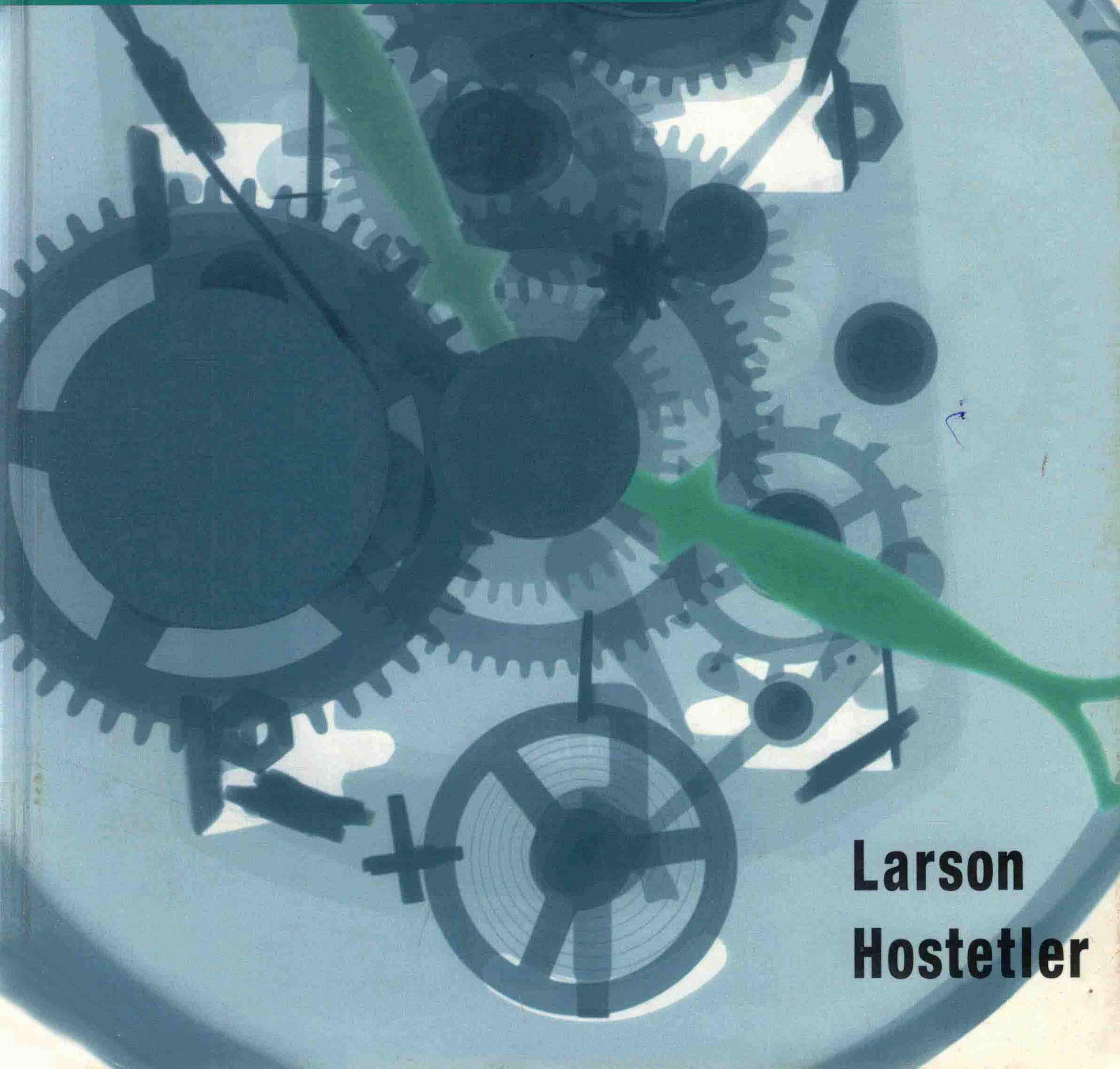
Intermediate Algebra

THIRD EDITION



Larson
Hostetler

Intermediate Algebra

Third Edition

Ron Larson
The Pennsylvania State University
The Behrend College

Robert P. Hostetler
The Pennsylvania State University
The Behrend College

With the assistance of
David E. Heyd
The Pennsylvania State University
The Behrend College

Houghton Mifflin Company
Boston New York

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We have included examples and exercises that use real-life data as well as technology output from a variety of software. This would not have been possible without the help of many people and organizations. Our wholehearted thanks go to all for their time and effort.

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A Word from the Authors

Welcome to *Intermediate Algebra*, Third Edition. In this revision, we have continued to focus on developing students' proficiency and conceptual understanding of algebra. We hope you enjoy the Third Edition.

In response to intermediate algebra instructors, we have revised and reorganized the coverage of topics for the Third Edition. To improve the flow of the material, Chapter 2 "Graphs and Functions" now includes Section 2.4 "Equations of Lines" (formerly Section 7.1). Chapter 4 "Rational Expressions, Equations, and Functions" now includes Section 4.1 "Integer Exponents and Scientific Notation" (formerly Section 5.1). Chapter 7 has been renamed "Linear Models and Graphs of Nonlinear Models." "Variation" has been moved forward from Section 7.5 to Section 7.1, and "Graphs of Rational Functions" has been moved from Section 4.5 to Section 7.5.

In order to address the diverse needs and abilities of students, we offer a straightforward approach to the presentation of difficult concepts. In the Third Edition, the emphasis is on helping students learn a variety of techniques—symbolic, numeric, and visual—for solving problems. We are committed to providing students with a successful and meaningful course of study.

Our approach begins with Motivating the Chapter, a new feature that introduces each chapter. These multipart problems are designed to show students the relevance of algebra to the world around them. Each Motivating the Chapter feature is a real-life application that requires students to apply the concepts of the chapter in order to solve each part of the problem. Problem-solving and critical thinking skills are emphasized here and throughout the text in applications that appear in the examples and exercise sets.

To improve the usefulness of the text as a study tool, we added Objectives, which highlight the main concepts that students will learn throughout the section. Each objective is restated in the margin at the point where the concept is introduced, to help keep students focused as they read the section. The Chapter Summary was revised for the Third Edition to make it a more comprehensive and effective study tool. It now highlights the important mathematical vocabulary (Key Terms) and primary concepts (Key Concepts) of the chapter. For easy reference, the Key Terms are correlated to the chapter by page number and the Key Concepts by section number.

As students proceed through each chapter they have many opportunities to assess their understanding. They can check their progress after each section with the exercise sets (which are correlated to examples in the section), midway through the chapter with the Mid-Chapter Quiz, and at the end of the chapter with the Review Exercises (which are correlated to the sections) and the Chapter Test. The exercises and test items were carefully chosen and graded in difficulty to allow students to gain confidence as they progress. In addition, students can assess their understanding of previously learned concepts through the Integrated Review exercises that precede the section exercise sets and the Cumulative Tests that follow Chapters 3, 6, and 9.

In the Third Edition, we combined the Technology and Discovery features of the Second Edition. Technology Tips provide point-of-use instructions for using a graphing utility. Technology Discovery features encourage students to explore mathematical concepts with graphing utilities and scientific calculators. Both are highlighted and can easily be omitted without loss of continuity in coverage of material.

To show students the practical uses of algebra, we highlight the connections between the mathematical concepts and the real world in the multitude of applications found throughout the text. We believe that students can overcome their difficulties in mathematics if they are encouraged and supported throughout the learning process. Too often, students become frustrated and lose interest in the material when they cannot follow the text. With this in mind, every effort has been made to write a readable text that can be understood by every student. We hope that your students find our approach engaging and effective.

Ron Larson

Robert P. Hostetler

Features

1 Linear Equations and Inequalities

Rob Crandall/Stock Boston

In 1996, 96 million households in the United States had televisions. Of these, 63 million or 65.3% had cable television provided by one of over 11,000 cable television systems. (Source: Television Bureau of Advertising, Inc., Warren Publishing)

Motivating the Chapter

Cable Television and You

You are having cable television installed in your house. You need to decide if you will purchase one or more premium movie channels or pay-per-view movies. You will not have both. Standard service is $31.20 per month and is required if you want a premium movie channel or pay-per-view movies. Each premium movie channel is $11.91 per month, and pay-per-view is $2.99 per month plus $3.95 per movie.

See Section 1.3, Exercise 86

a. Write a verbal model that gives the monthly cost of cable television based on the number of premium movie channels that you order.
b. Write an algebraic equation for your verbal model from part (a). Create a table that shows the amount paid per month for one, two, three, four, and five premium movie channels.
c. Write a verbal model that gives the monthly cost of cable television based on the number of pay-per-view movies you watch.
d. Write an algebraic equation for your verbal model from part (c). Create a table that shows the amount paid per month for one, two, three, four, five, six, seven, and eight pay-per-view movies.
e. If you are paying for two premium movie channels, what percent of your bill goes to paying for these movie channels?

See Section 1.4, Exercise 121

f. Your budget allows you to spend at most $50 per month on cable television. Use the algebraic model from part (b) to determine the number of premium movie channels you could purchase each month.
g. Your budget allows you to spend at most $50 per month on cable television. Use the algebraic model from part (d) to determine the number of pay-per-view movies that you could watch each month. Compare this with your answer to part (f). Which option would you choose, and why?

Chapter Opener *New*

Every chapter opens with *Motivating the Chapter*. Each of these multipart problems incorporates the concepts presented in the chapter in the context of a single real-world application. *Motivating the Chapter* problems are correlated to sections and exercises and can be assigned as students work through the chapter or can be assigned as individual or group projects. The icon identifies an exercise that relates back to *Motivating the Chapter*.

Section Opener *New*

Every section begins with a list of learning objectives. Each objective is restated in the margin at the point where it is covered.

Historical Note

Historical notes featuring mathematicians or mathematical artifacts are included throughout the text.

122 Chapter 2 Graphs and Functions

2.1 The Rectangular Coordinate System

Objectives

1 Plot points on a rectangular coordinate system.
2 Determine whether an ordered pair is a solution of an equation.
3 Use the Distance Formula to determine the distance between two points.

1 Plot points on a rectangular coordinate system.


Corbis-Bettmann

René Descartes
(1596–1650)
Descartes was a French mathematician, philosopher, and scientist. He is sometimes called the father of modern philosophy, and his phrase "I think, therefore I am" has been quoted often. In mathematics, Descartes is known as the father of analytic geometry. Prior to Descartes's time, geometry and algebra were separate mathematical studies. It was Descartes's introduction of the rectangular coordinate system that brought the two studies together.

The Rectangular Coordinate System

Just as you can represent real numbers by points on the real number line, you can represent ordered pairs of real numbers by points in a plane. This plane is called a **rectangular coordinate system** or the **Cartesian plane**, after the French mathematician René Descartes.

A rectangular coordinate system is formed by two real number lines intersecting at a right angle, as shown in Figure 2.1. The horizontal number line is usually called the ***x*-axis**, and the vertical number line is usually called the ***y*-axis**. (The plural of axis is *axes*.) The point of intersection of the two axes is called the **origin**, and the axes separate the plane into four regions called **quadrants**.

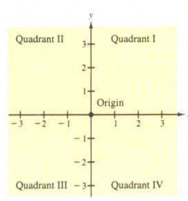

Figure 2.1

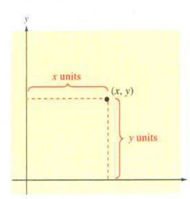

Figure 2.2

Each point in the plane corresponds to an **ordered pair** (x, y) of real numbers x and y, called the **coordinates** of the point. The first number (or ***x*-coordinate**) tells how far to the left or right the point is from the vertical axis, and the second number (or ***y*-coordinate**) tells how far up or down the point is from the horizontal axis, as shown in Figure 2.2.

A positive x-coordinate implies that the point lies to the *right* of the vertical axis; a negative x-coordinate implies that the point lies to the *left* of the vertical axis; and an x-coordinate of zero implies that the point lies *on* the vertical axis. Similar statements can be made about y-coordinates. A positive y-coordinate implies that the point lies *above* the horizontal axis; a negative y-coordinate implies that the point lies *below* the horizontal axis; and a y-coordinate of zero implies that the point lies *on* the horizontal axis.

3 Solve a linear equation in nonstandard form.

Solving Linear Equations in Nonstandard Form

Linear equations often occur in nonstandard forms that contain symbols of grouping or like terms that are not combined. Here are some examples.

$$x + 2 = 2x - 6, \quad 6(y - 1) = 2y - 3, \quad \frac{x}{18} + \frac{3x}{4} = 2$$

The next three examples show how to solve these linear equations.

Study Tip

Remember that the goal in solving any linear equation is to rewrite the given equation so that all the variable terms are on one side of the equal sign and all constant terms are on the other side.

Example 4 Solving a Linear Equation in Nonstandard Form

$x + 2 = 2x - 6$ Original equation

$-2x + x + 2 = -2x + 2x - 6$ Add $-2x$ to both sides.

$-x + 2 = -6$ Combine like terms.

$-x + 2 - 2 = -6 - 2$ Subtract 2 from both sides.

$-x = -8$ Combine like terms.

$(-1)(-x) = (-1)(-8)$ Multiply both sides by -1.

$x = 8$ Simplify.

The solution is 8. Check this in the original equation.

In most cases, it helps to remove symbols of grouping as a first step in solving an equation. This is illustrated in Example 5.

Example 5 Solving a Linear Equation That Contains Parentheses

$6(y - 1) = 2y - 3$ Original equation

$6y - 6 = 2y - 3$ Distributive Property

$6y - 2y - 6 = 2y - 2y - 3$ Subtract $2y$ from both sides.

$4y - 6 = -3$ Combine like terms.

$4y - 6 + 6 = -3 + 6$ Add 6 to both sides.

$4y = 3$ Combine like terms.

$\frac{4y}{4} = \frac{3}{4}$ Divide both sides by 4.

$y = \frac{3}{4}$ Simplify.

The solution is $\frac{3}{4}$. Check this in the original equation.

Examples

Each example was carefully chosen to illustrate a particular mathematical concept or problem-solving technique. The examples cover a wide variety of problems and are titled for easy reference. Many examples include detailed, step-by-step solutions with side comments, which explain the key steps of the solution process.

Applications

A wide variety of real-life applications are integrated throughout the text in examples and exercises. These applications demonstrate the relevance of algebra in the real world. Many of the applications use current, real data. The icon indicates an example that involves a real-life application.

As a consumer today, you are presented almost daily with vast amounts of data given in various forms. Data are given in *numerical* form using lists and tables and in *graphical* form using scatter plots, lines, circle graphs, and bar graphs. Graphical forms are more visual and make wide use of Descartes's rectangular coordinate system to show the relationship between two variables. Today, Descartes's ideas are commonly used in virtually every scientific and business-related field.

Example 3 Representing Data Graphically

The population (in millions) of California from 1982 through 1997 is listed in the table. Plot these points on a rectangular coordinate system. (Source: U.S. Bureau of the Census)

Year	1982	1983	1984	1985	1986	1987	1988	1989
Population	24.8	25.4	25.8	26.4	27.1	27.8	28.5	29.2

Year	1990	1991	1992	1993	1994	1995	1996	1997
Population	29.8	30.4	30.9	31.2	31.4	31.6	31.9	32.3

Solution

Begin by choosing which variable will be plotted on the horizontal axis and which will be plotted on the vertical axis. For these data, it seems natural to plot the years on the horizontal axis (which means that the population must be plotted on the vertical axis). Next, use the data in the table to form ordered pairs. For instance, the first three ordered pairs are (1982, 24.8), (1983, 25.4), and (1984, 25.8). All 16 points are shown in Figure 2.5. Note that the break in the x-axis indicates that the numbers between 0 and 1982 have been omitted. The break in the y-axis indicates that the numbers between 0 and 24 have been omitted.

Population of California

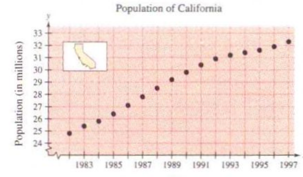

Figure 2.5

Problem Solving

This text provides many opportunities for students to sharpen their problem-solving skills. In both the examples and the exercises, students are asked to apply verbal, numerical, analytical, and graphical approaches to problem solving. In the spirit of the AMATYC and NCTM standards, students are taught a five-step strategy for solving applied problems, which begins with constructing a verbal model and ends with checking the answer.

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2 Use a mathematical model to solve a mixture problem.

Rates in Mixture Problems

Many real-life problems involve combinations of two or more quantities that make up new or different quantities. Such problems are called **mixture problems.** They are usually composed of the sum of two or more "hidden products" that involve rate factors. Here is the generic form of the verbal model for mixture problems.

First rate · Amount + Second rate · Amount = Final rate · Final amount

Example 4 A Mixture Problem

A nursery wants to mix two types of lawn seed. Type A sells for $10 per pound and type B sells for $15 per pound. To obtain 20 pounds of a mixture at $12 per pound, how many pounds of each type of seed are needed?

Solution

The rates are the unit prices for each type of seed.

Verbal Model: Total cost of $10 seed + Total cost of $15 seed = Total cost of $12 seed

Labels:
Unit price of type A = 10 (dollars per pound)
Pounds of $10 seed = x (pounds)
Unit price of type B = 15 (dollars per pound)
Pounds of $15 seed = $20 - x$ (pounds)
Unit price of mixture = 12 (dollars per pound)
Pounds of $12 seed = 20 (pounds)

Equation: $10x + 15(20 - x) = 12(20)$

$10x + 300 - 15x = 240$ Distributive Property

$300 - 5x = 240$ Combine like terms.

$-5x = -60$ Subtract 300 from both sides.

$x = 12$ Divide both sides by −5.

The mixture should contain 12 pounds of the $10 seed and 20 − 12 = 8 pounds of the $15 seed.

Study Tip

When you set up a verbal model, be sure to check that you are working with the *same type of units* in each part of the model. For instance, in Example 4 note that each of the three parts of the verbal model measures cost. (If two parts measured cost and the other part measured pounds, you would know that the model was incorrect.)

Remember that when you have found a solution, you should always go back to the original statement of the problem and check to see that the solution makes sense—both algebraically and from a practical point of view. For instance, you can check the result of Example 4 as follows.

$$\underbrace{\left(\frac{\$10}{\text{pound}}\right)\left(12 \text{ pounds}\right)}_{\$10\text{ seed}} + \underbrace{\left(\frac{\$15}{\text{pound}}\right)\left(8 \text{ pounds}\right)}_{\$15\text{ seed}} = \underbrace{\left(\frac{\$12}{\text{pound}}\right)\left(20 \text{ pounds}\right)}_{\$12\text{ seed}}$$

$$\$120 + \$120 = \$240$$

Geometry

Coverage and integration of geometry in examples and exercises have been enhanced throughout the Third Edition.

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Example 7 Rewriting a Formula

In the perimeter formula $P = 2l + 2w$, solve for w.

Solution

$P = 2l + 2w$ Original formula

$P - 2l = 2w$ Subtract $2l$ from both sides.

$\frac{P - 2l}{2} = w$ Divide both sides by 2.

Example 8 Using a Geometric Formula

A local streets department plans to put sidewalks along the two streets that bound your corner lot, which is 250 feet long on one side with an area of 30,000 square feet. Each lot owner is to pay $1.50 per foot of sidewalk bordering his or her lot.

a. Find the width of your lot.

b. How much will you have to pay for the sidewalks put on your lot?

Solution

Figure 1.2 shows a labeled diagram of your lot.

a. *Verbal Model:* Area = Length · Width

Labels:
Area of lot = 30,000 (square feet)
Length of lot = 250 (feet)
Width of lot = w (feet)

Equation: $30{,}000 = 250 \cdot w$

$\frac{30{,}000}{250} = w$

$120 = w$

Your lot is 120 feet wide.

b. *Verbal Model:* Cost = Rate per foot · Length of sidewalk

Labels:
Cost of sidewalks = C (dollars)
Rate per foot = 1.50 (dollars per foot)
Total length of sidewalk = 120 + 250 (feet)

Equation: $C = 1.50(120 + 250)$

$C = 1.50 \cdot 370$

$C = 555$

You will have to pay $555 to have the sidewalks put on your lot.

Study Tip

When solving problems such as the one in Example 8, you may find it helpful to draw and label a diagram.

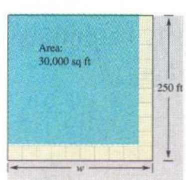


Figure 1.2

FEATURES

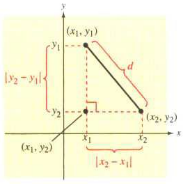


Figure 2.9 *Distance Between Two Points*

To develop a general formula for the distance between two points, let (x_1, y_1) and (x_2, y_2) represent two points in the plane (that do not lie on the same horizontal or vertical line). With these two points, a right triangle can be formed, as shown in Figure 2.9. Note that the third vertex of the triangle is (x_1, y_2). Because (x_1, y_1) and (x_1, y_2) lie on the same vertical line, the length of the vertical side of the triangle is $|y_2 - y_1|$. Similarly, the length of the horizontal side is $|x_2 - x_1|$. By the Pythagorean Theorem, the square of the distance between (x_1, y_1) and (x_2, y_2) is

$$d^2 = |x_2 - x_1|^2 + |y_2 - y_1|^2.$$

Because the distance d must be positive, you can choose the positive square root and write

$$d = \sqrt{|x_2 - x_1|^2 + |y_2 - y_1|^2}.$$

Finally, replacing $|x_2 - x_1|^2$ and $|y_2 - y_1|^2$ by the equivalent expressions $(x_2 - x_1)^2$ and $(y_2 - y_1)^2$ gives you the **Distance Formula.**

▶ The Distance Formula

The distance d between two points (x_1, y_1) and (x_2, y_2) is

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}.$$

Note that for the special case in which the two points lie on the same vertical or horizontal line, the Distance Formula still works. For instance, applying the Distance Formula to the points $(2, -2)$ and $(2, 4)$ produces

$$d = \sqrt{(2-2)^2 + [4-(-2)]^2} = \sqrt{6^2} = 6$$

which is the same result obtained in Example 6.

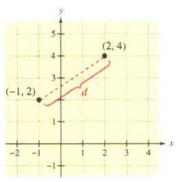


Figure 2.10

Example 7 **Finding the Distance Between Two Points**

Find the distance between the points $(-1, 2)$ and $(2, 4)$, as shown in Figure 2.10.

Solution

Let $(x_1, y_1) = (-1, 2)$ and $(x_2, y_2) = (2, 4)$, and apply the Distance Formula.

$d = \sqrt{[2-(-1)]^2 + (4-2)^2}$	Substitute coordinates of points.
$= \sqrt{3^2 + 2^2}$	Simplify.
$= \sqrt{13}$	Simplify.
≈ 3.61	Use a calculator.

When using the Distance Formula, it does not matter which point is considered (x_1, y_1) and which is (x_2, y_2), because the result will be the same. For instance, in Example 7, let $(x_1, y_1) = (2, 4)$ and $(x_2, y_2) = (-1, 2)$. Then

$$d = \sqrt{[(-1) - 2]^2 + (2-4)^2} = \sqrt{(-3)^2 + (-2)^2} = \sqrt{13} \approx 3.61.$$

Definitions and Rules

All important definitions, rules, formulas, properties, and summaries of solution methods are highlighted for emphasis. Each of these features is also titled for easy reference.

Graphics

Visualization is a critical problem-solving skill. To encourage the development of this skill, students are shown how to use graphs to reinforce algebraic and numeric solutions and to interpret data. The numerous figures in examples and exercises throughout the text were computer generated for accuracy.

Technology Tips

Point-of-use instructions for using graphing utilities appear in the margins. They provide convenient reference for students using graphing technology. In addition, they encourage the use of graphing technology as a tool for visualization of mathematical concepts, for verification of other solution methods, and for facilitation of computations. The *Technology Tips* can easily be omitted without loss of continuity in coverage.

2 Solve a rational equation containing variable denominators.

Equations Containing Variable Denominators

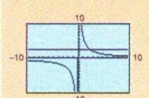
Remember that you always *exclude* those values of a variable that make the denominator of a rational expression zero. This is especially critical for solving equations that contain variable denominators. You will see why in the examples that follow.

Technology: Tip

You can use a graphing utility to estimate the solution of the equation in Example 4. To do this, graph the left side of the equation and the right side of the equation on the same screen.

$$y_1 = \frac{7}{x} - \frac{1}{3x} \text{ and } y_2 = \frac{8}{3}$$

The solution of the equation is the x-coordinate of the point at which the two graphs intersect, as shown below.



Example 4 **An Equation Containing Variable Denominators**

Solve the equation.

$$\frac{7}{x} - \frac{1}{3x} = \frac{8}{3}$$

Solution

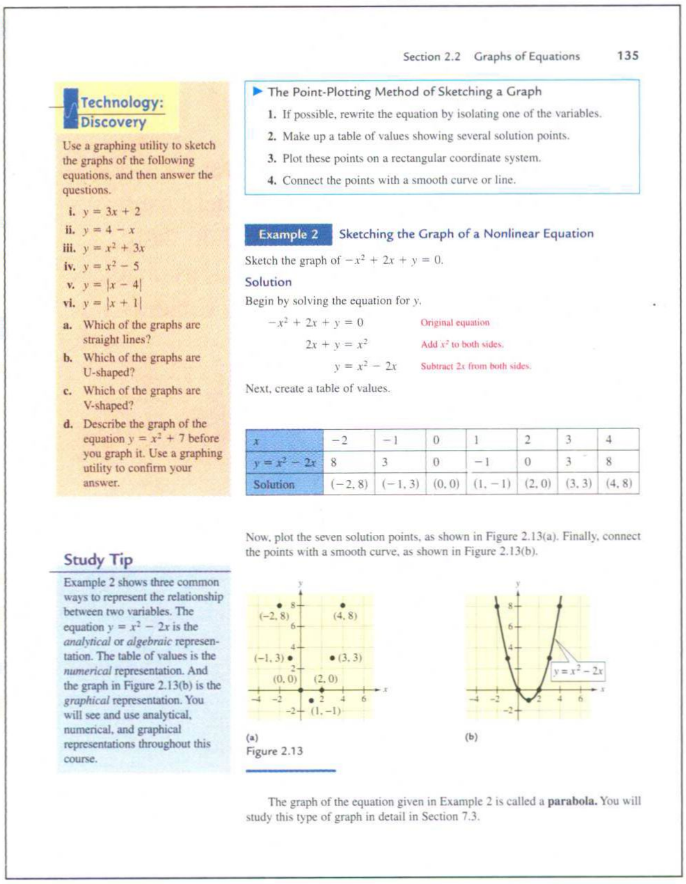
For this equation, the least common denominator is $3x$. So, begin by multiplying both sides of the equation by $3x$.

$\frac{7}{x} - \frac{1}{3x} = \frac{8}{3}$	Original equation
$3x\left(\frac{7}{x} - \frac{1}{3x}\right) = 3x\left(\frac{8}{3}\right)$	Multiply both sides by LCD of $3x$.
$\frac{21x}{x} - \frac{3x}{3x} = \frac{24x}{3}$	Distributive Property
$21 - 1 = 8x$	Simplify.
$\frac{20}{8} = x$	Combine like terms and divide both sides by 8.
$x = \frac{5}{2}$	Simplify.

The solution is $\frac{5}{2}$. You can check this as follows.

Check

$\frac{7}{x} - \frac{1}{3x} = \frac{8}{3}$	Original equation
$\frac{7}{5/2} - \frac{1}{3(5/2)} \stackrel{?}{=} \frac{8}{3}$	Substitute $\frac{5}{2}$ for x.
$7\left(\frac{2}{5}\right) - \frac{2}{15} \stackrel{?}{=} \frac{8}{3}$	Invert and multiply.
$\frac{14}{5} - \frac{2}{15} \stackrel{?}{=} \frac{8}{3}$	Simplify.
$\frac{40}{15} \stackrel{?}{=} \frac{8}{3}$	Combine like terms.
$\frac{8}{3} = \frac{8}{3}$	Solution checks. ✓



Technology: Discovery

Use a graphing utility to sketch the graphs of the following equations, and then answer the questions.

i. $y = 3x + 2$
ii. $y = 4 - x$
iii. $y = x^2 + 3x$
iv. $y = x^2 - 5$
v. $y = |x - 4|$
vi. $y = |x + 1|$

a. Which of the graphs are straight lines?
b. Which of the graphs are U-shaped?
c. Which of the graphs are V-shaped?
d. Describe the graph of the equation $y = x^2 + 7$ before you graph it. Use a graphing utility to confirm your answer.

▶ **The Point-Plotting Method of Sketching a Graph**

1. If possible, rewrite the equation by isolating one of the variables.
2. Make up a table of values showing several solution points.
3. Plot these points on a rectangular coordinate system.
4. Connect the points with a smooth curve or line.

Example 2 Sketching the Graph of a Nonlinear Equation

Sketch the graph of $-x^2 + 2x + y = 0$.

Solution

Begin by solving the equation for y.

$-x^2 + 2x + y = 0$ — Original equation

$2x + y = x^2$ — Add x^2 to both sides.

$y = x^2 - 2x$ — Subtract $2x$ from both sides.

Next, create a table of values.

x	-2	-1	0	1	2	3	4
$y = x^2 - 2x$	8	3	0	-1	0	3	8
Solution	$(-2, 8)$	$(-1, 3)$	$(0, 0)$	$(1, -1)$	$(2, 0)$	$(3, 3)$	$(4, 8)$

Now, plot the seven solution points, as shown in Figure 2.13(a). Finally, connect the points with a smooth curve, as shown in Figure 2.13(b).

Study Tip

Example 2 shows three common ways to represent the relationship between two variables. The equation $y = x^2 - 2x$ is the *analytical* or *algebraic* representation. The table of values is the *numerical* representation. And the graph in Figure 2.13(b) is the *graphical* representation. You will see and use analytical, numerical, and graphical representations throughout this course.

(a) (b)

Figure 2.13

The graph of the equation given in Example 2 is called a **parabola.** You will study this type of graph in detail in Section 7.3.

Technology Discovery

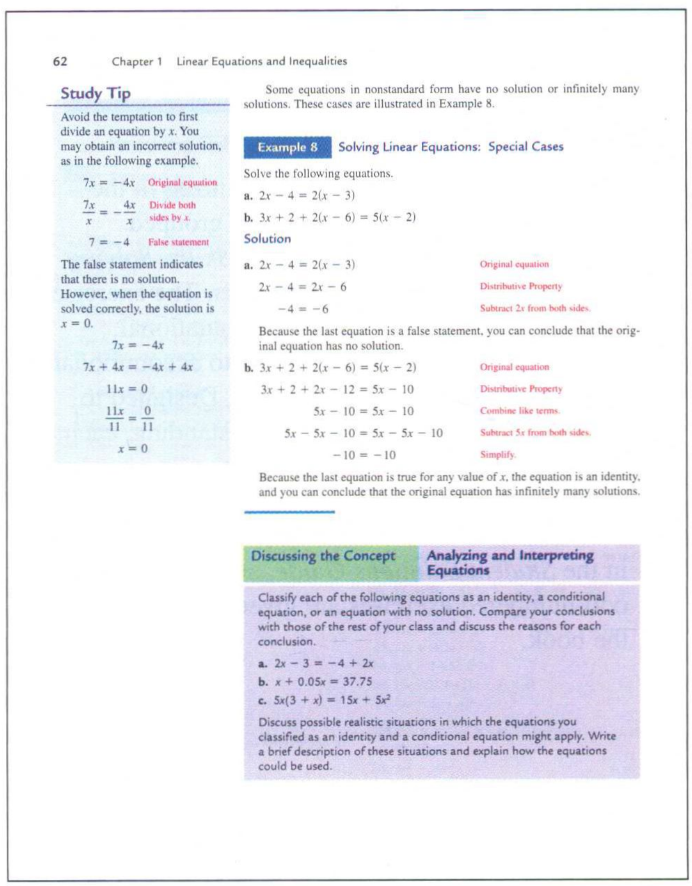
Utilizing the power of technology (scientific calculators and graphing utilities), *Technology Discovery* invites students to engage in active exploration of mathematical concepts and discovery of mathematical relationships. These activities encourage students to use their critical thinking skills and help them develop an intuitive understanding of theoretical concepts. *Technology Discovery* features can easily be omitted without loss of continuity of coverage.

Study Tips

Study Tips offer students specific point-of-use suggestions for studying algebra, as well as pointing out common errors and discussing alternative solution methods. They appear in the margins.

Discussing the Concept

Each section concludes with a *Discussing the Concept* feature. Designed as a section wrap-up activity to give students an opportunity to think, talk, and write about mathematics, each of these activities encourages students to synthesize the mathematical concepts presented in the section. *Discussing the Concept* can be assigned as an independent or collaborative activity or can be used as a basis for a class discussion.



Study Tip

Avoid the temptation to first divide an equation by x. You may obtain an incorrect solution, as in the following example.

$7x = -4x$ — Original equation

$\frac{7x}{x} = -\frac{4x}{x}$ — Divide both sides by x.

$7 = -4$ — False statement

The false statement indicates that there is no solution. However, when the equation is solved correctly, the solution is $x = 0$.

$$7x = -4x$$
$$7x + 4x = -4x + 4x$$
$$11x = 0$$
$$\frac{11x}{11} = \frac{0}{11}$$
$$x = 0$$

Some equations in nonstandard form have no solution or infinitely many solutions. These cases are illustrated in Example 8.

Example 8 Solving Linear Equations: Special Cases

Solve the following equations.

a. $2x - 4 = 2(x - 3)$

b. $3x + 2 + 2(x - 6) = 5(x - 2)$

Solution

a. $2x - 4 = 2(x - 3)$ — Original equation

$2x - 4 = 2x - 6$ — Distributive Property

$-4 = -6$ — Subtract $2x$ from both sides.

Because the last equation is a false statement, you can conclude that the original equation has no solution.

b. $3x + 2 + 2(x - 6) = 5(x - 2)$ — Original equation

$3x + 2 + 2x - 12 = 5x - 10$ — Distributive Property

$5x - 10 = 5x - 10$ — Combine like terms.

$5x - 5x - 10 = 5x - 5x - 10$ — Subtract $5x$ from both sides.

$-10 = -10$ — Simplify.

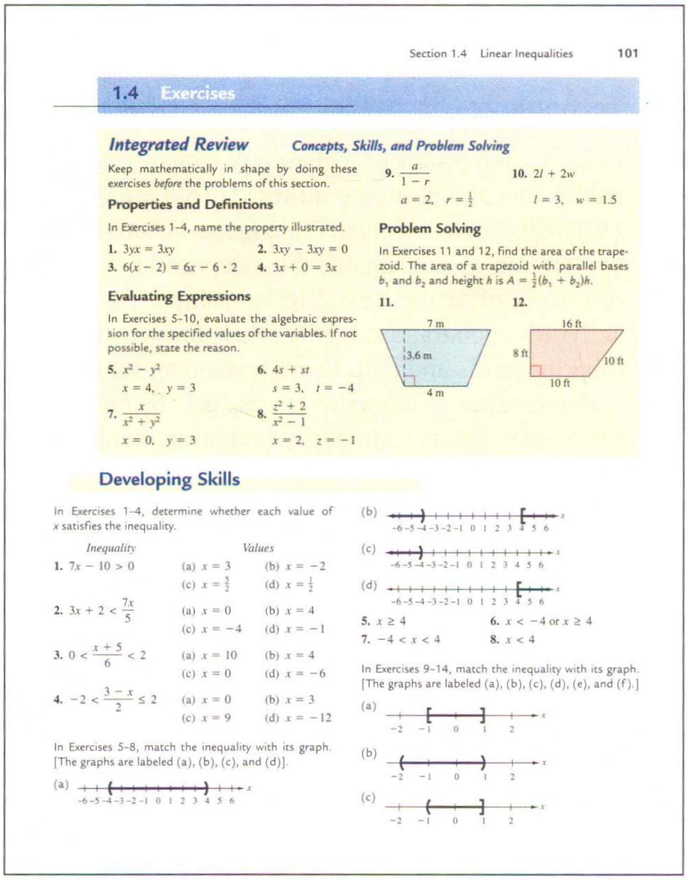
Because the last equation is true for any value of x, the equation is an identity, and you can conclude that the original equation has infinitely many solutions.

Discussing the Concept **Analyzing and Interpreting Equations**

Classify each of the following equations as an identity, a conditional equation, or an equation with no solution. Compare your conclusions with those of the rest of your class and discuss the reasons for each conclusion.

a. $2x - 3 = -4 + 2x$
b. $x + 0.05x = 37.75$
c. $5x(3 + x) = 15x + 5x^2$

Discuss possible realistic situations in which the equations you classified as an identity and a conditional equation might apply. Write a brief description of these situations and explain how the equations could be used.



Section 1.4 Linear Inequalities 101

1.4 Exercises

Integrated Review *Concepts, Skills, and Problem Solving*

Keep mathematically in shape by doing these exercises *before* the problems of this section.

Properties and Definitions

In Exercises 1–4, name the property illustrated.

1. $3yx = 3xy$
2. $3xy - 3xy = 0$
3. $6(x - 2) = 6x - 6 \cdot 2$
4. $3x + 0 = 3x$

Evaluating Expressions

In Exercises 5–10, evaluate the algebraic expression for the specified values of the variables. If not possible, state the reason.

5. $x^2 - y^2$; $x = 4,\ y = 3$
6. $4s + st$; $s = 3,\ t = -4$
7. $\frac{x}{x^2 + y^2}$; $x = 0,\ y = 3$
8. $\frac{z^2 + 2}{x^2 - 1}$; $x = 2,\ z = -1$
9. $\frac{a}{1 - r}$; $a = 2,\ r = \frac{1}{2}$
10. $2l + 2w$; $l = 3,\ w = 1.5$

Problem Solving

In Exercises 11 and 12, find the area of the trapezoid. The area of a trapezoid with parallel bases b_1 and b_2 and height h is $A = \frac{1}{2}(b_1 + b_2)h$.

11. 12.

Developing Skills

In Exercises 1–4, determine whether each value of x satisfies the inequality.

Inequality	Values	
1. $7x - 10 > 0$	(a) $x = 3$	(b) $x = -2$
	(c) $x = \frac{5}{2}$	(d) $x = \frac{1}{2}$
2. $3x + 2 < \frac{7x}{5}$	(a) $x = 0$	(b) $x = 4$
	(c) $x = -4$	(d) $x = -1$
3. $0 < \frac{x + 5}{6} < 2$	(a) $x = 10$	(b) $x = 4$
	(c) $x = 0$	(d) $x = -6$
4. $-2 < \frac{3 - x}{2} \le 2$	(a) $x = 0$	(b) $x = 3$
	(c) $x = 9$	(d) $x = -12$

In Exercises 5–8, match the inequality with its graph. [The graphs are labeled (a), (b), (c), and (d)].

(a) (b) (c) (d)

5. $x \ge 4$
6. $x < -4$ or $x \ge 4$
7. $-4 < x < 4$
8. $x < 4$

In Exercises 9–14, match the inequality with its graph. [The graphs are labeled (a), (b), (c), (d), (e), and (f).]

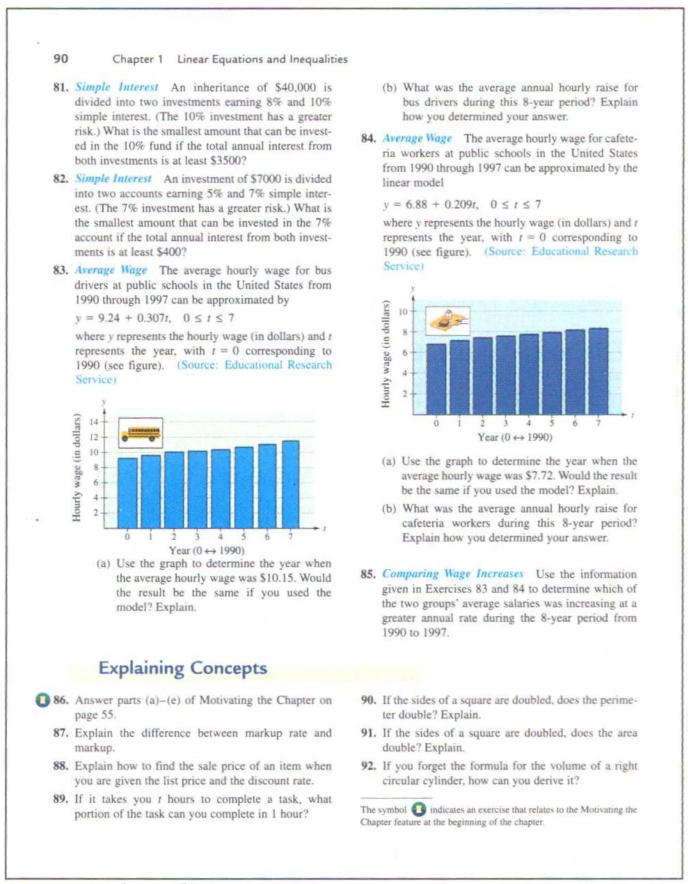
(a) (b) (c)

Integrated Review

Each exercise set (except in Chapter P) is preceded by *Integrated Review* exercises. These exercises are designed to help students keep up with concepts and skills learned in previous chapters. Answers to all *Integrated Review* problems are given in the back of the book.

Exercises

The exercise sets have been reorganized in the Third Edition. Each exercise set is grouped into three categories: *Developing Skills*, *Solving Problems*, and *Explaining Concepts*. The exercise sets offer a diverse variety of computational, conceptual, and applied problems to accommodate many teaching and learning styles. Designed to build competence, skill, and understanding, each exercise set is graded in difficulty to allow students to gain confidence as they progress. Detailed solutions to all odd-numbered exercises are given in the *Student Solutions Guide*, and answers to all odd-numbered exercises are given in the back of the book.



90 Chapter 1 Linear Equations and Inequalities

81. *Simple Interest* An inheritance of \$40,000 is divided into two investments earning 8% and 10% simple interest. (The 10% investment has a greater risk.) What is the smallest amount that can be invested in the 10% fund if the total annual interest from both investments is at least \$3500?

82. *Simple Interest* An investment of \$7000 is divided into two accounts earning 5% and 7% simple interest. (The 7% investment has a greater risk.) What is the smallest amount that can be invested in the 7% account if the total annual interest from both investments is at least \$400?

83. *Average Wage* The average hourly wage for bus drivers at public schools in the United States from 1990 through 1997 can be approximated by

$y = 9.24 + 0.307t,\quad 0 \le t \le 7$

where y represents the hourly wage (in dollars) and t represents the year, with $t = 0$ corresponding to 1990 (see figure). (Source: Educational Research Service)

(a) Use the graph to determine the year when the average hourly wage was \$10.15. Would the result be the same if you used the model? Explain.

(b) What was the average annual hourly raise for bus drivers during this 8-year period? Explain how you determined your answer.

84. *Average Wage* The average hourly wage for cafeteria workers at public schools in the United States from 1990 through 1997 can be approximated by the linear model

$y = 6.88 + 0.209t,\quad 0 \le t \le 7$

where y represents the hourly wage (in dollars) and t represents the year, with $t = 0$ corresponding to 1990 (see figure). (Source: Educational Research Service)

(a) Use the graph to determine the year when the average hourly wage was \$7.72. Would the result be the same if you used the model? Explain.

(b) What was the average annual hourly raise for cafeteria workers during this 8-year period? Explain how you determined your answer.

85. *Comparing Wage Increases* Use the information given in Exercises 83 and 84 to determine which of the two groups' average salaries was increasing at a greater annual rate during the 8-year period from 1990 to 1997.

Explaining Concepts

86. Answer parts (a)–(e) of Motivating the Chapter on page 55.
87. Explain the difference between markup rate and markup.
88. Explain how to find the sale price of an item when you are given the list price and the discount rate.
89. If it takes you t hours to complete a task, what portion of the task can you complete in 1 hour?
90. If the sides of a square are doubled, does the perimeter double? Explain.
91. If the sides of a square are doubled, does the area double? Explain.
92. If you forget the formula for the volume of a right circular cylinder, how can you derive it?

The symbol indicates an exercise that relates to the Motivating the Chapter feature at the beginning of the chapter.

CHAPTER SUMMARY

Key Terms

rectangular coordinate system, *p. 122*
Cartesian plane, *p. 122*
x-axis, *p. 122*
y-axis, *p. 122*
origin, *p. 122*
quadrants, *p. 122*
ordered pair, *p. 122*
x-coordinate, *p. 122*
y-coordinate, *p. 122*
Pythagorean Theorem, *p. 127*
Distance Formula, *p. 128*
graph (of an equation), *p. 134*
linear equation, *p. 134*
x-intercept, *p. 137*
y-intercept, *p. 137*
straight-line depreciation, *p. 138*
slope, *p. 142*
slope-intercept form, *p. 146*
point-slope form, *p. 155*
general form, *p. 155*
two-point form, *p. 156*
linear extrapolation, *p. 159*
linear interpolation, *p. 159*
relation, *p. 164*
domain, *pp. 164, 165, 168*
range, *pp. 164, 165, 168*
function, *p. 165*
independent variable, *p. 167*
dependent variable, *p. 167*
function notation, *p. 168*
implied domain, *p. 170*
graph (of a function), *p. 177*

Key Concepts

2.1 Guidelines for verifying solutions

To verify that an ordered pair (x, y) is a solution of an equation with variables x and y, use the following steps.

1. Substitute the values of x and y into the equation.
2. Simplify both sides of the equation.
3. If both sides simplify to the same number, the ordered pair is a solution. If the two sides yield different numbers, the ordered pair is not a solution.

2.2 The point-plotting method of sketching a graph

1. If possible, rewrite the equation by isolating one of the variables.
2. Make up a table of values showing several solution points.
3. Plot these points on a rectangular coordinate system.
4. Connect the points with a smooth curve or line.

2.4 Summary of equations of lines

1. Slope of a line through (x_1, y_1) and (x_2, y_2):
$$m = \frac{y_2 - y_1}{x_2 - x_1}$$
2. General form of equation of line: $ax + by + c = 0$
3. Equation of vertical line: $x = a$
4. Equation of horizontal line: $y = b$
5. Slope-intercept form of equation of line: $y = mx + b$
6. Point-slope form of equation of line: $y - y_1 = m(x - x_1)$
7. Parallel lines (equal slopes): $m_1 = m_2$
8. Perpendicular lines (negative reciprocal slopes): $m_2 = -\frac{1}{m_1}$

2.5 Characteristics of a function

1. Each element in the domain A must be matched with an element in the range, which is contained in set B.
2. Some elements in set B may not be matched with any element in the domain A.
3. Two or more elements of the domain may be matched with the same element in the range.
4. No element of the domain is matched with two different elements in the range.

2.6 Vertical Line Test for functions

A set of points on a rectangular coordinate system is the graph of y as a function of x if and only if no vertical line intersects the graph at more than one point.

2.6 Vertical and horizontal shifts

Let c be a positive real number. Vertical and horizontal shifts of the graph of the function $y = f(x)$ are represented as follows.

1. Vertical shift c units upward: $h(x) = f(x) + c$
2. Vertical shift c units downward: $h(x) = f(x) - c$
3. Horizontal shift c units to the right: $h(x) = f(x - c)$
4. Horizontal shift c units to the left: $h(x) = f(x + c)$

2.6 Reflections in the coordinate axes

Reflections of the graph of $y = f(x)$ are represented as:

1. Reflection in the x-axis: $h(x) = -f(x)$
2. Reflection in the y-axis: $h(x) = f(-x)$

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Chapter Summary

The *Chapter Summary* has been completely revised in the Third Edition. Designed to be an effective study tool for students preparing for exams, it highlights the *Key Terms* (referenced by page) and the *Key Concepts* (referenced by section) presented in the chapter.

Review Exercises

The *Review Exercises* at the end of each chapter have been reorganized in the Third Edition. They are grouped into two categories: *Reviewing Skills* and *Solving Problems*. Exercises under *Reviewing Skills* are correlated to sections in the chapter. The *Review Exercises* offer students additional practice in preparation for exams. Answers to all odd-numbered exercises are given in the back of the book.

Review Exercises 247

REVIEW EXERCISES

Reviewing Skills

3.1 In Exercises 1 and 2, state why the algebraic expression is not a polynomial.

1. $x^2 + 2 + 3x^{1/2}$
2. $z^2 - 2 + 4z^{-2}$

In Exercises 3–6, write the polynomial in standard form. Then identify the leading coefficient and the degree of the polynomial.

3. $6x^3 - 4x + 5x^2 - x^4$
4. $2x^6 - 5x^3 + x^5 - 7$
5. $14 - 6x + 3x^2 - 7x^3$
6. $9x - 2x^3 + x^5 - 8x^7$

In Exercises 7–10, give an example of a polynomial in x that satisfies the conditions. (*Note:* Each problem has many correct answers.)

7. A binomial of degree 4
8. A trinomial of degree 5 and leading coefficient -6
9. A monomial of degree 3 and leading coefficient 5
10. A binomial of degree 2 and leading coefficient 7

In Exercises 11–22, perform the operations and simplify.

11. $(5x + 3x^2) + (6 - x - 4x^2)$
12. $(6x + 1) + (x^2 - 4x)$
13. $(5x^3 - 6x + 11) + (5 + 6x - x^2 - 8x^3)$
14. $(7 - 12x^2 + 8x^3) + (x^4 - 6x^3 + 7x^2 - 5)$
15. $(3t - 5) - (t^2 - t - 5)$
16. $(10y^2 + 3) - (y^2 + 4y - 9)$
17. $(3x^5 + 4x^2 - 8x + 12) - (2x^5 + x) + (3x^2 - 4x^3 - 9)$
18. $(7x^4 - 10x^2 + 4x) + (x^3 - 3x) - (3x^4 - 5x^2 + 1)$
19. $(-x^3 - 3x) - 4(2x^3 - 3x + 1)$
20. $(7z^2 + 6z) - 3(5z^2 + 2z)$
21. $3y^2 - [2y + 3(y^2 + 5)]$
22. $(16a^3 + 5a) - 5[a + (2a^3 - 1)]$

3.2 In Exercises 23–36, use the rules for exponents to simplify the expression.

23. $x^2 \cdot x^3$
24. $-3y^2 \cdot y^4$
25. $(u^2)^3$
26. $(v^4)^2$
27. $(-2z)^3$
28. $(-3y)^2(2)$
29. $-(u^2v)^2(-4u^3v)$
30. $(12x^2y)(3x^2y^4)^2$
31. $\frac{12z^5}{6z^2}$
32. $\frac{15m^3}{25m}$
33. $\frac{120u^5v^3}{15u^3v}$
34. $-\frac{(-2x^2y^3)^2}{-3xy^2}$
35. $\left(\frac{72x^4}{6x^2}\right)^2$
36. $\left(-\frac{y^2}{2}\right)^3$

In Exercises 37–50, perform the multiplication and simplify.

37. $(-2x)^3(x + 4)$
38. $(-4y)^2(y - 2)$
39. $3x(2x^2 - 5x + 3)$
40. $-2y(5y^2 - y - 4)$
41. $(x - 2)(x + 7)$
42. $(x + 6)(x - 9)$
43. $(5x + 3)(3x - 4)$
44. $(4x - 1)(2x - 5)$
45. $(4x^2 + 3)(6x^2 + 1)$
46. $(3y^2 + 2)(4y^2 - 5)$
47. $(2x^2 - 3x + 2)(2x + 3)$
48. $(5s^3 + 4s - 3)(4s - 5)$
49. $2u(u - 7) - (u + 1)(u - 7)$
50. $(3v + 2)(-5v) + 5v(3v + 2)$

In Exercises 51–60, use special product formulas to find the product.

51. $(4x - 7)^2$
52. $(8 - 3x)^2$
53. $(2x + 3y)^2$
54. $(u + 4v)^2$
55. $(5u - 8)(5u + 8)$
56. $(7a + 4)(7a - 4)$
57. $(2u + v)(2u - v)$
58. $(5x - 2y)(5x + 2y)$
59. $[(u - 3) + v][(u - 3) - v]$
60. $[(m - 5) + n]^2$

3.3 In Exercises 61–64, factor out the greatest common factor.

61. $6x^2 + 15x^3$
62. $8y - 12y^4$
63. $28(x + 5) - 70(x + 5)^2$
64. $(u - 9v)(u - v) + v(u - 9v)$

FEATURES

224 Chapter 3 Polynomials and Factoring

Mid-Chapter Quiz

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

1. Determine the degree and leading coefficient of the polynomial
$3 - 2x + 4x^3 - 2x^4$.

2. Explain why $2x - 3x^{1/2} + 5$ is not a polynomial.

In Exercises 3–18, perform the indicated operations and simplify.

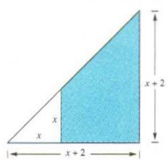
3. Add $2t^3 + 3t^2 - 2$ to $t^3 + 9$.
4. $(3 - 7y) + (7y^2 + 2y - 3)$
5. $(7x^3 - 3x^2 + 1) - (x^2 - 2x^3)$
6. $(5 - u) - 2[3 - (u^2 + 1)]$
7. $(-5n^2)(-2n^3)$
8. $(-2x^2)^3(x^4)$
9. $\dfrac{6x^7}{(-2x^2)^3}$
10. $\left(\dfrac{4y^2}{5x}\right)^2$
11. $7y(4 - 3y)$
12. $(x - 7)(x + 3)$
13. $(4x - y)(6x - 5y)$
14. $2z(z + 5) - 7(z + 5)$
15. $(6r + 5)(6r - 5)$
16. $(2x - 3)^2$
17. $(x + 1)(x^2 - x + 1)$
18. $(x^2 - 3x + 2)(x^2 + 5x - 10)$

In Exercises 19–22, factor the expression completely.

19. $28a^2 - 21a$
20. $25 - 4x^2$
21. $z^3 + 3z^2 - 9z - 27$
22. $4y^3 - 32x^3$

23. Find all possible products of the form $(5x + m)(2x + n)$ such that $mn = 10$.

24. Find the area of the shaded portion of the figure.



25. An object is thrown downward from the top of a 100-foot building with an initial velocity of -5 feet per second. Use the position function $h(t) = -16t^2 - 5t + 100$ to find the height of the object when $t = 1$ and $t = 2$.

26. A manufacturer can produce and sell x T-shirts per week. The total cost (in dollars) for producing the T-shirts is given by $C = 5x + 2000$ and the total revenue is given by $R = 19x$. Find the profit obtained by selling 1000 T-shirts per week.

Chapter Test 193

Chapter Test

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

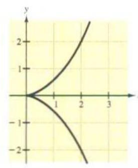


Figure for 12

1. Determine the quadrant in which the point (x, y) lies if $x > 0$ and $y < 0$.

2. Plot the points $(0, 5)$ and $(3, 1)$. Then find the distance between them.

3. Find the x- and y-intercepts of the graph of the equation $y = -3(x + 1)$.

4. Sketch the graph of the equation $y = |x - 2|$.

5. Find the slope (if possible) of the line passing through each pair of points.
(a) $(-4, 7), (2, 3)$ (b) $(3, -2), (3, 6)$

6. Sketch the graph of the line passing through the point $(0, -6)$ with slope $m = \frac{4}{3}$.

7. Plot the x- and y-intercepts of the graph of $2x + 5y - 10 = 0$. Use the results to sketch the graph.

8. Write the equation $5x + 3y - 9 = 0$ in slope-intercept form. Find the slope of the line that is perpendicular to this line.

9. Find an equation of the line through the points $(25, -15)$ and $(75, 10)$.

10. Find an equation of the line with slope -2 that passes through the point $(2, -4)$.

11. Find an equation of the vertical line through the point $(-2, 4)$.

12. The graph of $y^2(4 - x) = x^3$ is shown at the left. Does the graph represent y as a function of x? Explain your reasoning.

13. Determine whether the relation represents a function. Explain.
(a) $\{(2, 4), (-6, 3), (3, 3), (1, -2)\}$ (b) $\{(0, 0), (1, 5), (-2, 1), (0, -4)\}$

14. Evaluate $g(x) = x/(x - 3)$ for the indicated values.
(a) $g(2)$ (b) $g(\frac{7}{2})$ (c) $g(x + 2)$

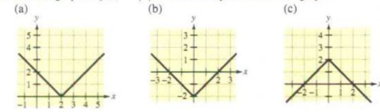
15. Find the domain of each function.
(a) $h(t) = \sqrt{9 - t}$ (b) $f(x) = \dfrac{x + 1}{x - 4}$

16. Sketch the graph of the function $g(x) = \sqrt{2 - x}$.

17. Describe the transformation of the graph of $f(x) = x^2$ that would produce the graph of $g(x) = -(x - 2)^2 + 1$.

18. After 4 years, the value of a \$26,000 car will have depreciated to \$10,000. Write the value V of the car as a linear function of t, the number of years since the car was purchased. When will the car be worth \$16,000? Explain your reasoning.

19. Use the graph of $f(x) = |x|$ to write an equation for each graph.



Mid-Chapter Quiz

Each chapter contains a *Mid-Chapter Quiz*. This feature allows students to perform a self-assessment midway through the chapter. Answers to all *Mid-Chapter Quiz* exercises are given in the back of the book.

Chapter Test

Each chapter ends with a *Chapter Test*. This feature allows students to perform a self-assessment at the end of the chapter. Answers to all *Chapter Test* exercises are given in the back of the book.

Cumulative Test

The *Cumulative Tests* that follow Chapters 3, 6, and 9 provide a comprehensive self-assessment tool that helps students check their mastery of previously covered material. Answers to all *Cumulative Test* exercises are given in the back of the book.

Cumulative Test: Chapters P–3 251

Cumulative Test: Chapters P–3

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

1. Place the correct symbol (<, >, or =) between the two numbers.
(a) -2 ▭ 5 (b) $\frac{1}{3}$ ▭ $\frac{1}{2}$ (c) $|2.3|$ ▭ $-|-4.5|$

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

In Exercises 3–5, perform the operations and simplify.

3. (a) $t(3t - 1) - 2t(t + 4)$ (b) $3x(x^2 - 2) - x(x^2 + 5)$
4. (a) $(2a^2b)^3(-ab^2)^2$ (b) $\left(\dfrac{2x^4y^2}{4x^3y}\right)^2$
5. (a) $(2x + 1)(x - 5)$ (b) $[2 + (x - y)]^2$

In Exercises 6–8, solve the equations or inequalities.

6. (a) $12 - 5(3 - x) = x + 3$ (b) $1 - \dfrac{x + 2}{4} = \dfrac{7}{8}$
7. (a) $|3x - 5| = 7$ (b) $2t^2 - 5t - 3 = 0$
8. (a) $3(1 - x) > 6$ (b) $-12 \le 4x - 6 < 10$

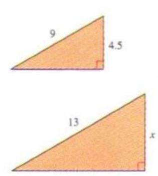


Figure for 10

9. Your annual automobile insurance premium is \$1225. Because of a driving violation, your premium is increased 15%. What is your new premium?

10. The triangles at the left are similar. Solve for x by using the fact that corresponding sides of similar triangles are proportional.

11. Solve $|x - 2| \ge 3$ and sketch its solution.

12. The revenue from selling x units of a product is $R = 12.90x$. The cost of producing x units is $C = 8.50x + 450$. To obtain a profit, the revenue must be greater than the cost. For what values of x will this product produce a profit? Explain your reasoning.

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

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

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

16. Find the slope of the line passing through $(-4, 0)$ and $(4, 6)$. Then find the distance between the points.

17. Determine the equation of a line through the point $(-2, 1)$ (a) parallel to $2x - y = 1$ and (b) perpendicular to $3x + 2y = 5$.

In Exercises 18 and 19, factor the polynomials.

18. (a) $3x^2 - 8x - 35$ (b) $9x^2 - 144$
19. (a) $y^3 - 3y^2 - 9y + 27$ (b) $8t^3 - 40t^2 + 50t$

In Exercises 20 and 21, graph the equation.

20. $4x + 3y - 12 = 0$
21. $y = 1 - (x - 2)^2$

Supplements

Intermediate Algebra, Third Edition, by Larson and Hostetler is accompanied by a comprehensive supplements package, which includes resources for both students and instructors. All items are keyed to the text.

Printed Resources

For the Student

Study and Solutions Guide by Gerry C. Fitch, Louisiana State University
(0-395-97662-6)

- Detailed, step-by-step solutions to all Integrated Review exercises and to all odd-numbered exercises in the section exercise sets and in the review exercises
- Detailed, step-by-step solutions to all Mid-Chapter Quiz, Chapter Test, and Cumulative Test questions

Graphing Calculator Keystroke Guide by Benjamin N. Levy and Laurel Technical Services
(0-395-87777-6)

- Keystroke instructions for the following graphing calculators: (Texas Instruments) *TI-80*, *TI-81*, *TI-82*, *TI-83*, *TI-85*, and *TI-92*; (Casio) *fx-7700GE*, *fx-9700GE*, and *CFX-9800G*; (Hewlett Packard) *HP-38G*; and (Sharp) *EL-9200/9300*
- Examples with step-by-step solutions
- Extensive graphics screen output
- Technology tips

For the Instructor

Instructor's Annotated Edition
(0-395-97663-4)

- Includes entire student edition
- Instructor's answer section, which includes answers to all even-numbered exercises, Technology Discovery boxes, Technology Tip boxes, and Discussing the Concept activities
- Annotations at point of use that offer strategies and suggestions for teaching the course and point out common student errors

Test Item File and Instructor's Resource Guide by Ann R. Kraus, The Pennsylvania State University, The Behrend College
(0-395-97661-8)

- Printed test bank with approximately 3300 test items, coded by level of difficulty
- Technology-required test items, coded for easy reference
- Chapter test forms with answer key
- Two final exams
- Transparency masters

- Notes to the instructor, which include information on standardized tests such as the Texas Academic Skills Program (TASP), the Florida College Level Academic Skills Test (CLAST), and the California State University Entry Level Mathematics (ELM) Exam. A list of skills covered by the test and the corresponding sections in the text where the topics are covered are also provided.
- Alternative assessment strategies

Media Resources

For Students and Instructors

Website (***www.hmco.com***)
Contains, but is not limited to, the following student and instructor resources:
- Study guide (for students), which includes section summaries, additional examples with solutions, and starter exercises with answers
- Chapter projects and additional real-life applications
- Geometry review
- ACE Algebra Tutor
- Graphing calculator programs
- Math Matters and Career Interviews

HM^3 Tutor
(Instructor's version Windows: 0-618-04208-3)
This networkable, interactive tutorial software offers the following features:
- Algorithmically generated practice and quiz problems
- A variety of multiple-choice and free-response questions, varying in degree of difficulty
- Animated examples and interactivity within lessons
- Hints and full solutions available for every problem
- Integrated classroom management system (for instructors), which includes a syllabus builder and the capability to track and report student performance
- Non-networkable student version (Windows: 0-395-97656-1)

For the Student

Videotape Series by Dana Mosely
(0-395-97670-7)
- Comprehensive section-by-section coverage
- Detailed explanations of important concepts
- Numerous examples and applications, often illustrated by means of computer-generated animations
- Discussion of study skills

For the Instructor

Computerized Test Bank
(Windows: 0-395-97665-0; Macintosh: 0-395-97666-9)
- Test-generating software for IBM and Macintosh computers
- Approximately 3300 test items
- Also available as a printed test bank

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Ron Larson
Robert P. Hostetler

How to Study Algebra

Your success in algebra depends on your active participation both in class and outside of class. Because the material you learn each day builds on the material you learned previously, it is important that you keep up with the course work every day and develop a clear plan of study. To help you learn how to study algebra, we have prepared a set of guidelines that highlight key study strategies.

Preparing for Class

The syllabus your instructor provides is an invaluable resource that outlines the major topics to be covered in the course. Use it to help you prepare. As a general rule, you should set aside two to four hours of study time for each hour spent in class. Being prepared is the first step toward success in algebra. Before class,

- ❒ Review your notes from the previous class.
- ❒ Read the portion of the text that will be covered in class.
- ❒ Use the objectives list at the beginning of each section to keep you focused on the main ideas presented in the section.
- ❒ Pay special attention to the definitions, rules, and concepts highlighted in boxes. Also, be sure you understand the meanings of mathematical symbols and of terms written in boldface type. Keep a vocabulary journal for easy reference.
- ❒ Read through the solved examples. Use the side comments given in the solution steps to help you follow the solution process. Also, read the *Study Tips* given in the margins.
- ❒ Make notes of anything you do not understand as you read through the text. If you still do not understand after your instructor covers the topic in question, ask questions before your instructor moves on to a new topic.
- ❒ If you are using technology in this course, read the *Technology Tips* and try the *Technology Discovery* exercises.

Keeping Up

Another important step toward success in algebra involves your ability to keep up with the work. It is very easy to fall behind, especially if you miss a class. To keep up with the course work, be sure to

- ❒ Attend every class. Bring your text, a notebook, and a pen or pencil. If you miss a class, get the notes from a classmate as soon as possible and review them carefully.
- ❒ Take notes in class. After class, read through your notes and add explanations so that your notes make sense to *you*.
- ❒ Reread the portion of the text that was covered in class. This time, work each example *before* reading through the solution.