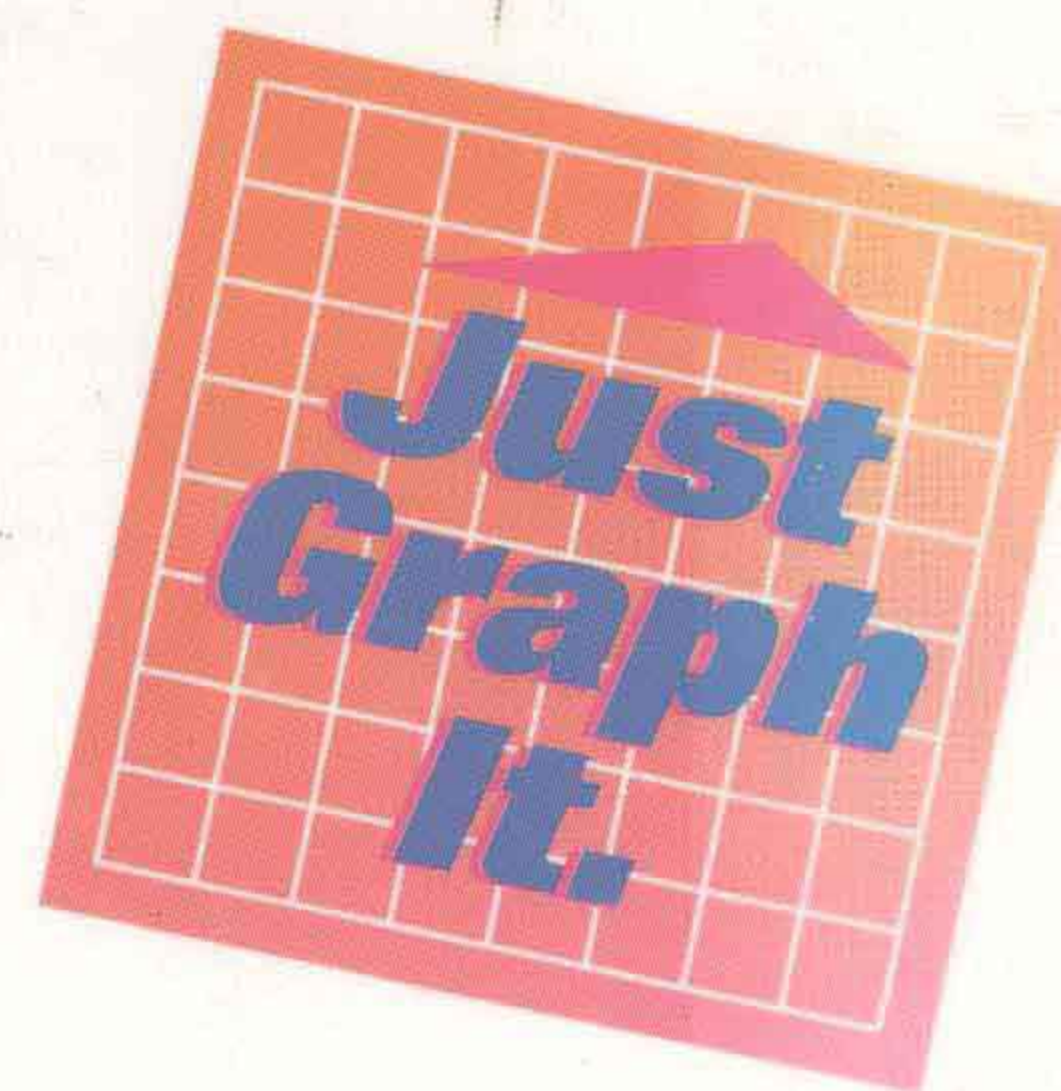
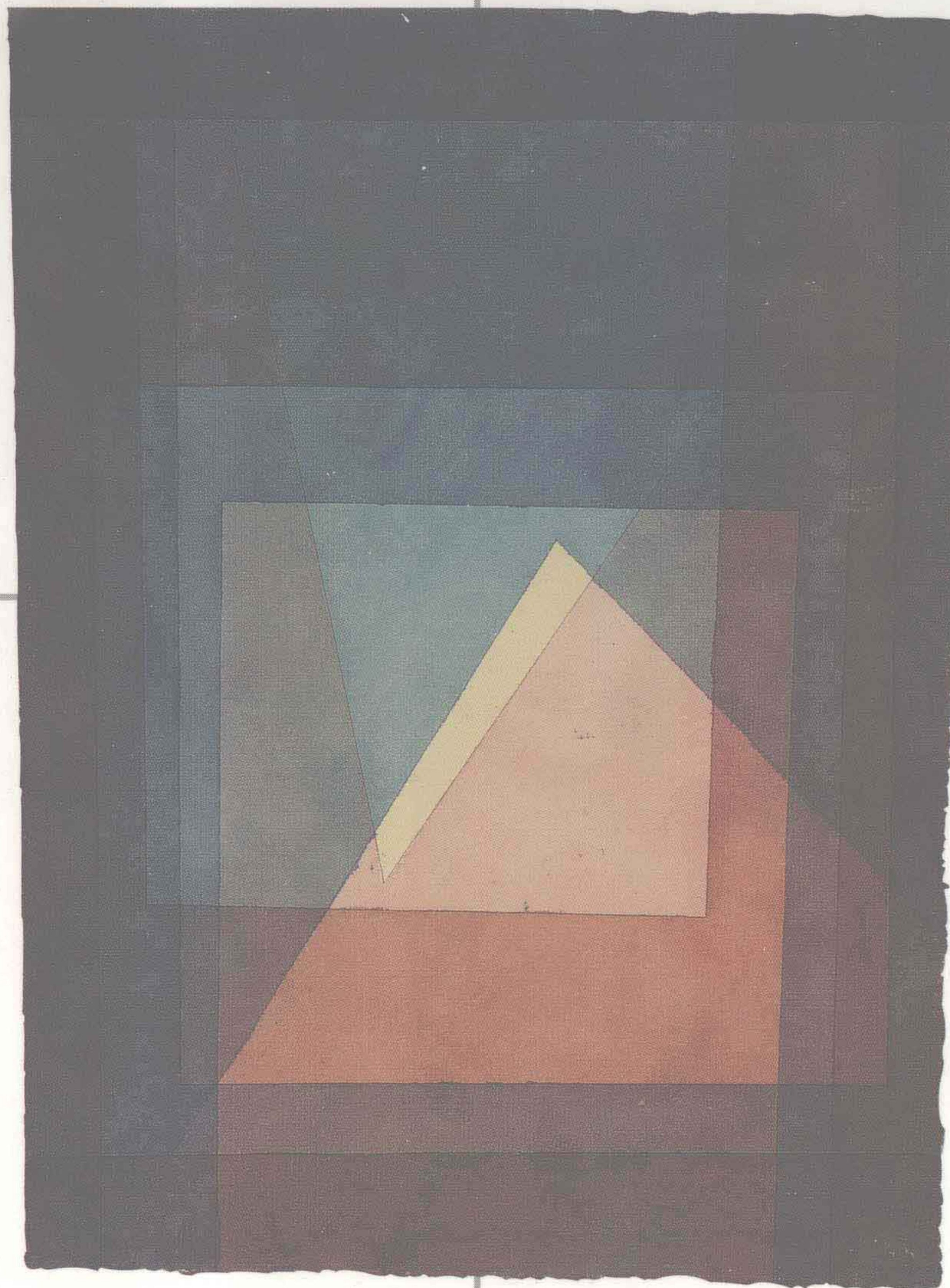


INSTRUCTOR'S ANNOTATED EDITION

INTERMEDIATE ALGEBRA

Graphs and Functions



LARSON HOSTETLER NEPTUNE

INSTRUCTOR'S ANNOTATED EDITION

INTERMEDIATE ALGEBRA

Graphs and Functions

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Preface

Intermediate Algebra: Graphs and Functions has two basic goals: first, to help students develop proficiency in algebra; and, second, to show students how algebra can be used as a modeling language for real-life problems. To support these two functions, the text has several key pedagogical features.

Mathematics as Problem Solving Throughout the text, students are encouraged to consider multiple approaches to problem-solving — algebraic, graphical, and numerical. For real-life problems, students are encouraged to use the following approach: construct a verbal model, label variable and constant terms, construct an algebraic model, solve the algebraic model, answer the question, and check the answer in the original statement of the problem.

Mathematics as Communication The discussion problems at the end of each section offer students the opportunity to think, talk, and write about mathematics in different ways. Students are encouraged to draw new conclusions about the concepts presented and to develop a sense of how each topic studied fits into the whole concept of algebra.

Mathematics as Reasoning While the text stresses skill development in algebra, it does so in the broader context of developing an understanding of algebraic properties and principles. Many of the examples and exercises in the text ask students to explain the reasons for choosing a particular problem-solving approach.

Mathematical Connections Numerous applications are integrated throughout every section of the text — both as solved examples and as exercises. As a result, students will constantly use and review their problem-solving skills. The text applications cover a wide range of relevant topics, and many use real data. The examples and exercises in the text connect algebra not only to real life, but also to other branches of mathematics, such as geometry.

These and other features of the text are described in greater detail on the following pages.

3

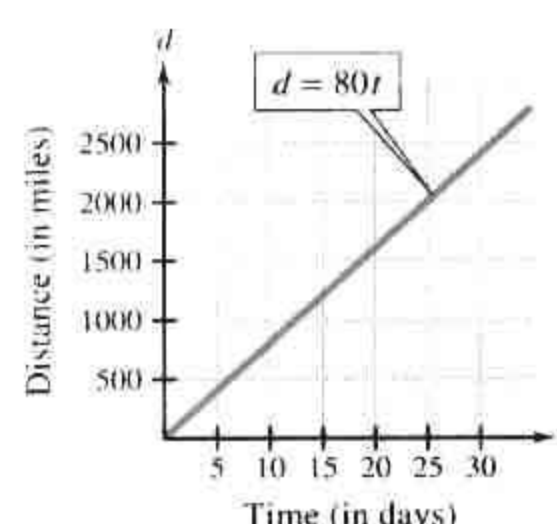
Linear Functions, Equations, and Inequalities

- 3.1 Applications of Linear Equations
- 3.2 More Applications: Consumer and Scientific Problems
- 3.3 Linear Inequalities in One Variable
- 3.4 Equations and Inequalities Involving Absolute Value
- 3.5 Slope: An Aid to Graphing Linear Functions
- 3.6 Equations of Lines

Each year, monarch butterflies migrate from the northern United States to Mexico. The butterflies travel at an average rate of 80 miles per day. The distance d (in miles) traveled for a given time t (in days) is given by

$$(\text{Distance}) = (\text{rate})(\text{time})$$

$$d = 80t$$



Use this model to approximate the distance traveled by monarch butterfly in 25 days. How long does it take to travel 2000 miles?



Section Topics

Each section begins with a list of important topics that are covered in the section. These topics are also the subsection titles and can be used for easy reference and review by students.

Definitions and Rules

All of the important rules, formulas, and definitions are boxed for emphasis. Each is also titled for easy reference.

Notes

Notes appear after definitions and examples. Anticipating students' needs, the notes give additional insight, point out common errors, and describe generalizations.

Features of the Text

Chapter Opener

Each chapter contains a list of the topics to be covered and a real-life application that helps motivate the chapter. This application poses one or two questions that are designed to pique students' curiosity.

SECTION
1.4

Operations with Polynomials

Basic Definitions • Adding and Subtracting Polynomials • Multiplying Polynomials • Special Products • Applications

Basic Definitions

An algebraic expression containing only terms of the form ax^k , where a is any real number and k is a nonnegative integer, is called a **polynomial in one variable** or simply a **polynomial**. Here are some examples of polynomials in one variable.

$$3x - 8, \quad x^4 + 3x^3 - x^2 - 8x + 1, \quad x^3 + 5, \quad \text{and} \quad 9x^5$$

In the term ax^k , a is called the **coefficient**, and k the **degree**, of the term. Note that the degree of the term ax is 1, and the degree of a constant term is zero. Because a polynomial is an algebraic *sum*, the coefficients take on the signs between the terms. For instance,

$$x^3 - 4x^2 + 3 = (1)x^3 + (-4)x^2 + (0)x + 3$$

has coefficients 1, -4, 0, and 3.

Polynomials are usually written in order of descending powers of the variable. This is referred to as **standard form**. For example, the standard form of $3x^2 - 5 - x^3 + 2x$ is

$$-x^3 + 3x^2 + 2x - 5. \quad \text{Standard form}$$

The **degree of a polynomial** is defined as the degree of the term with the highest power, and the coefficient of this term is called the **leading coefficient** of the polynomial. For instance, the polynomial $-3x^4 + 4x^2 + x + 7$ is of fourth degree and its leading coefficient is -3.

Definition of a Polynomial in x

Let $a_n, \dots, a_2, a_1, a_0$ be real numbers and let n be a nonnegative integer. A **polynomial in x** is an expression of the form

$$a_n x^n + a_{n-1} x^{n-1} + \dots + a_2 x^2 + a_1 x + a_0,$$

where $a_n \neq 0$. The polynomial is of **degree n** , and the number a_n is called the **leading coefficient**. The number a_0 is called the **constant term**.

NOTE The following are *not* polynomials, for the reasons stated.

$2x^{-1} + 5$	Exponent in $2x^{-1}$ is <i>not</i> nonnegative.
$x^3 + 3x^{1/2}$	Exponent in $3x^{1/2}$ is <i>not</i> an integer.

EXAMPLE 10 ■ Constructing a Verbal Model

Find two consecutive integers such that the sum of the first and three times the second is 87.

Solution

Verbal model: First integer + 3 · Second integer = 87

Labels: First integer = n
Second integer = $n + 1$

Algebraic equation: $n + 3(n + 1) = 87$ Algebraic model
 $n + 3n + 3 = 87$ Distributive Property
 $4n = 84$ Subtract 3 from both sides and combine terms
 $n = 21$ Divide both sides by 4

Thus, the first integer is 21, and the second integer is $21 + 1 = 22$. You can check this by substituting 21 and 22 for two consecutive integers in the original problem. ■

EXAMPLE 11 ■ Using a Verbal Model to Construct an Algebraic Equation

Write an algebraic equation that represents the following problem: You have accepted a job with an annual salary of \$27,630. This salary includes a year-end bonus of \$750. If you are paid twice a month, what will be your gross pay for each paycheck?

Solution

Because there are 12 months in a year and you will be paid twice a month, it follows that you will receive 24 paychecks during the year. You can construct an algebraic equation for this problem as follows. Begin with a verbal model, then assign labels, and finally form an algebraic equation.

Verbal model: Income for year =

Labels: Income for year = 27,630 (dollars)
Amount of each paycheck =
Bonus = 750 (dollars)

Algebraic equation: $27,630 = 24x$

The algebraic equation for this problem is $27,630 = 24x$. Using the techniques discussed in Section 3.1, you can solve for x . If you do this, you will find that the salary per paycheck is \$1,151.25.

You could solve the problems in Example 10 and Example 11 by using a calculator. For instance, in Example 11 you could solve for x by dividing \$27,630 by 24 to get \$1,151.25.

Applications

Real-world applications are integrated throughout the text both in examples and in exercises. These applications offer students a constant review of problem-solving skills and emphasize the relevance of the mathematics. Many of the applications use current, real data, and all are titled for reference.

Problem-Solving Process

Students are taught the following strategies — in keeping with the spirit of NCTM standards — for solving applied problems. (1) Construct a verbal model; (2) label variable and constant terms; (3) construct an algebraic model; (4) using the model, solve the problem; and (5) check the answer in the original statement of the problem.

Examples

Each of the nearly 900 examples was carefully chosen to illustrate a particular concept or problem-solving technique and to enhance students' understanding. The examples are titled for easy reference.

EXAMPLE 13 ■ Creating a Real-Life Model

For the years 1980 through 1990, the number B (in millions) of children's books that were sold in the United States can be modeled by $B = 18.7t + 119$, where $t = 0$ represents 1980. During the same years, the average price p of a children's book can be modeled by $p = 0.2t + 3.3$. These two models can be used to write a model for the total sales (in millions of dollars) of children's books for 1980 through 1990. Use the model to find the total sales in 1988. (Source: *Book Industry Times*)

Solution

Let S represent the yearly sales in millions of dollars.

Total yearly sales = Number sold each year · Average price per book each year

$$S = (18.7t + 119)(0.2t + 3.3)$$

To find the total sales in 1988, substitute 8 for t in this model.

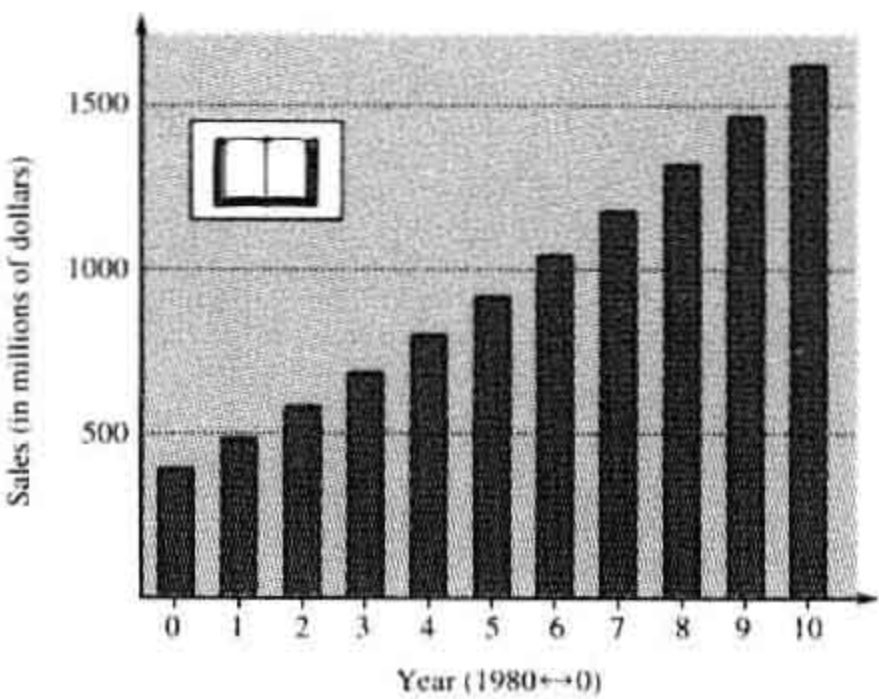
$$\begin{aligned} S &= (18.7t + 119)(0.2t + 3.3) && \text{Total sales model} \\ &= (18.7 \cdot 8 + 119)(0.2 \cdot 8 + 3.3) && \text{Substitute 8 for } t \\ &= (268.6)(4.9) && \text{Perform operations within parentheses} \\ &= 1316.14 && \text{Multiply} \end{aligned}$$

The total sales of children's books in 1988 was about \$1316 million (or about \$1.3 billion). The bar graph shown in Figure 1.9 shows the total sales of children's books from 1980 through 1990. ■

According to the NEA, over half of the adults in the United States read at least one book for enjoyment each year. Reading books to children increases the likelihood that the children will read for enjoyment as adults.



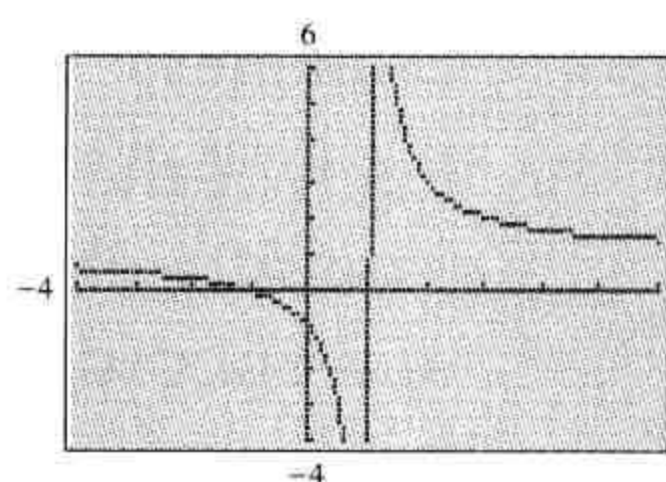
FIGURE 1.9



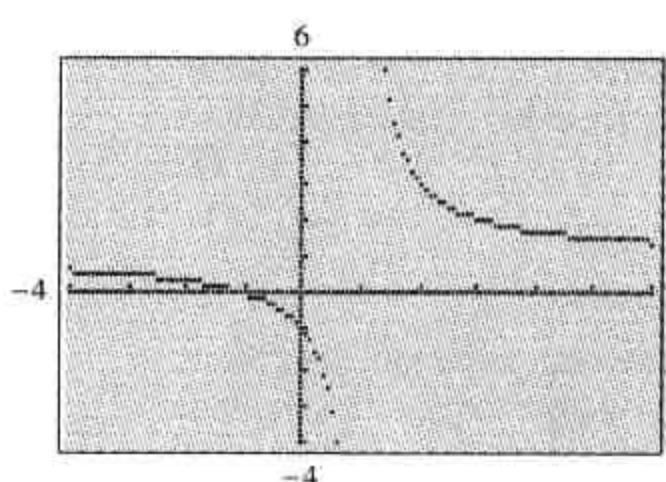
Using a Graphing Calculator

Most graphing calculators have two graphing modes: a *connected mode* and a *dot mode* (see figures below). The connected mode works well for graphs of functions that are continuous (have no holes or breaks). The connected mode does not, however, work well for the graphs of many rational functions because they are often composed of two or more disconnected branches. To correct this problem, change the calculator to dot mode.

On the screen shown at left below, notice the vertical line at approximately $x = 1$. This line is *not* part of the graph—it is simply the calculator's attempt to connect the two branches of the graph.



Connected Mode
Graph of $f(x) = \frac{x+1}{x-1}$



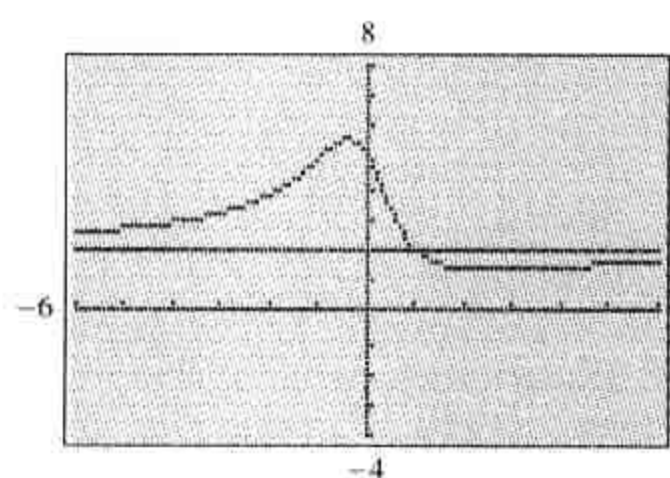
Dot Mode
Graph of $f(x) = \frac{x+1}{x-1}$

EXAMPLE 1 ■ Investigating Asymptotic Behavior

Some people think that the graph of a rational function has a vertical asymptote. This, however, is not the case. The graph of

$$f(x) = \frac{2x^2 - 3x + 5}{x^2 + 1}$$

and its horizontal asymptote $y = 2$ is shown on the graph. The graph crosses its horizontal asymptote at $x = 1$.



Solution

From the screen at left, it appears that the graph crosses the horizontal asymptote at $x = 1$. You can confirm this by evaluating $f(1)$:

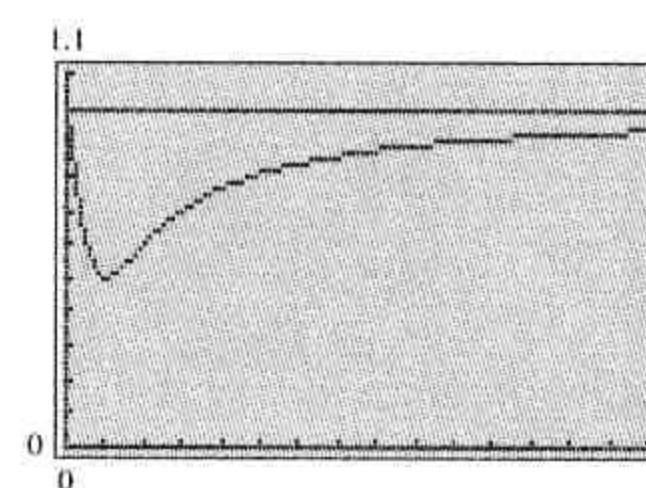
$$f(1) = \frac{2(1^2) - 3(1) + 5}{1^2 + 1} = \frac{4}{2} = 2$$

EXAMPLE 2 ■ Pollution Level of a Pond

Some organic waste has been dumped into a pond. One component of the decomposition process is oxidation, whereby oxygen dissolved in the pond water is combined with decomposing material. Let $L = 1$ represent the normal oxygen level in the pond, and let t represent the number of weeks that have elapsed since the waste was dumped. The oxygen level in the pond can be modeled by

$$L = \frac{t^2 - t + 1}{t^2 + 1}$$

Sketch the graph of this model, and use the graph to explain how the oxygen level has changed during the 15 weeks since the waste was dumped.



Oxygen Level of Pond

Solution

The screen at left shows the graph of the model and the line $L = 1$ (the normal oxygen level). From the graph, you can see that the oxygen dropped to 50% of its normal level after 1 week. Then, during the next several weeks, the oxygen level gradually returned to normal. Now, at the end of the 15th week, the oxygen level has reached 93% of normal.

EXERCISES

In Exercises 1–6, find bounds for x and y such that the calculator screen displays the basic characteristics of the graph of the rational function.

1. $f(x) = \frac{x-5}{x+1}$

2. $f(x) = \frac{2x-5}{x-4}$

3. $f(x) = \frac{x^2-1}{x^2-4}$

4. $f(x) = \frac{2x^2-7x+5}{x^2+2x+1}$

5. $f(x) = \frac{x^2-5x}{2x^2+1}$

6. $f(x) = \frac{x^3-1}{x^3+1}$

7. Use a graphing calculator to sketch the graphs of f and g on the same screen. (Use a range of $-5 \leq x \leq 5$ and $-4 \leq y \leq 20$.)

$$f(x) = x \quad \text{and} \quad g(x) = \frac{x^2 + x + 1}{x + 1}$$

Use long division to rewrite $g(x)$. Then use the result to explain why the two graphs are close to each other for large values of $|x|$.

8. For the years 1975 to 1990, the number N (in millions) of long-playing albums sold in the United States can be approximated by the model

$$N = \frac{1000 - 74.41t + 1.45t^2}{2.94 - 0.336t + 0.0125t^2}$$

where $t = 5$ represents 1975. Sketch the graph of this function and use the graph to find the year in which the sales peaked. (Source: Recording Industry Association of America)

EXAMPLE 5 ■ Finding the Intercepts of a Graph
Find the intercepts and sketch the graph of $y = 2x - 3$.

Solution
To determine whether the graph has any x -intercepts, let y be zero and solve the resulting equation for x .

$$y = 2x - 3$$
$$0 = 2x - 3$$
$$\frac{3}{2} = x$$

Given equation

Let $y = 0$

Solve equation for x

Therefore, the graph has one x -intercept, which occurs at the point $(\frac{3}{2}, 0)$.
To determine whether the graph has any y -intercepts, let x be zero and solve the resulting equation for y .

$$y = 2x - 3$$
$$y = 2(0) - 3$$
$$y = -3$$

Given equation

Let $x = 0$

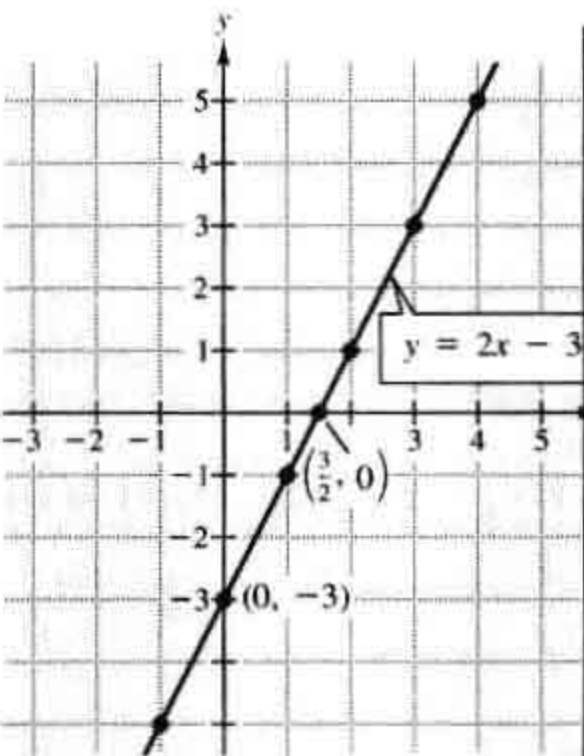
Solve equation for y

Therefore, the graph has one y -intercept, which occurs at the point $(0, -3)$.
To sketch the graph of the equation, make a table of values, as shown in Table 2.9. (Notice that the two intercepts are included in the table.) Finally, using the solution points in the table, sketch the graph of the equation, as shown in Figure 2.20.

TABLE 2.9

x	-1	0	1	$\frac{3}{2}$	2	3	4
$y = 2x - 3$	-5	-3	-1	0	1	3	5
Solution Points	$(-1, -5)$	$(0, -3)$	$(1, -1)$	$(\frac{3}{2}, 0)$	$(2, 1)$	$(3, 3)$	$(4, 5)$

FIGURE 2.20



Mid-Chapter Quiz

Each chapter contains a mid-chapter quiz after the third section. This feature allows students to perform a self-assessment midway through the chapter. Answers to mid-chapter quizzes are given at the end of the text.

Graphing

Graphing is introduced in Chapter 2. From that point on, students are encouraged to consider using graphs to reinforce algebraic solutions.

2

Mid-Chapter Quiz

Take this quiz as you would take a quiz in class. After you are done, check your work against the answers in the back of the book.

In Exercises 1–8, solve the equation.

1. $24 - 2x = x$

3. $\frac{5x}{6} - \frac{2}{3} = 1$

5. $(s - 16)(s + 15) = 0$

7. $4x^2 - 4x + 1 = 0$

9. Solve for C

Temperature Conversion: $F = \frac{9}{5}C + 32$

10. Solve for l

Perimeter of a Rectangle: $P = 2(l + w)$
2. $3(x - 4) + 4 = -2(x - 1)$

4. $\frac{t}{4} - \frac{t}{6} = 1$

6. $y(y + 6) = 72$

8. $3t^2 - 4t + 6 = 10$

11. The surface area of a cylinder (see figure) is given by $S = 2\pi rh + 2\pi r^2$.
- (a) Solve for h .
- (b) Find h if $S = 105$ square inches and $r = 3$ inches.
12. An object is thrown upward from a height of 64 feet with an initial velocity of 48 feet per second. Find the time t for the object to reach the ground by solving the following equation.

$$-16t^2 + 48t + 64 = 0$$

13. Two people can complete a task in t hours, where t must satisfy the equation

$$\frac{t}{12} + \frac{t}{20} = 1.$$

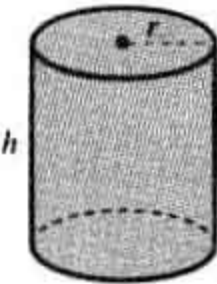
Find the required time t .

14. (a) Determine the quadrant(s) in which the point (x, y) is located if $xy < 0$.
(b) Explain your reasoning.

In Exercises 15 and 16, use the points $(-3, 0)$ and $(7, 3)$.

15. Plot the points in a rectangular coordinate system.
16. Find the distance between the points. Round your result to two decimal places.
17. Determine whether the ordered pairs are solution points to the equation $5x - 3y + 10 = 0$.
- (a) $(-2, 0)$ (b) $(0, 3)$ (c) $(1, -2)$ (d) $(-5, -5)$

Figure for 11



DISCUSSION PROBLEM ■ Red Herrings

Most applied problems in textbooks give precisely the right amount of information that is necessary to solve a given problem. In real life, however, you often must sort through the given information and discard information that is irrelevant to the problem. Such irrelevant information is called a **red herring**. Find the red herrings in the following problems.

- Suppose you are hired for a job that pays \$8 per hour. After a 90-day review, your salary will be increased to \$8.50 per hour. During your first two weeks on the job, you work 80 hours. How much will you be paid for your first two weeks of work?
- A person leaves home at noon and drives 50 miles before stopping to fill the car with gas. The person then continues driving until 3 P.M. At the beginning of the trip, the car's odometer reading is 45,768, and at the end of the trip, the reading is 45,930. Find the average speed of the car during the entire trip. ■

Warm-Up

The following warm-up exercises involve skills that were covered in earlier sections. You will use these skills in the exercise set for this section.

In Exercises 1–10, solve the equation.

- $44 - 16x = 0$
- $-4(x - 5) = 0$
- $3[4 + 5(x - 1)] = 6x + 2$
- $\frac{3x}{8} + \frac{3}{4} = 2$
- $\frac{x}{3} + \frac{x}{2} = \frac{1}{3}$
- $x - \frac{x}{4} = 15$
- $\frac{5x}{4} + \frac{1}{2} = x - \frac{1}{2}$
- $0.25x + 0.75(10 - x) = 3$

3.2 EXERCISES

means that a graphing utility can be used to solve the exercise or check your solution.

In Exercises 1–8, find the missing quantities. (Assume that the markup rate is based on the cost.)

Merchandise	Cost	Selling Price	Markup	Markup Rate
1. Wristwatch	\$45.95	\$64.33		
2. Bicycle	\$84.20	\$113.67		
3. Sleeping bag		\$250.80	\$98.80	

Warm-Up

Each section (except for Section 1.1) contains a set of ten warm-up exercises that enables students to review and practice the previously learned skills necessary to master the new skills presented in the section. All warm-up exercises are answered at the end of the text.

Calculators and Computers

Two types of calculators are discussed: scientific and graphing. In examples and exercises, the graphing capability of graphing calculators and computer graphing software is investigated; however, coverage of this material is optional.

Discussion Problems

Discussion problems appear at the end of each section. They encourage students to think, talk, and write about mathematics, both individually and in groups.

Warm-Up

The following warm-up exercises involve skills that were covered in earlier sections. You will use these skills in the exercise set for this section.

In Exercises 1–6, sketch the graph of the equation.

- $y = 3 - 2x$
- $y = \frac{1}{2}x - 1$
- $y = (x - 2)^2 - 4$
- $y = 9 - (x + 1)^2$
- $x - y^2 = 0$
- $y = |x| + 1$

In Exercises 7–10, evaluate the function at the indicated values.

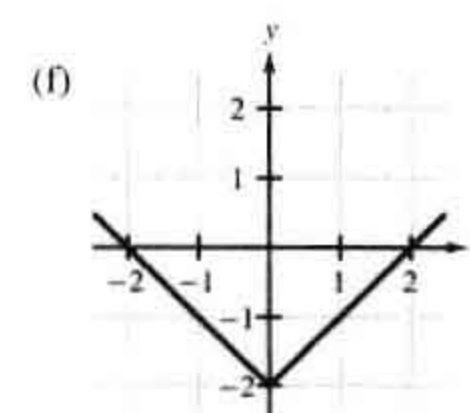
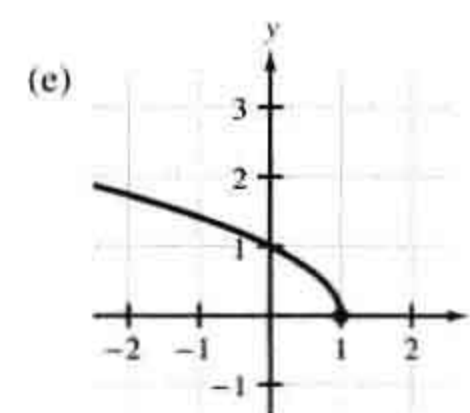
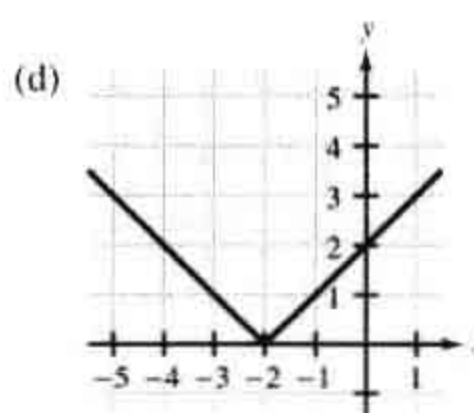
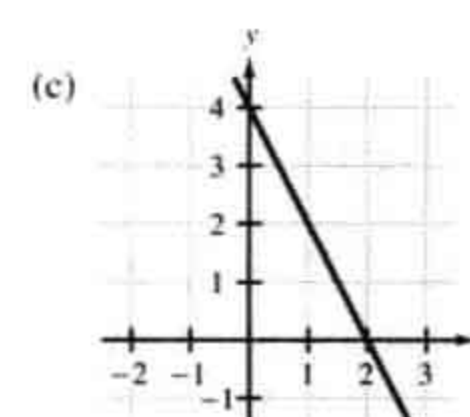
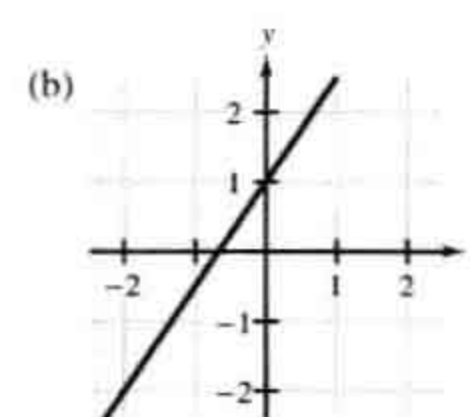
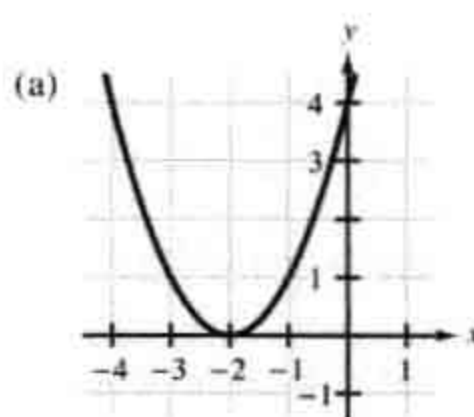
Function	Function Value	
7. $f(x) = \frac{1}{3}x^2$	(a) $f(6)$	(b) $f(\frac{3}{4})$
8. $f(x) = 3 - 2x$	(a) $f(5)$	(b) $f(x + 3) - f(3)$
9. $f(x) = \frac{x}{x + 10}$	(a) $f(5)$	(b) $f(c - 6)$
10. $f(x) = \sqrt{x - 4}$	(a) $f(16)$	(b) $f(t + 3)$

2.6 EXERCISES

means that a graphing utility can help you solve the exercise or check your solution.

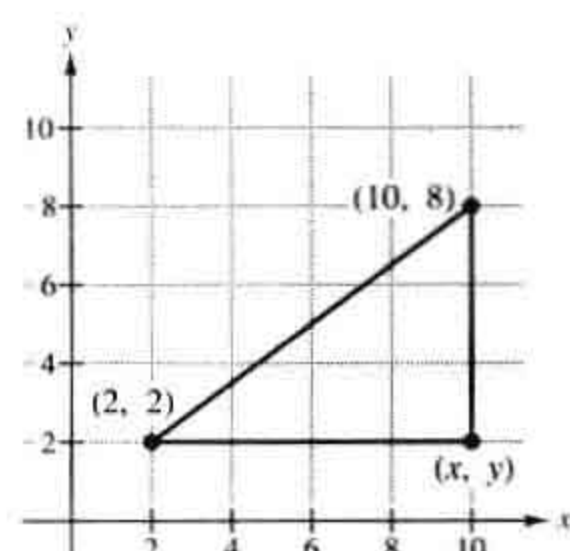
In Exercises 1–6, match the function with its graph. [The graphs are labeled (a), (b), (c), (d), (e), and (f).]

- $f(x) = 4 - 2x$
- $f(x) = \frac{3}{2}x + 1$
- $g(x) = \sqrt{1 - x}$
- $g(x) = (x + 2)^2$
- $h(x) = |x| - 2$
- $h(x) = |x + 2|$

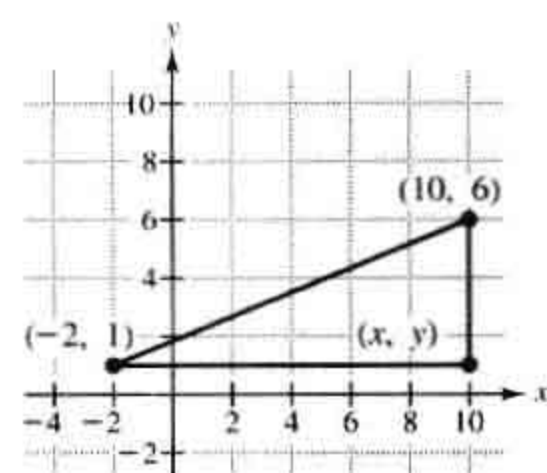


In Exercises 47–50, find (a) the missing coordinates of the one vertex of the right triangle, (b) the lengths of the vertical and horizontal sides of the triangle, (c) the length of the hypotenuse, and (d) the distance between the two given points.

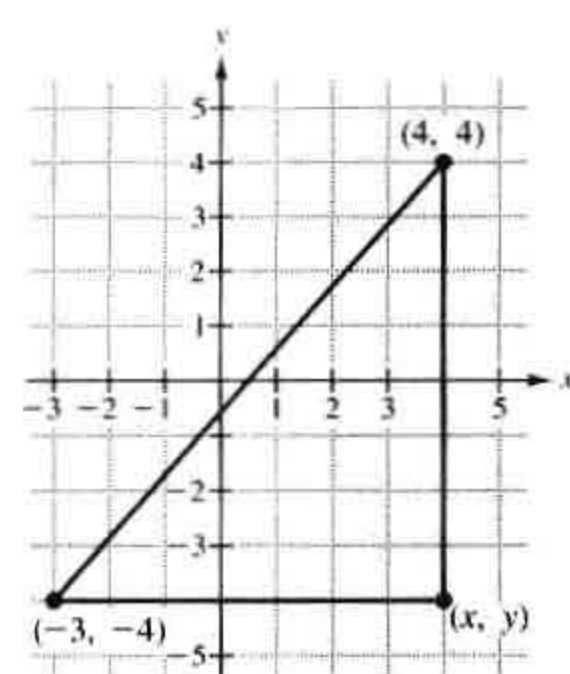
47. (10, 8), (2, 2)



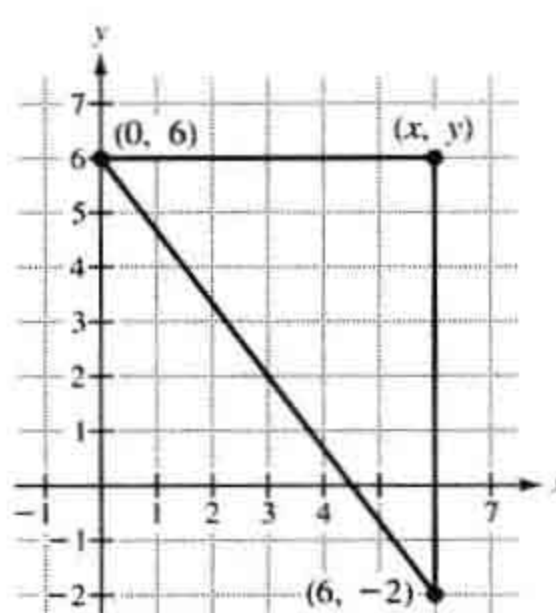
48. (-2, 1), (10, 6)



49. (-3, -4), (4, 4)



50. (0, 6), (6, -2)



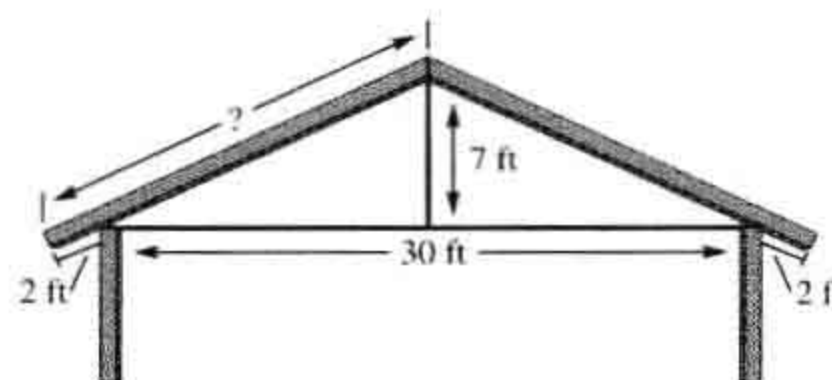
In Exercises 51–58, find the distance between the two points. If appropriate, round the result to two decimal places.

51. (1, 3), (5, 6) 52. (3, 10), (15, 5)
 53. (0, 0), (12, -9) 54. (-5, 0), (3, 15)
 55. (-2, -3), (4, 2) 56. (-5, 4), (10, -3)
 57. (1, 3), (3, -2) 58. $(\frac{1}{2}, 1)$, $(\frac{3}{2}, 2)$

In Exercises 59–62, determine whether the points are vertices of a right triangle.

59. (2, 3), (2, 6), (6, 3)
 60. (2, 4), (-1, 6), (-3, 1)
 61. (8, 3), (5, 2), (1, 9)
 62. (2, 4), (1, 1), (7, -1)

63. **Housing Construction** A house is 30 feet wide and the ridge of the roof is 7 feet above the top of the walls (see figure). Find the length of the rafters if they overhang the edge of the walls by 2 feet.



123. $x^2 + bx + 5$

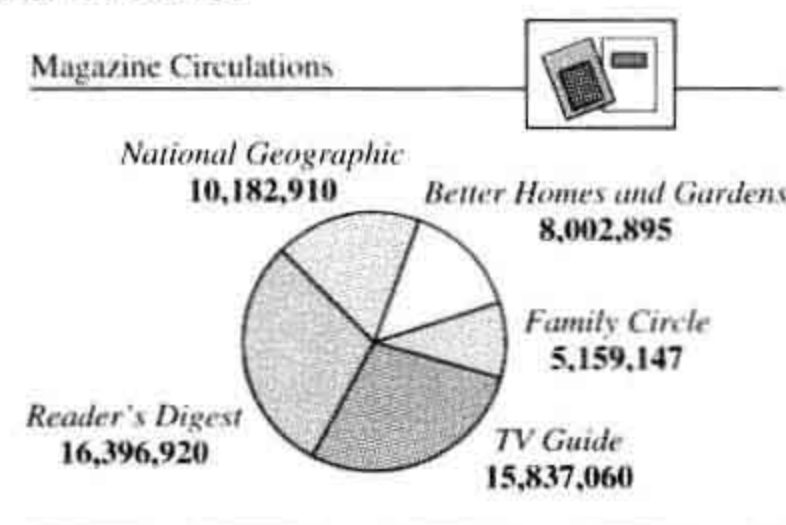
124. $x^2 + bx + 6$

125. $2x^2 + bx - 15$

126. $3x^2 + bx - 22$

Magazine Circulations In Exercises 127 and 128, use the figure showing the circulations for the top five magazines in the United States for the first six months of 1990. (Source: Audit Bureau of Circulations)

Figure for 127 and 128



127. Determine the combined circulation for the five magazines.

128. What is the difference in circulation between *Reader's Digest* and *National Geographic*?

129. **Total Charge** Suppose you purchased a product by making a down payment of \$239 plus nine monthly payments of \$45 each. What is the total amount you paid for the product?

Exercise Sets

The nearly 7000 exercises contain numerous computational and applied problems dealing with a wide range of topics. Anticipating students' needs, these problems are carefully graded to increase in difficulty as students' problem-solving skills develop. Each pair of consecutive problems is similar, with the answer to the odd-numbered problem given at the end of the text. Exercise sets appear at the end of each text section. The opportunity to use calculators — to show patterns, to experiment, to calculate, or to create graphic models — is available with selected topics.

Algebra

trinomial.

+ 169

109. $4s^2 + 36st + 81t^2$

110. $u^2 - 10uv + 25v^2$

pletely, if possible.

$3b + 27b^3$

$8x^3 + 1$

$x^2 - 2x + 1$

$4t^3 + 7t^2 - 2t$

113. $8x(2x - 3) - 4(2x - 3)$

116. $t^3 - 216$

119. $x^2 + x - 1$

122. $6h^3 - 22h^2 - 8h$

at the trinomial is factorable.

123. $x^2 + bx + 5$

124. $x^2 + bx + 6$

125. $2x^2 + bx - 15$

126. $3x^2 + bx - 22$

Graphics

The ability to visualize problems is a critical skill that students need in order to solve them. To encourage the development of this skill, the text has an abundance of figures, which are computer-generated for accuracy.

130. **Total Charge** Suppose you purchased a product by making a down payment of \$387 plus 12 monthly payments of \$68 each. What is the total amount you paid for the product?

131. **Exploratory Exercise** Enter any number between 0 and 1 in a calculator. Take the square root of the number. Then take the square root of the result, and keep repeating the process. What number does the calculator display seem to be approaching?

132. **Calculator Experiment** Use a calculator to calculate 12^4 in two ways.*

Scientific

(a) 12 $\boxed{y^x}$ 4 $\boxed{=}$

(b) 12 $\boxed{x^2}$ $\boxed{x^2}$

Graphing

(a) 12 $\boxed{\wedge}$ 4 $\boxed{\text{ENTER}}$

(b) 12 $\boxed{x^2}$ $\boxed{x^2}$ $\boxed{\text{ENTER}}$

Why do these two methods give the same result?

133. **Probability** The probability of three successes in five trials of an experiment is $10p^3(1-p)^2$. Find this product.

*The graphing calculator keystrokes in this text correspond to the TI-81 and TI-82 graphing calculators from Texas Instruments. For other graphing calculators, the keystrokes may differ.

2 REVIEW EXERCISES

In Exercises 1–4, determine whether the values of the variable are solutions of the equation.

Equation	Values of the Variable	
1. $45 - 7x = 3$	(a) $x = 3$	(b) $x = 6$
2. $3(5 - x) = 6 - x$	(a) $x = \frac{9}{2}$	(b) $x = -\frac{2}{3}$
3. $\frac{x}{7} + \frac{x}{5} = 1$	(a) $x = \frac{35}{12}$	(b) $x = 2$
4. $\frac{x+2}{6} = \frac{7}{2}$	(a) $x = -12$	(b) $x = 19$

In Exercises 5–24, solve the equation and check the result. (Some of the equations have no solutions.)

- | | | | |
|---|--|------------------------------|------------------------------------|
| 5. $17 - 7x = 3$ | 6. $3 + 6x = 51$ | 7. $4y - 6(y - 5) = 2$ | 8. $7x + 2(7 - x) = 8$ |
| 9. $1.4t + 2.1 = 0.9t - 2$ | 10. $8(x - 2) = 3(x - 2)$ | 11. $\frac{3x}{4} = 4$ | 12. $-\frac{5x}{14} = \frac{1}{2}$ |
| 13. $\frac{4}{5}x - \frac{1}{10} = \frac{3}{2}$ | 14. $\frac{1}{4}s + \frac{3}{8} = \frac{5}{2}$ | 15. $\frac{v - 20}{-8} = 2v$ | 16. $x + \frac{2x}{5} = 1$ |
| 17. $10x(x - 3) = 0$ | 18. $3x(4x + 7) = 0$ | 19. $v^2 - 100 = 0$ | 20. $(x + 3)^2 - 25 = 0$ |
| 21. $x^2 - 25x = -150$ | 22. $4t^2 - 12t = -9$ | 23. $3s^2 - 2s - 8 = 0$ | 24. $z(5 - z) + 36 = 0$ |

In Exercises 25–28, solve the equation and round your answer to two decimal places. (A calculator may be helpful.)

- | | | | |
|------------------------|-----------------------------|-------------------------------|----------------------------------|
| 25. $382x - 575 = 715$ | 26. $3.625x + 3.5 = 22.125$ | 27. $\frac{x}{2.33} = 14.302$ | 28. $\frac{7x}{3} + 2.5 = 8.125$ |
|------------------------|-----------------------------|-------------------------------|----------------------------------|

In Exercises 29–32, solve the equation for the specified variable.

- | | |
|---|--|
| 29. $2x - 7y + 4 = 0$, Solve for x . | 30. $\frac{3}{5}u - 4v = 2v + 3$, Solve for v . |
| 31. $V = \pi r^2 h$, Solve for h . | 32. $S = 2\pi r^2 + 2\pi rh$, Solve for h . |

In Exercises 33 and 34, plot the points in a rectangular coordinate system.

- | | |
|---|--|
| 33. $(0, -3)$, $(\frac{5}{2}, 5)$, $(-2, -4)$ | 34. $(1, -\frac{3}{2})$, $(-2, 2\frac{3}{4})$, $(5, 10)$ |
|---|--|

In Exercises 35–38, plot the points and find the distance between them. If appropriate, round the result to two decimal places.

- | | | | |
|-------------------------|---------------------------|---------------------------|----------------------------|
| 35. $(1, 3)$, $(5, 6)$ | 36. $(2, -5)$, $(6, -5)$ | 37. $(-6, -1)$, $(1, 2)$ | 38. $(-2, 10)$, $(3, -2)$ |
|-------------------------|---------------------------|---------------------------|----------------------------|

Review Exercises

A set of review exercises appears at the end of each chapter. Answers to all odd-numbered review exercises appear at the end of the text.

Graphs, and Functions

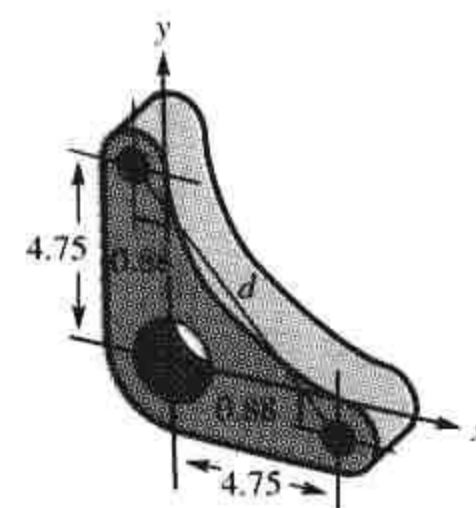
62. $h(x) = \begin{cases} x^3, & \text{if } x \leq 1 \\ (x - 1)^2 + 1, & \text{if } x > 1 \end{cases}$
- (a) $h(2)$ (b) $h(-\frac{1}{2})$ (c) $h(0)$ (d) $h(4) - h(3)$
64. $f(x) = 3x$
- (a) $\frac{f(x+1) - f(1)}{x}$ (b) $\frac{f(x-5) - f(5)}{x}$
66. $f(x) = 8$
- (a) $f(x+h)$ (b) $\frac{f(x+h) - f(x)}{h}$

69. $f(x) = \frac{1}{5-x}$ 70. $G(x) = \sqrt{x+4}$

In Exercises 71–76, (a) describe the transformation and (b) sketch the graph.

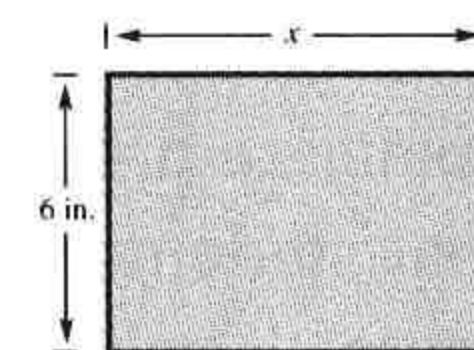
- | | | |
|------------------------|--------------------------|------------------------|
| 71. $g(x) = -(x+1)^2$ | 72. $h(x) = 9 - (x-2)^2$ | 73. $f(t) = t-2 - 1$ |
| 74. $f(x) = x+1 - 2$ | 75. $g(x) = x^3 - 2$ | 76. $h(x) = (x-2)^3$ |

77. **Rocker Arm Design** Find the distance d between the centers of the two small bolt holes in the rocker arm shown in the figure. Round the result to two decimal places.

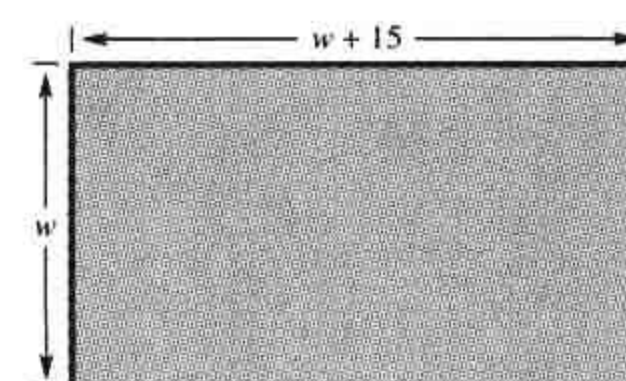


78. **Velocity of a Ball** The velocity of a ball thrown upward from ground level is given by $v = -32t + 80$, where t is the time in seconds and v is the velocity in feet per second.
- (a) Find the velocity when $t = 2$.
- (b) Find the time when the ball reaches its maximum height. (Hint: Find the time when $v = 0$.)
- (c) Find the velocity when $t = 3$.

79. **Dimensions of a Rectangle** The area of the rectangle in the figure is 48 square inches. Find x .



80. **Dimensions of a Rectangle** The perimeter of the rectangle in the figure is 110 feet. Find the dimensions of the rectangle.



Geometry

Geometric formulas and concepts are reviewed throughout the text. For reference, common formulas are presented inside the front and back covers.

2

Chapter Test

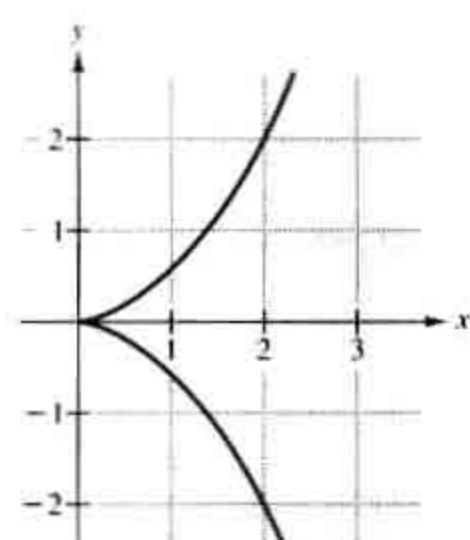
Take this test as you would take a test in class. After you are done, check your work against the answers in the back of the book.

- Determine whether the given value of x is a solution of the equation $3(5 - 2x) - (3x - 1) = -2$.
(a) $x = -4$ (b) $x = 2$
- Solve for r in the equation $2(r - s) = 5r - 4s + 1$.

In Exercises 3–8, solve the equation.

- $6x - 5 = 19$
- $15 - 7(1 - x) = 3(x + 8)$
- $\frac{2x}{3} = \frac{x}{2} + 4$
- $\frac{t - 5}{12} = \frac{3}{8}$
- $(y + 2)^2 - 9 = 0$
- $12 + 5y - 3y^2 = 0$

- Determine the quadrant in which the point (x, y) lies if $xy > 0$. Explain your reasoning.
- Find the distance between the points $(0, 9)$ and $(3, 1)$.
- Find the x - and y -intercepts of the graph of the equation $y = x(x + 1) - 3(x + 1)$.
- Sketch the graph of the equation $y = |x - 2|$.
- Use the vertical line test on the graph in the figure to determine whether the equation $y^2(4 - x) = x^3$ represents y as a function of x .



- Evaluate the function $f(x) = 3x - 2$ at the indicated values.
(a) $f(6)$ (b) $f(x + h) - f(x)$
(c) $f(t + 1)$ (d) $f\left(\frac{5}{3}\right)$
- Sketch the graph of the function $g(x) = \sqrt{x - 3} + 1$.

Cumulative Test

Cumulative tests have been placed after Chapters 3, 6, and 10. These tests reinforce the message that is presented throughout the text — that mathematics is a continuing story and requires constant synthesis and review. Answers are given at the end of the text.

Chapter Test

Each chapter contains an end-of-chapter test. Answers to chapter tests are given at the end of the text.

1-3

Cumulative Test

Take this test as you would take a test in class. After you are done, check your work against the answers in the back of the book.

In Exercises 1 and 2, evaluate the expression.

- $18 - (3 - 8)$
- $-\frac{8}{45} \div \frac{12}{25}$

In Exercises 3–6, perform the indicated operations and simplify.

- $(2a^2b)^3(-ab^2)^2$
- $3xy(x^2 - 2) - xy(x^2 + 5)$
- $t(3t - 1) - 2t(t + 4)$
- $[2 + (x - y)]^2$

In Exercises 7–10, solve the equation.

- $12 - 5(3 - x) = x + 3$
- $1 - \frac{x + 2}{4} = \frac{7}{8}$
- $y^2 - 64 = 0$
- $2t^2 - 5t - 3 = 0$

11. Determine whether the equation $x - y^3 = 0$ represents y as a function of x .

12. Find the domain of the function $f(x) = \sqrt{x - 2}$.

- Given $f(x) = x^2 - 3x$, find
(a) $f(4)$
(b) $f(c + 3)$.

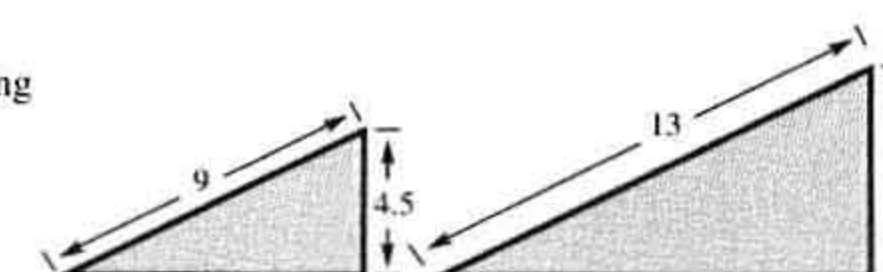
14. Write an algebraic expression for the statement, "The number n is tripled and the product is decreased by 8."

15. Find two consecutive integers such that their sum is 89 less than their product.

16. The annual insurance premium for a policyholder is \$1225. Find the annual premium if the policyholder must pay a 15% surcharge because of a driving violation.

17. Solve the proportion $\frac{t - 1}{4} = \frac{11}{12}$.

18. Solve for the length x of the side of the second triangle by using the fact that corresponding sides of similar triangles are proportional.



19. Solve and sketch the solution $|x - 2| \geq 3$.

20. The revenue from selling x units of a product is $R = 12.90x$. The cost of producing x units is $C = 8.50x + 450$. For a profit to be obtained, the revenue must be greater than the cost. For what values of x will this product produce a profit?

- Consider the two points $(-4, 0)$ and $(4, 6)$.
(a) Find the distance between the points.
(b) Find an equation of the line through the points.

22. Sketch a graph of the linear equation $4x + 3y - 12 = 0$.

Supplements

Intermediate Algebra: Graphs and Functions by Larson, Hostetler, and Neptune is accompanied by a comprehensive supplements package for maximum teaching effectiveness and efficiency.

Instructor's Annotated Edition

Student Study and Solutions Guide by Carolyn F. Neptune, Johnson County Community College

Complete Solutions Guide by Carolyn F. Neptune, Johnson County Community College

Test Item File with Ready-made Tests by David C. Falvo, The Pennsylvania State University, The Behrend College

Intermediate Algebra: Graphs and Functions Videotapes by Dana Mosely, Valencia Community College

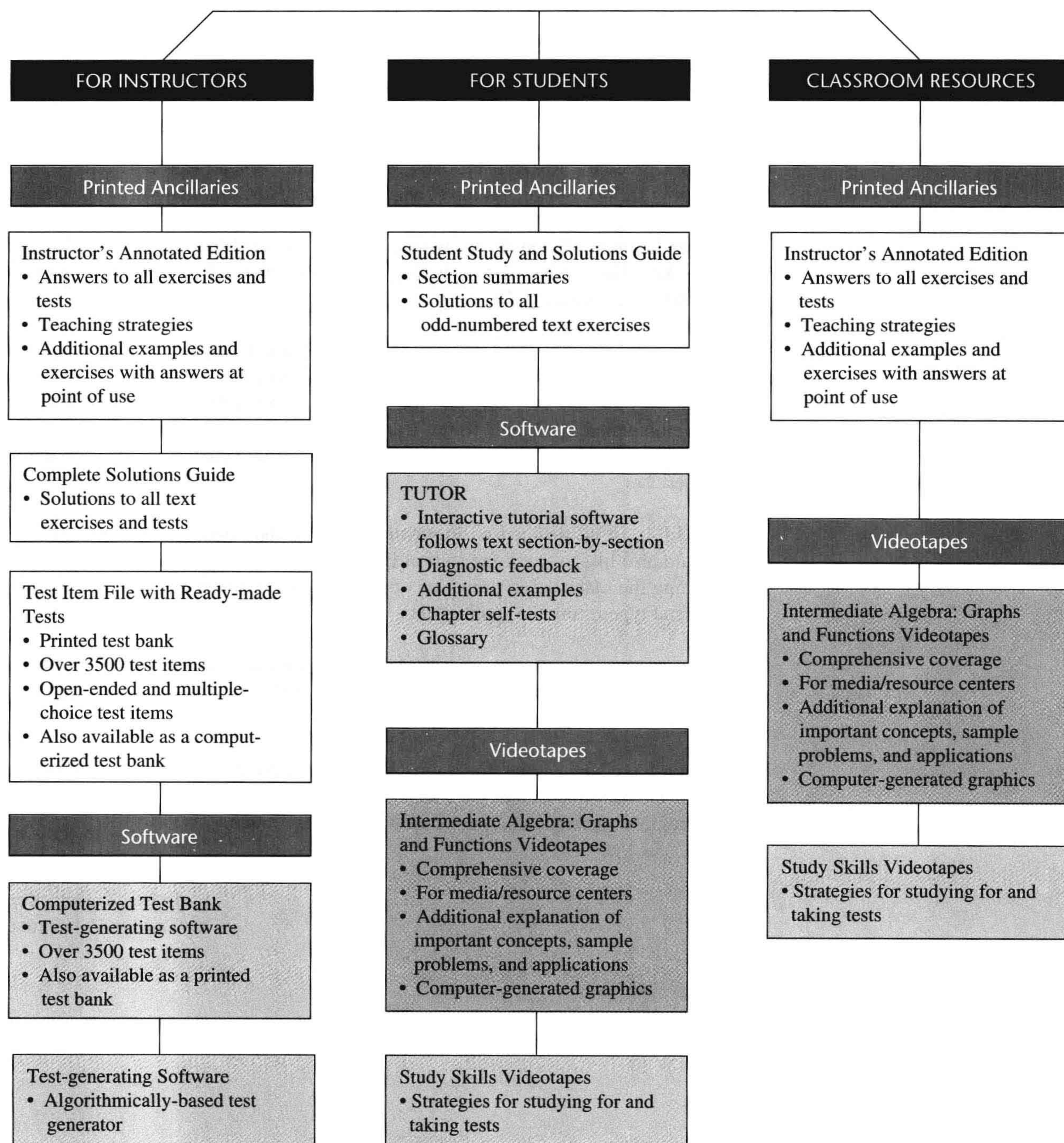
Intermediate Algebra: Graphs and Functions TUTOR by Timothy R. Larson and John R. Musser

Test-Generating Software (Macintosh, IBM)

Study Skills Videotapes by Paul Nolting

This complete supplements package offers ancillary materials for students and instructors and for classroom resources. Each item is keyed directly to the textbook for ease of use. For the convenience of software users, a technical support telephone number is available with all D.C. Heath software products: (617) 860-1218. The components of this comprehensive teaching and learning package are outlined on the following page.

INTERMEDIATE ALGEBRA: GRAPHS AND FUNCTIONS



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Roland E. Larson
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