \text{ pesos}} = \frac{\$50}{x \text{ pesos}} \quad \text{or} \quad \frac{1}{9.761} = \frac{50}{x}$$

$$1 \cdot x = (9.761) \cdot 50$$

$$x = 488.05 \text{ pesos}$$

So $50 buys 488 pesos and 5 centavos.

1. Based on the currency exchange rates for February 4, 2001, find the amount of each local currency that is equivalent to $50 U.S. and find the number of U.S. dollars that is equivalent to 200 units of each local currency. Round your answers to the nearest hundredth.
   (a) $50 = _____ Canadian dollars, and 200 Canadian dollars = _____ U.S. dollars.
   (b) $50 = _____ Cayman Island dollars, and 200 Cayman Island dollars = _____ U.S. dollars.
   (c) $50 = _____ Jamaican dollars, and 200 Jamaican dollars = _____ U.S. dollars.
2. Set up a proportion to find the number of U.S. dollars that was equivalent to 1 Mexican Peso. 1 Mexican peso was equivalent to $ _____(U.S.).
3. From Problem 2, you should recognize the conversion rate based on 1 Mexican peso as the expression $\frac{1}{9.761}$. What is the mathematical word that describes the relationship between the conversion rates 9.761 and $\frac{1}{9.761}$?

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New! Focus on Real-Data Applications These one-page activities, found throughout the text, present even more relevant and in-depth looks at how mathematics is used in the real world. Designed to help instructors answer the often-asked question, "When will I ever use this stuff?," these activities ask students to read and interpret data from newspaper articles, the Internet, and other familiar, real sources. The activities are well suited to collaborative work and can also be completed by individuals or used for open-ended class discussions.

Calculator Tips These optional tips, marked with calculator icons, offer basic information and instruction for students using calculators in the course.

Calculator Tip When using a calculator to find unit prices, remember that division is *not* commutative. In Example 3 you wanted to find cost per ounce. Let the *order* of the *words* help you enter the numbers in the correct order.

cost	per	ounce
↓	↓	↓
Enter the cost	Per means divide	Enter number of ounces
↓	↓	↓
$2.73	÷	36 = 0.076 (rounded)

If you entered 36 ÷ 2.73 =, you'd get the number of *ounces* per *dollar.* How could you use that information to find the best buy? (*Answer:* The best buy would be to get the greatest number of ounces per dollar.)

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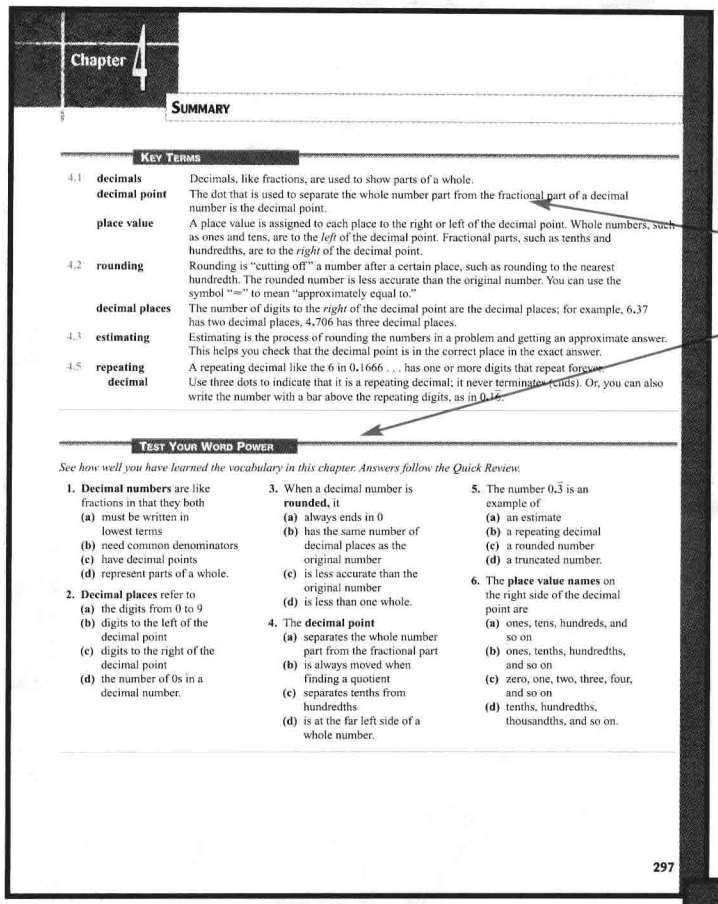

Chapter 4

SUMMARY

KEY TERMS

4.1	**decimals**	Decimals, like fractions, are used to show parts of a whole.
	decimal point	The dot that is used to separate the whole number part from the fractional part of a decimal number is the decimal point.
	place value	A place value is assigned to each place to the right or left of the decimal point. Whole numbers, such as ones and tens, are to the *left* of the decimal point. Fractional parts, such as tenths and hundredths, are to the *right* of the decimal point.
4.2	**rounding**	Rounding is "cutting off" a number after a certain place, such as rounding to the nearest hundredth. The rounded number is less accurate than the original number. You can use the symbol "≈" to mean "approximately equal to."
	decimal places	The number of digits to the *right* of the decimal point are the decimal places; for example, 6.37 has two decimal places, 4.706 has three decimal places.
4.3	**estimating**	Estimating is the process of rounding the numbers in a problem and getting an approximate answer. This helps you check that the decimal point is in the correct place in the exact answer.
4.5	**repeating decimal**	A repeating decimal like the 6 in 0.1666 . . . has one or more digits that repeat forever. Use three dots to indicate that it is a repeating decimal; it never terminates (ends). Or, you can also write the number with a bar above the repeating digits, as in $0.1\overline{6}$.

TEST YOUR WORD POWER

See how well you have learned the vocabulary in this chapter. Answers follow the Quick Review.

1. **Decimal numbers** are like fractions in that they both
   (a) must be written in lowest terms
   (b) need common denominators
   (c) have decimal points
   (d) represent parts of a whole.
2. **Decimal places** refer to
   (a) the digits from 0 to 9
   (b) digits to the left of the decimal point
   (c) digits to the right of the decimal point
   (d) the number of 0s in a decimal number.
3. When a decimal number is **rounded,** it
   (a) always ends in 0
   (b) has the same number of decimal places as the original number
   (c) is less accurate than the original number
   (d) is less than one whole.
4. The **decimal point**
   (a) separates the whole number part from the fractional part
   (b) is always moved when finding a quotient
   (c) separates tenths from hundredths
   (d) is at the far left side of a whole number.
5. The number $0.\overline{3}$ is an example of
   (a) an estimate
   (b) a repeating decimal
   (c) a rounded number
   (d) a truncated number.
6. The **place value names** on the right side of the decimal point are
   (a) ones, tens, hundreds, and so on
   (b) ones, tenths, hundredths, and so on
   (c) zero, one, two, three, four, and so on
   (d) tenths, hundredths, thousandths, and so on.

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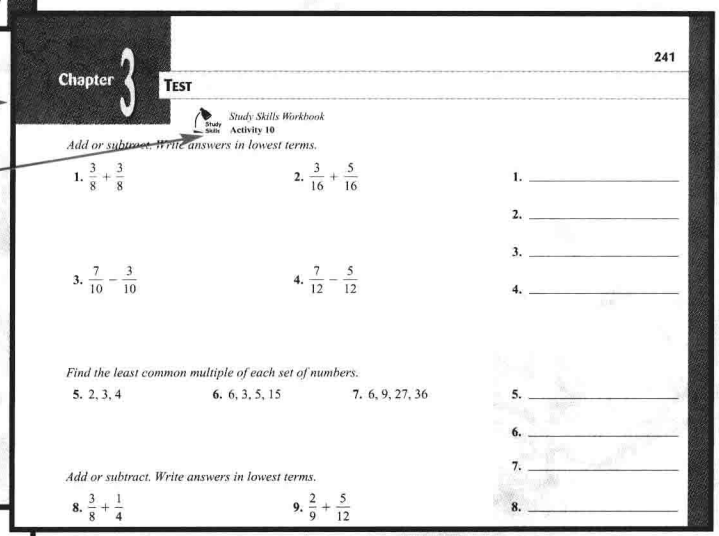
End-of-Chapter Material One of the most admired features of the Lial textbooks is the extensive and well-thought-out end of chapter material. At the end of each chapter, students will find:

Key Terms are listed, defined, and referenced back to the appropriate section number.

New! Test Your Word Power To help students understand and master mathematical vocabulary, Test Your Word Power has been incorporated in each Chapter Summary. Students are quizzed on Key Terms from the chapter in a multiple-choice format. Answers and examples illustrating each term are provided.

A Chapter Test helps students practice for the real thing.

New! Study Skills Component A desklight icon at key points in the text directs students to a separate *Study Skills Workbook* containing activities correlated directly to the text. This unique workbook explains how the brain actually learns, so students understand *why* the study tips presented will help them succeed in the course.



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Chapter 3 TEST

Study Skills Workbook Activity 10

Add or subtract. Write answers in lowest terms.

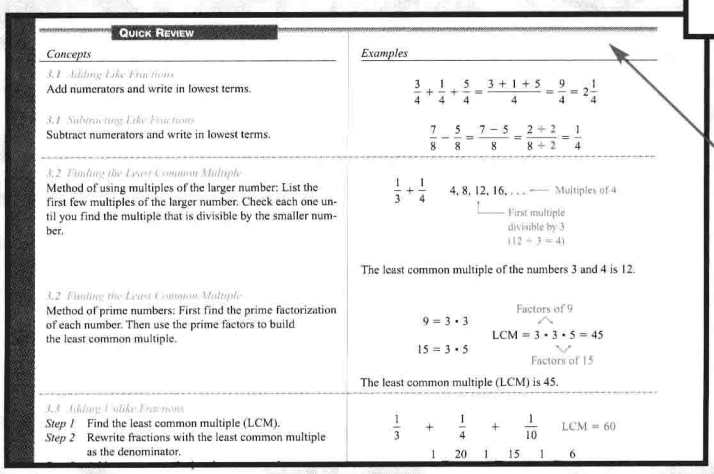
1. $\frac{3}{8} + \frac{3}{8}$
2. $\frac{3}{16} + \frac{5}{16}$
3. $\frac{7}{10} - \frac{3}{10}$
4. $\frac{7}{12} - \frac{5}{12}$

Find the least common multiple of each set of numbers.

5. 2, 3, 4
6. 6, 3, 5, 15
7. 6, 9, 27, 36

Add or subtract. Write answers in lowest terms.

8. $\frac{3}{8} + \frac{1}{4}$
9. $\frac{2}{9} + \frac{5}{12}$

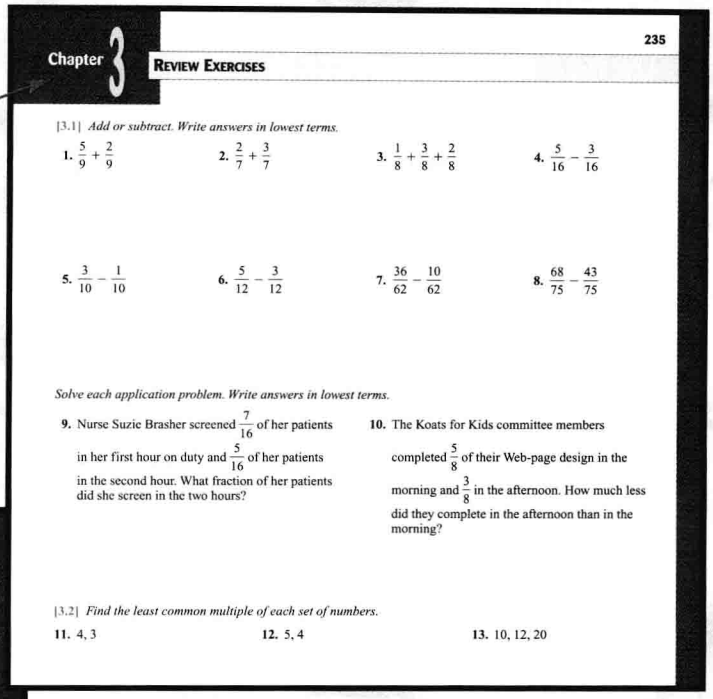


QUICK REVIEW

Concepts	*Examples*
3.1 Adding Like Fractions Add numerators and write in lowest terms.	$\frac{3}{4} + \frac{1}{4} + \frac{5}{4} = \frac{3+1+5}{4} = \frac{9}{4} = 2\frac{1}{4}$
3.1 Subtracting Like Fractions Subtract numerators and write in lowest terms.	$\frac{7}{8} - \frac{5}{8} = \frac{7-5}{8} = \frac{2 \div 2}{8 \div 2} = \frac{1}{4}$
3.2 Finding the Least Common Multiple Method of using multiples of the larger number: List the first few multiples of the larger number. Check each one until you find the multiple that is divisible by the smaller number.	$\frac{1}{3} + \frac{1}{4}$ 4, 8, 12, 16, . . . ← Multiples of 4 ↑ First multiple divisible by 3 ($12 \div 3 = 4$) The least common multiple of the numbers 3 and 4 is 12.
3.2 Finding the Least Common Multiple Method of prime numbers: First find the prime factorization of each number. Then use the prime factors to build the least common multiple.	$9 = 3 \cdot 3$ $15 = 3 \cdot 5$ Factors of 9 LCM = $3 \cdot 3 \cdot 5 = 45$ Factors of 15 The least common multiple (LCM) is 45.
3.3 Adding Unlike Fractions *Step 1* Find the least common multiple (LCM). *Step 2* Rewrite fractions with the least common multiple as the denominator.	$\frac{1}{3} + \frac{1}{4} + \frac{1}{10}$ LCM = 60 1 20 1 15 1 6

Quick Review sections give students not only the main concepts from the chapter (referenced back to the appropriate section), but also an adjacent example of each concept.

Review Exercises are keyed to the appropriate sections so that students can refer to examples of that type of problem if they need help.



Chapter 3 REVIEW EXERCISES 235

[3.1] *Add or subtract. Write answers in lowest terms.*

1. $\frac{5}{9} + \frac{2}{9}$
2. $\frac{2}{7} + \frac{3}{7}$
3. $\frac{1}{8} + \frac{3}{8} + \frac{2}{8}$
4. $\frac{5}{16} - \frac{3}{16}$
5. $\frac{3}{10} - \frac{1}{10}$
6. $\frac{5}{12} - \frac{3}{12}$
7. $\frac{36}{62} - \frac{10}{62}$
8. $\frac{68}{75} - \frac{43}{75}$

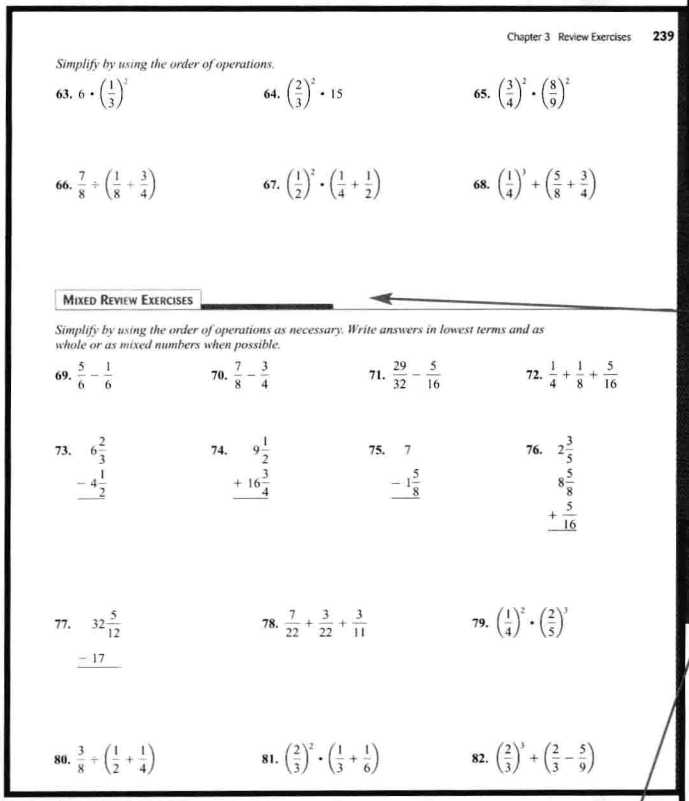
Solve each application problem. Write answers in lowest terms.

9. Nurse Suzie Brasher screened $\frac{7}{16}$ of her patients in her first hour on duty and $\frac{5}{16}$ of her patients in the second hour. What fraction of her patients did she screen in the two hours?

10. The Koats for Kids committee members completed $\frac{5}{8}$ of their Web-page design in the morning and $\frac{3}{8}$ in the afternoon. How much less did they complete in the afternoon than in the morning?

[3.2] *Find the least common multiple of each set of numbers.*

11. 4, 3
12. 5, 4
13. 10, 12, 20



Chapter 3 Review Exercises 239

Simplify by using the order of operations.

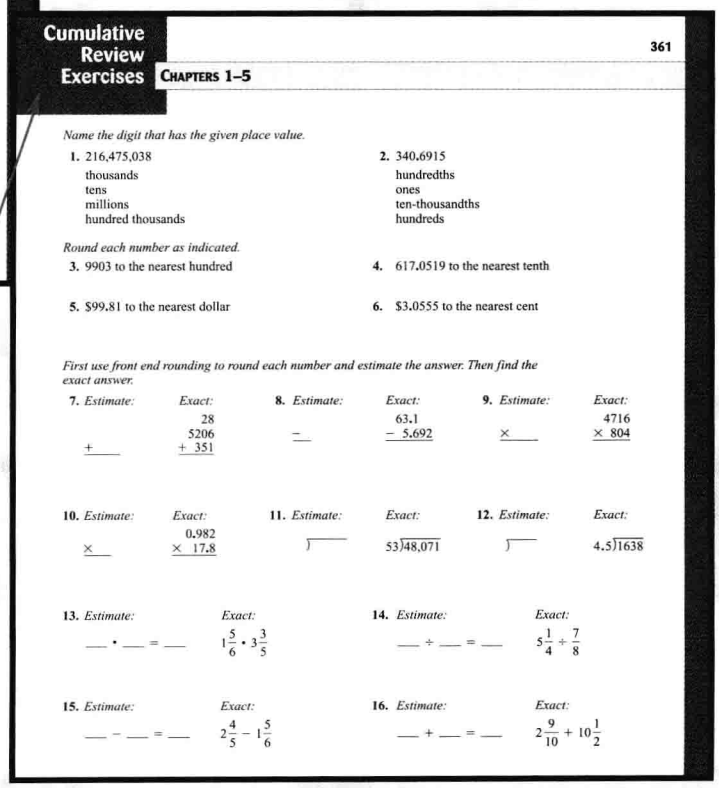
63. $6 \cdot \left(\frac{1}{3}\right)^2$
64. $\left(\frac{2}{3}\right)^2 \cdot 15$
65. $\left(\frac{3}{4}\right)^2 \cdot \left(\frac{8}{9}\right)^2$
66. $\frac{7}{8} \div \left(\frac{1}{8} + \frac{3}{4}\right)$
67. $\left(\frac{1}{2}\right)^2 \cdot \left(\frac{1}{4} + \frac{1}{2}\right)$
68. $\left(\frac{1}{4}\right)^3 + \left(\frac{5}{8} + \frac{3}{4}\right)$

MIXED REVIEW EXERCISES

Simplify by using the order of operations as necessary. Write answers in lowest terms and as whole or as mixed numbers when possible.

69. $\frac{5}{6} - \frac{1}{6}$
70. $\frac{7}{8} - \frac{3}{4}$
71. $\frac{29}{32} - \frac{5}{16}$
72. $\frac{1}{4} + \frac{1}{8} + \frac{5}{16}$
73. $6\frac{2}{3} - 4\frac{1}{2}$
74. $9\frac{1}{2} + 16\frac{3}{4}$
75. $7 - 1\frac{5}{8}$
76. $2\frac{3}{5} + 8\frac{5}{8} + \frac{5}{16}$
77. $32\frac{5}{12} - 17$
78. $\frac{7}{22} + \frac{3}{22} + \frac{3}{11}$
79. $\left(\frac{1}{4}\right)^2 \cdot \left(\frac{2}{5}\right)^3$
80. $\frac{3}{8} \div \left(\frac{1}{2} + \frac{1}{4}\right)$
81. $\left(\frac{2}{3}\right)^2 \cdot \left(\frac{1}{3} + \frac{1}{6}\right)$
82. $\left(\frac{2}{3}\right)^3 + \left(\frac{2}{3} - \frac{5}{9}\right)$

Mixed Review Exercises require students to solve problems without the help of section reference.



Cumulative Review Exercises CHAPTERS 1–5 361

Name the digit that has the given place value.

1. 216,475,038
   thousands
   tens
   millions
   hundred thousands

2. 340.6915
   hundredths
   ones
   ten-thousandths
   hundreds

Round each number as indicated.

3. 9903 to the nearest hundred
4. 617.0519 to the nearest tenth
5. $99.81 to the nearest dollar
6. $3.0555 to the nearest cent

First use front end rounding to round each number and estimate the answer. Then find the exact answer.

7. *Estimate:* ___ + ___ *Exact:* 28 + 5206 + 351
8. *Estimate:* ___ − ___ *Exact:* 63.1 − 5.692
9. *Estimate:* ___ × ___ *Exact:* 4716 × 804
10. *Estimate:* ___ × ___ *Exact:* 0.982 × 17.8
11. *Estimate:* ___) ___ *Exact:* 53)48,071
12. *Estimate:* ___) ___ *Exact:* 4.5)1638
13. *Estimate:* ___ • ___ = ___ *Exact:* $1\frac{5}{6} \cdot 3\frac{3}{5}$
14. *Estimate:* ___ ÷ ___ = ___ *Exact:* $5\frac{1}{4} \div \frac{7}{8}$
15. *Estimate:* ___ − ___ = ___ *Exact:* $2\frac{4}{5} - 1\frac{5}{6}$
16. *Estimate:* ___ + ___ = ___ *Exact:* $2\frac{9}{10} + 10\frac{1}{2}$

Cumulative Review Exercises gather various types of exercises from preceding chapters to help students remember and retain what they are learning throughout the course.

To the Student: Success in Mathematics

There are two main reasons why students have difficulty with mathematics:

- Students start in a course for which they do not have the necessary background knowledge.
- Students don't know how to study mathematics effectively.

Your instructor can help you decide whether this is the right course for you. We can give you some study tips.

Studying mathematics *is* different from studying subjects like English and history. The key to success is regular practice. This should not be surprising. After all, can you learn to play the piano or ski well without a lot of regular practice? The same is true for learning mathematics. Working problems nearly every day is the key to becoming successful. Here is a list of things that will help you succeed in studying mathematics.

1. *Attend class regularly.* Pay attention to what your instructor says and does in class, and take careful notes. In particular, note the problems the instructor works on the board and copy the complete solutions. Keep these notes separate from your homework to avoid confusion when you review them later.
2. Don't hesitate to *ask questions in class.* It is not a sign of weakness but of strength. There are always other students with the same question who are too shy to ask.
3. *Read your text carefully.* Many students read only enough to get by, usually only the examples. Reading the complete section will help you solve the homework problems. Most exercises are keyed to specific examples or objectives that will explain the procedures for working them.
4. Before you start on your homework assignment, *rework the problems the teacher worked in class.* This will reinforce what you have learned. Many students say, "I understand it perfectly when you do it, but I get stuck when I try to work the problem myself."
5. Do your homework assignment only *after reading the text* and reviewing your notes from class. Check your work against the answers in the back of the book. If you get a problem wrong and are unable to understand why, mark that problem and ask your instructor about it. Then practice working additional problems of the same type to reinforce what you have learned.
6. *Work as neatly as you can.* Write your symbols clearly, and make sure the problems are clearly separated from each other. Working neatly will help you to think clearly and also make it easier to review the homework before a test.
7. After you complete a homework assignment, *look over the text again.* Try to identify the main ideas that are in the lesson. Often they are clearly highlighted or boxed in the text.
8. *Use the chapter test at the end of each chapter as a practice test.* Work through the problems under test conditions, without referring to the text or the answers until you are finished. You may want to time yourself to see how long it takes you. When you finish, check your answers against those in the back of the book, and study the problems you missed.

9. *Keep all quizzes and tests that are returned to you,* and use them when you study for future tests and the final exam. These quizzes and tests indicate what concepts your instructor considers to be most important. Be sure to correct any problems on these tests that you missed, so you will have the corrected work to study.
10. *Don't worry if you do not understand a new topic right away.* As you read more about it and work through the problems, you will gain understanding. Each time you review a topic you will understand it a little better. Few people understand each topic completely right from the start.

Reading a list of study tips is a good start, but you may need some help actually *applying* the tips to your work in this math course.

Watch for this icon as you work in this textbook, particularly in the first few chapters. It will direct you to one of 12 activities in the *Study Skills Workbook* that comes with this text. Each activity helps you to actually *use* a study skills technique. These techniques will greatly improve your chances for success in this course.

- Find out *how your brain learns new material.* Then use that information to set up effective ways to learn math.
- Find out *why short-term memory is so short* and what you can do to help your brain remember new material weeks and months later.
- Find out *what happens when you "blank out" on a test* and simple ways to prevent it from happening.

All the activities in the *Study Skills Workbook* are brain-friendly ways to enjoy and succeed at math. Whether you need help with note taking, managing homework, taking tests, or preparing for a final exam, you'll find specific, clearly explained ideas that really work because they're based on research about how the brain learns and remembers.

Diagnostic Pretest

Study Skills Workbook
Activity 1

[Chapter 1]

1. Use digits to write "eighty-nine million, twenty-three thousand, five hundred seven." **1.** _____

2. Subtract. $\begin{array}{r} 7009 \\ -\ 2678 \\ \hline \end{array}$ **2.** _____

3. Divide. $20{,}213 \div 29$ **3.** _____

4. Round 88,658 to the nearest thousand. **4.** _____

[Chapter 2]

5. Write $\frac{235}{8}$ as a mixed number. **5.** _____

6. Write the prime factorization of 392 using exponents. **6.** _____

7. A cake recipe calls for $2\frac{1}{4}$ cups of flour. How much flour is needed to make 5 cakes? **7.** _____

8. First estimate the answer. Then multiply to find the exact answer. Write the exact answer as a mixed number. **8.** *Estimate:* _____

Exact: _____

$$5\frac{3}{4} \cdot 2\frac{1}{8}$$

[Chapter 3]

9. Find the least common multiple of 5, 8, 12, and 30. **9.** _____

10. Subtract. Write your answer in lowest terms. **10.** _____

$$\frac{9}{10} - \frac{4}{15}$$

11. First estimate the answer. Then add to find the exact answer. Write the exact answer as a mixed number. **11.** *Estimate:* _____

Exact: _____

$$8\frac{2}{9} + 12\frac{5}{6}$$

12. Use the order of operations to simplify. **12.** _____

$$\left(\frac{3}{4}\right)^2 + \left(\frac{5}{6} - \frac{2}{3}\right)$$

[Chapter 4]

13. _____ **13.** Round \$1.3852 to the nearest cent.

14. _____ **14.** Write $6\frac{5}{9}$ as a decimal. Round to the nearest thousandth if necessary.

15. _____ **15.** Use the order of operations to simplify $4.5^2 - 3.2 + 0.6 \cdot 12$.

16. _____ **16.** Find the cost (to the nearest cent) of 5.3 pounds of chicken at \$1.59 per pound.

[Chapter 5]

17. _____ **17.** Write the ratio "50 minutes to 4 hours" in lowest terms. Change to the same units if necessary.

18. _____ **18.** Determine whether the proportion is true or false.

$$\frac{16.2}{23.6} = \frac{5.4}{8}$$

19. _____ **19.** Find the unknown number in the proportion. Write your answer as a mixed number.

$$\frac{2\frac{1}{2}}{x} = \frac{\frac{3}{4}}{8}$$

20. _____ **20.** Martha earns \$59.50 in 7 hours. How much will she earn in 40 hours?

[Chapter 6]

Write each number as a percent.

21. _____ **21.** 0.582

22. _____ **22.** $8\frac{3}{4}$

23. _____ **23.** The price of a cell phone is \$128 plus 6% sales tax. Find the total cost of the phone including sales tax.

24. _____ **24.** Roberto's annual salary was \$24,500. After his first year on the job, he received a raise to \$26,215. Find the percent of increase.

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