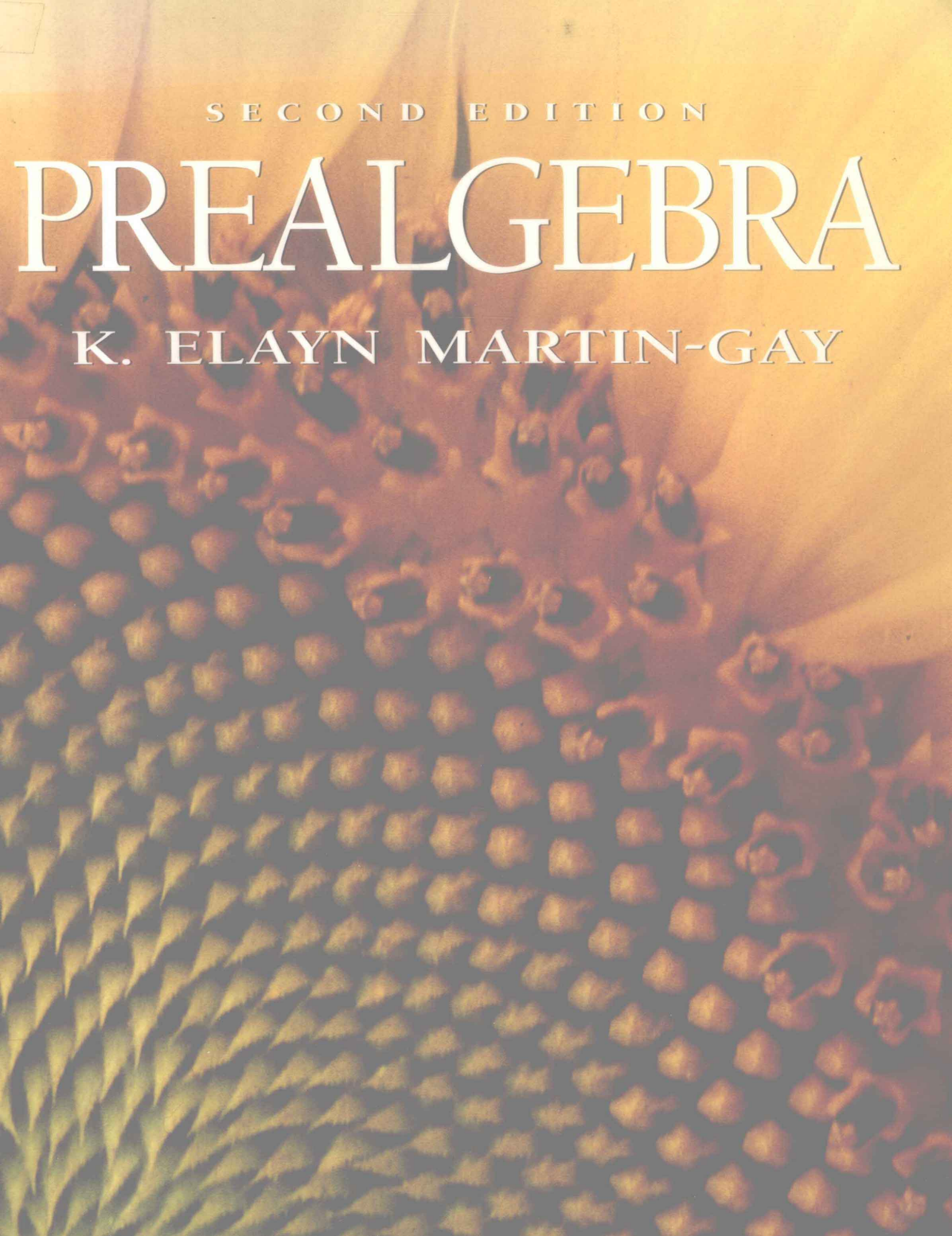


SECOND EDITION

PREALGEBRA

K. ELAYN MARTIN-GAY



PREALGEBRA

S E C O N D E D I T I O N

K. Elayn Martin-Gay

University of New Orleans



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To Jewett B. Gay, and to the memory
of her husband, Jack Gay

PREFACE

ABOUT THE BOOK

This book was written to help students make the transition from arithmetic to algebra. To reach this goal, I introduce algebraic concepts early and repeat them as I treat traditional arithmetic topics, thus laying the groundwork for the next algebra course your students will take. A second goal was to show students the relevancy of the mathematics in everyday life and in the workplace.

In preparing this second edition, I considered the comments and suggestions of colleagues throughout the country and of the many users of the first edition. The numerous features that contributed to the success of the first edition have been retained. This updated revision includes new mathematical content and increased attention to geometric concepts, data interpretation, problem solving, and real-life applications. I have carefully chosen pedagogical features to help students understand and retain concepts. The key content and pedagogical features are described on this and the following pages.

In addition, the supplements to this text have been enhanced and the range of supplements increased, offering a complete integrated teaching and learning package for maximum support and effectiveness.

KEY PEDAGOGICAL FEATURES IN THE SECOND EDITION

Readability and Connections Many reviewers of this edition as well as users of the previous edition have commented favorably on the readability and clear, organized presentation. I have tried to make the writing style as clear as possible while still retaining the mathematical integrity of the content. As new topics are presented, efforts have been made to relate the new ideas to those that the students may already know. Constant reinforcement and connections within problem-solving strategies, geometric concepts, pattern recognition, and situations from everyday life can help students gradually master both new and old information.


Accessible Real-World Applications Many new practical applications are found throughout the book in worked-out examples and exercise sets. The applications were carefully chosen to be accessible, to help motivate students, and to

strengthen their understanding of mathematics in the real world. They help show connections to a wide range of areas such as consumer applications, biology, environmental issues, allied health, business, entertainment, history, art, finance, sports, and physical science, as well as to important related mathematical areas such as geometry. Many involve current and interesting real-life data. Sources for data include newspapers, magazines, government publications, and reference books.

Unique Exercise Sets Each exercise set is divided into two parts. Both parts contain graded problems. The first part is carefully keyed to worked examples in the text. A student can gain confidence and then move on to the remaining exercises, which are not keyed to examples. There are ample exercises throughout the book, including end-of-chapter reviews, tests, and cumulative reviews. In addition, each exercise set contains one or more of the following features.

Mental Mathematics These problems are found at the beginning of many exercise sets. They are mental warmups that reinforce concepts found in the accompanying section and increase students' confidence before they tackle an exercise set. By relying on their own mental skills, students increase not only their confidence in themselves, but also their number sense and estimation ability.

Review Exercises Formerly called Skill Review, these exercises are found at the end of each section after Chapter 1. These problems are keyed to earlier sections and review concepts learned earlier in the text that are needed in the next section or in the next chapter. These exercises show the links between earlier topics and later material.


Conceptual and Writing Exercises These exercises, now found in almost every exercise set, are keyed with the icon . They require students to show an understanding of a concept learned in the corresponding section. This is accomplished by asking students questions that require them to use two or more concepts together. Some of these exercises require students to stop, think, and explain in their own words the concept(s) used in the exercises they have just completed. Guidelines recommended by the American Mathematical Association of Two-Year Colleges (AMATYC Crossroads guidelines) and other professional groups suggest incorporating writing in mathematics courses to reinforce concepts.

Practice Problems Throughout the text, each worked example has a parallel problem called a Practice Problem, found in the margin. Practice Problems invite students to be actively involved in the learning process before beginning the section exercise set. Practice Problems *immediately reinforce* a concept after it is developed.

Reminder Reminders, formerly Helpful Hint boxes, contain practical advice on problem solving. Reminders appear in the context of material in the chapter and give students extra help in understanding and working problems. They are highlighted in a box for quick reference.

Visual Reinforcement of Concepts The text contains a wealth of graphics, models, and illustrations to visually clarify and reinforce concepts. These include new bar charts, line graphs, application illustrations, calculator screens, and geometric figures.

Scientific Calculator Explorations and Exercises Scientific Calculator Explorations contain examples and exercises placed appropriately throughout the text to instruct students on the proper use of the calculator and reinforce concepts.

Additional exercises building on the skills developed in the Explorations may be found in exercise sets throughout the text, and are marked with an icon . The inside back cover of the text includes a brief description of selected keys on a scientific calculator for reference as desired.

Group Activities Each chapter opens with a photograph and description of a real-life situation. At the close of the chapter, students can apply the mathematical and critical thinking skills they have learned to make decisions and answer the questions in the Group Activity, which is related to the chapter-opening situation. The Group Activity is a multi-part, often hands-on, problem. These new situations, designed for student involvement and interaction, allow for a variety of teaching and learning styles.



Answers and suggestions specific to the Group Activities are available in the Annotated Instructor's Edition.

Chapter Highlights Found at the end of each chapter, the new Chapter Highlights contain key definitions, concepts, and *examples* to help students better understand and retain what they have learned.

Chapter Review and Test The end of each chapter contains a review of topics introduced in the chapter. These review problems are keyed to sections. The chapter test is not keyed to sections.

Cumulative Review Each chapter after the first contains a cumulative review. Each problem contained in the cumulative review is actually an earlier worked example in the text that is referenced in the back of the book along with the answer. Students who need to see a complete worked-out solution, with explanation, can do so by turning to the appropriate example in the text.

Functional Use of Color and Design Elements of the text are highlighted with color or design to make it easier for students to read and study.

Videotape and Software Icons At the beginning of each section, videotape  and software  icons are displayed. The icons help remind students that these learning aids are available should they wish to use them in reviewing concepts and skills at their own pace. These learning aids have direct correlation with the text and emphasize the text's methods of solution.

NEW KEY CONTENT FEATURES IN THE SECOND EDITION

Greater Integration of Geometry There is increased emphasis and coverage of geometric concepts. This was accomplished by including a greater integration of geometry throughout the text such as focusing more on finding the perimeter and area of composite figures.

For instance, perimeter is now introduced earlier, in Section 1.2. Then further perimeter concepts are introduced in Section 3.6 and used throughout as appropriate. Similarly, the material on area is introduced in Section 1.5 and used throughout, with special emphasis in Section 5.9. Circumference of a circle, volume, polygons, the Pythagorean theorem, and other geometric concepts are introduced and integrated as appropriate.

More Intuitive Introduction to Graphing and Descriptive Statistics Reading tables and bar and line graphs is gradually introduced (beginning in Section 1.1), and then integrated throughout and reviewed and expanded in Section 6.1. Throughout this review, an emphasis is slowly placed on the concept of paired data. This leads naturally to the idea of an ordered pair of numbers and the rectangular coordinate system, introduced in Section 6.2. Chapter 6 also includes a new section on averages, medians, and modes.

Polynomials I have added a new chapter on polynomials. This chapter allows for increased flexibility in the amount and use of algebra topics needed for students to succeed in this course and to prepare them for future courses.

Problem-Solving Approach This is introduced with a new six-step process that is integrated throughout the text. The six steps are UNDERSTAND, ASSIGN, TRANSLATE, SOLVE, CHECK, and STATE. The repeated use of these steps in a variety of examples shows their wide applicability. Reinforcing the steps can increase students' comfort level and confidence in tackling problems.

A special emphasis and strong commitment are given to contemporary and practical applications of algebra. Real data were drawn from a variety of sources, including magazines, newspapers, government publications, and reference books.

Increased Opportunities to Use Technology Optional calculator explorations and exercises are integrated appropriately throughout the text.

New Examples Additional detailed step-by-step examples were added where needed. Many of these reflect real-life situations. Examples are used in two ways—numbered, as formal examples, to check or increase understanding of a topic, and unnumbered, to introduce a topic or informally discuss the topic.

New Exercises A significant amount of time was spent on the exercise sets. New exercises and additional examples help address a wide range of student learning styles and abilities. New kinds of exercises, strategically placed, include group activities, conceptual and writing exercises, real data applications, optional calculator exercises, and reading tables, charts, and graphs. In addition, the mental math, computational, and word problems were refined and enhanced. There is now a total of approximately 5,000 exercises.

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K. Elayn Martin-Gay

ABOUT THE AUTHOR

K. Elayn Martin-Gay has taught mathematics at the University of New Orleans for over 18 years and has received numerous teaching awards, including the local University Alumni Association's Award for Excellence in Teaching.

Over the years, Elayn has developed a videotaped lecture series to help her students better understand algebra. This highly successful video material is the basis for the five-book series *Prealgebra*, *Beginning Algebra*, *Intermediate Algebra*, *Introductory and Intermediate Algebra*, a combined approach, and *Intermediate Algebra: A Graphing Approach*.

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Using the Internet and a Web Browser, such as Netscape, can add to your mathematical resources. The following is a list of some of the sites that may be worth your or your students' visit.

Prentice Hall Home Page	http://www.prenhall.com
The Mathematical Association of America	http://www.maa.org
The American Mathematical Society	http://www.ams.org
The National Council of Teachers of Mathematics	http://www.nctm.org
The Census Bureau	http://www.census.gov

INTERNET GUIDE (ISBN 0-13-268616-3)

This guide provides a brief history of the Internet, discusses the uses of the World Wide Web, and describes how to find your way within the Internet and how to reach others on it. Contact your local Prentice Hall representative regarding the Internet Guide.

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HOW TO USE THE TEXT: A GUIDE FOR STUDENTS

Prealgebra, Second Edition has been designed as just one of the tools in a fully integrated learning package to help you develop prealgebra skills. Our goal is to encourage your success and mastery of the mathematical concepts introduced in this text. Take a few moments now to see how this text will help you excel.

CHAPTER

2

INTEGERS

- 2.1 INTRODUCTION TO INTEGERS
- 2.2 ADDING INTEGERS
- 2.3 SUBTRACTING INTEGERS
- 2.4 MULTIPLYING AND DIVIDING INTEGERS
- 2.5 ORDER OF OPERATIONS



INVESTIGATING INTEGERS

Popular board games often involve instructions for a player to move his or her playing piece forward several spaces each turn. Occasionally a player might receive an instruction to move backward. These instructions to move forward or backward a certain number of spaces can be represented by positive and negative integers.

IN THE CHAPTER GROUP ACTIVITY ON PAGE XXX, YOU WILL HAVE THE OPPORTUNITY TO PLAY A GAME BASED ON INTEGERS.

The photo application at the opening of every chapter and **applications throughout** offer real-world scenarios that connect mathematics to your life. In addition, at the end of the chapter, a group activity or discovery-based project further shows the chapter's applicability.

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There is an opportunity to **explore** an exercise that relates to the chapter-opening photo as a group activity or discovery-based project.



GROUP ACTIVITY

INVESTIGATING INTEGERS

- MATERIALS:**
- Colored thumbtacks
 - coin
 - six-sided die
 - tape

Try the following activity. The object is to have the largest absolute value at the end of the game.

1. Attach this page to a piece of cardboard with tape. Each group member should choose a different colored thumbtack as his or her playing piece. Insert each thumbtack at the starting place 0 on the number line at the left.

3. Continue taking turns until each group member has taken five turns. Verify your final position on the number line by finding the total of the integers in the table. Do your total and final position agree?

	SIGNED NUMBER
Turn 1:	
Turn 2:	
Turn 3:	
Turn 4:	
Turn 5:	
Total	

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STUDY FOR SUCCESS

As you study, **make connections**—this text’s organization can help you. There are features in this text designed to help you relate material you are learning to previously mastered material. Math topics are tied to real life as often as possible. Read the learning objectives at the beginning of every section.

Save time by having a plan. Follow the **six-step process**, and you will find yourself successfully solving a wide range of problems.

PROBLEM-SOLVING STEPS

1. UNDERSTAND the problem. During this step, don’t work with variables, but simply become comfortable with the problem. Some ways of accomplishing this are to
 - * Read and reread the problem.
 - * Construct a drawing.
2. ASSIGN a variable to an unknown in the problem. Use this variable to represent any other unknown quantities.
3. TRANSLATE the problem into an equation.
4. SOLVE the equation.
5. CHECK the proposed solution in the stated problem.
6. STATE your conclusion.

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REMINDER When simplifying expressions with exponents, notice that parentheses make an important difference.

$(-3)^2$ and -3^2 do not mean the same thing.

$(-3)^2$ means $(-3)(-3) = 9$.

-3^2 means the opposite of $3 \cdot 3$, or -9 .

Only with parentheses is the -3 squared.

“Reminders” contain practical advice and provide extra help in understanding and working problems.

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CHAPTER 9 HIGHLIGHTS

DEFINITIONS AND CONCEPTS	EXAMPLES
SECTION 9.1 ADDING AND SUBTRACTING POLYNOMIALS	
A polynomial is a monomial or a sum or difference of monomials.	Polynomials $5x^2 - 6x + 2$, $-\frac{9}{10}y$, 7
To add polynomials, combine like terms.	Add $(7z^2 - 6z + 2) + (5z^2 - 4z + 5)$. $(7z^2 - 6z + 2) + (5z^2 - 4z + 5)$ $= 7z^2 + 5z^2 - 6z - 4z + 2 + 5$ Group like terms. $= 12z^2 - 10z + 7$ Combine like terms.

The new **Chapter Highlights** contain key definitions, concepts, and examples to help students better understand and retain what they have learned.

Page 654

After reading the example, try the **Practice Problem** to help you better understand the concept.

PRACTICE PROBLEM 3

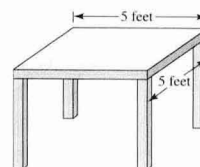
How much fencing is needed to enclose a square field 50 yards on a side?



Answers:
 2. 64 centimeters
 3. 200 yards

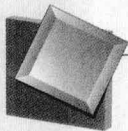
EXAMPLE 3

Find the perimeter of a square table top if each side is 5 feet long.



Solution:

The formula for the perimeter of a square is $P = 4s$. Use this formula and replace s by 5 feet.



CHECK YOUR UNDERSTANDING. EXPAND IT. EXPLORE!

Good exercise sets are essential to the make-up of a solid prealgebra textbook. The exercises you will find in this textbook are designed to help you understand skills and concepts as well as challenge and motivate you. Note, too, the Highlights, Test, Review and Cumulative Review found at the end of each chapter.

MENTAL MATH

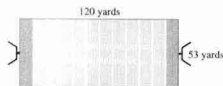
1. Find John Steven's net pay if his monthly salary is \$1635 and his total deductions are \$635.
2. Find Joann Bostic's commission on total sales of \$27,650 if she is paid 10% of total sales.
3. Find Tim Franklin's gross wages if he worked 40 hours a week and is paid \$10.00 per hour.
4. Mr. Carleson makes a monthly salary of \$2000.00. Find his annual gross pay.

Confidence building **Mental Math** problems are in many sections.

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Solve: See Examples 1–5.

13. A polygon has sides of length 5 feet, 3 feet, 2 feet, 7 feet, and 4 feet. Find its perimeter.
14. A triangle has sides of length 8 inches, 12 inches, and 10 inches. Find its perimeter.
15. Baseboard is to be installed in a square room that measures 15 feet on one side. Find how much baseboard is needed.
16. Find how much fencing is needed to enclose a rectangular rose garden 85 feet by 15 feet.
17. If a football field is 53 yards wide and 120 yards long, what is the perimeter?
18. A stop sign has eight equal sides of length 12 inches. Find its perimeter.



19. A metal strip is being installed around a workbench that is 8 feet long and 3 feet wide. Find how much stripping is needed.
20. Find how much fencing is needed to enclose a rectangular garden 70 feet by 21 feet.
21. If the stripping in Exercise 19 costs \$3 per foot, find the total cost of the stripping.
22. If the fencing in Exercise 20 costs \$2 per foot, find the total cost of the fencing.

Build your confidence with the beginning exercises; the first part of each exercise set is keyed to already worked examples. Then try the remaining exercises

Conceptual and Writing Exercises bring together two or more concepts and often require “in your own words” written explanation.

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CALCULATOR EXPLORATIONS

COMPOUND INTEREST FACTOR

A compound interest factor may be found by using your calculator and evaluating the formula

$$\text{compound interest factor} = \left(1 + \frac{r}{n}\right)^{nt}$$

where r is the interest rate, t is the time in years, and n is the number of times compounded per year. For example, we stated earlier that the compound interest factor for 10 years at 8% compounded semiannually is 2.19112. Let's find this factor by evaluating the compound interest factor formula when $r = 8\%$ or 0.08, $t = 10$, and $n = 2$ (compounded semiannually means 2 times per year). Thus,

$$\text{compound interest factor} = \left(1 + \frac{0.08}{2}\right)^{2 \cdot 10} \text{ or } \left(1 + \frac{0.08}{2}\right)^{20}$$

To evaluate, press the keys

() 1 + 0.08 ÷ 2) y^x 20 =

The display will read 2.1911231. Rounded to 5 decimal places, this is 2.19112.

Find the compound interest factor. Use the table in Appendix D to check your answer.

1. 5 years, 9%, compounded quarterly 1.56051
2. 15 years, 14%, compounded daily 8.16288
3. 20 years, 11%, compounded annually 8.06231

Calculator explorations and exercises are woven into the appropriate sections to reinforce concepts and motivate **discovery-based learning**.

Page 589

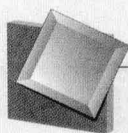
Review Exercises

Evaluate each expression using the given replacement numbers. See Section 2.5.

67. x^3 when $x = -3$
68. y^3 when $y = -5$
69. $2y$ when $y = -7$
70. $-5a$ when $a = -4$
71. $3z - y$ when $z = 2$ and $y = 6$
72. $7a - b$ when $a = 1$ and $b = -5$
73. $a^2 + 2b + 3$ when $a = 4$ and $b = 5$
74. $yx - z^2$ when $y = 6$, $x = 6$, and $z = 6$

Review Exercises review concepts learned earlier that are needed in the next section or next chapter.

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STUDENT RESOURCES

1.2

ADDING WHOLE NUMBERS AND PERIMETER

OBJECTIVES

- 1 Add whole numbers.
- 2 Identify properties of addition.
- 3 Find the perimeter of a polygon.
- 4 Solve problems by adding whole numbers.

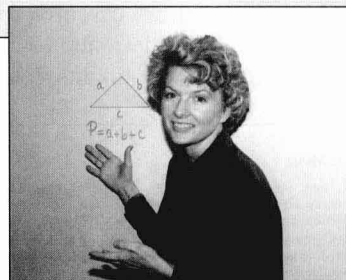
1 If one computer in an office has a 2-megabyte memory and a second computer has a 4-megabyte memory, the total memory in the two computers can be found by adding 2 and 4.

$$2 \text{ megabytes} + 4 \text{ megabytes} = 6 \text{ megabytes}$$

The **sum** is 6 megabytes of memory. Each of the numbers 2 and 4 is called an **addend**.

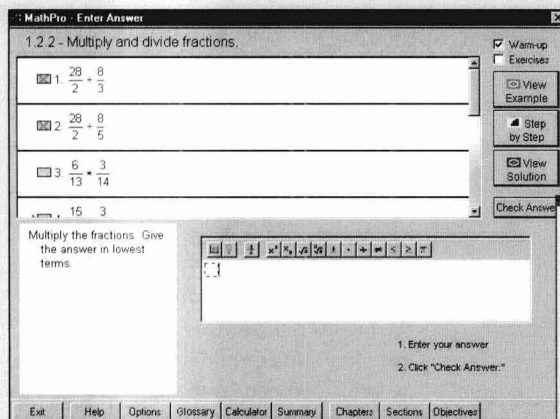


TAPE PA 1.2



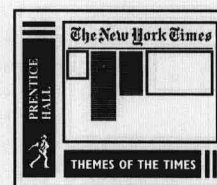
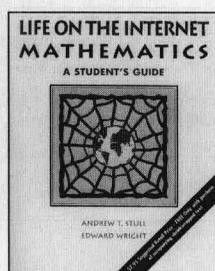
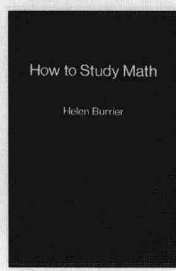
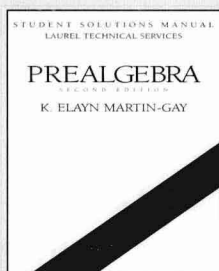
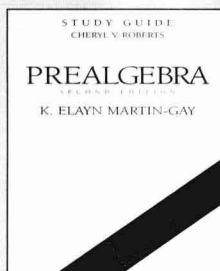
Text-specific videos hosted by the award-winning teacher and author of *Prelgebra, Second Edition* cover each objective in every chapter section as a supplementary review.

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