INTERMEDIATE ALGEBRA

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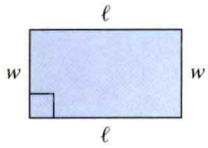
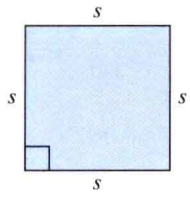
Perimeter and Circumference



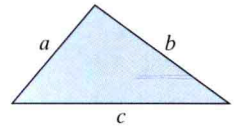
Rectangle

$P = 2l + 2w$



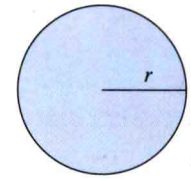
Square

$P = 4s$



Triangle

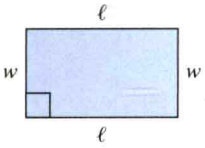
$P = a + b + c$



Circle

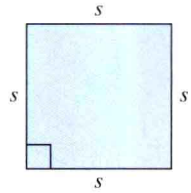
Circumference: $C = 2\pi r$

Area



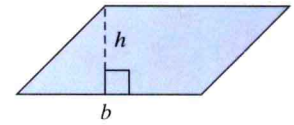
Rectangle

$A = lw$



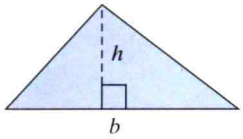
Square

$A = s^2$



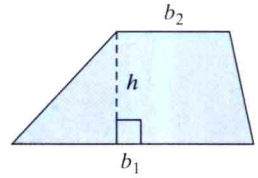
Parallelogram

$A = bh$



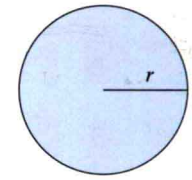
Triangle

$A = \frac{1}{2}bh$



Trapezoid

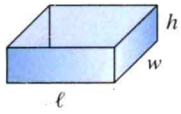
$A = \frac{1}{2}(b_1 + b_2)h$



Circle

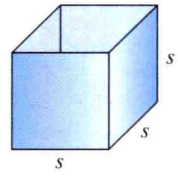
$A = \pi r^2$

Volume



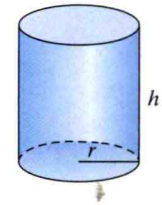
Rectangular Solid

$V = lwh$



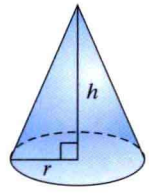
Cube

$V = s^3$



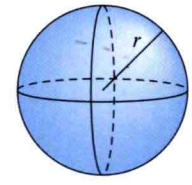
Right Circular Cylinder

$V = \pi r^2 h$



Right Circular Cone

$V = \frac{1}{3}\pi r^2 h$



Sphere

$V = \frac{4}{3}\pi r^3$

Linear Equations and Slope

The slope, m, of a line between two distinct points (x_1, y_1) and (x_2, y_2):

$$m = \frac{y_2 - y_1}{x_2 - x_1}, \quad x_2 - x_1 \neq 0$$

Standard form: $ax + by = c$, a and b are not both zero

Horizontal line: $y = k$

Vertical line: $x = k$

Slope intercept form: $y = mx + b$

Point-slope formula: $y - y_1 = m(x - x_1)$

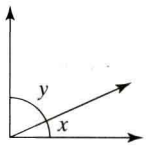
Midpoint Formula

Given two points (x_1, y_1) and (x_2, y_2), the midpoint is

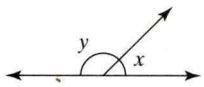
$$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$

Angles

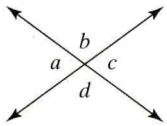
Two angles are **complementary** if the sum of their measures is 90°.



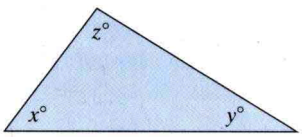
Two angles are **supplementary** if the sum of their measures is 180°.



In the figure below, $\angle a$ and $\angle c$ are vertical angles and $\angle b$ and $\angle d$ are vertical angles. The measures of vertical angles are equal.



The sum of the measures of the angles of a triangle is 180°.



$x° + y° + z° = 180°$

Properties and Definitions of Exponents

Let a and b $(b \neq 0)$ represent real numbers and m and n represent positive integers.

$$b^m b^n = b^{m+n}; \qquad \frac{b^m}{b^n} = b^{m-n}; \qquad (b^m)^n = b^{mn};$$

$$(ab)^m = a^m b^m; \qquad \left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}; \qquad b^0 = 1; \qquad b^{-n} = \left(\frac{1}{b}\right)^n$$

Difference of Squares:

$$a^2 - b^2 = (a + b)(a - b)$$

Difference of Cubes:

$$a^3 - b^3 = (a - b)(a^2 + ab + b^2)$$

Sum of Cubes:

$$a^3 + b^3 = (a + b)(a^2 - ab + b^2)$$

Perfect Square Trinomials:

$$a^2 + 2ab + b^2 = (a + b)^2$$

$$a^2 - 2ab + b^2 = (a - b)^2$$

The Quadratic Formula

The solutions to $ax^2 + bx + c = 0 \quad (a \neq 0)$ are given by

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

The Vertex Formula

For $f(x) = ax^2 + bx + c$ $(a \neq 0)$, the vertex is

$$\left(\frac{-b}{2a}, \frac{4ac - b^2}{4a}\right) \quad \text{or} \quad \left(\frac{-b}{2a}, f\left(\frac{-b}{2a}\right)\right)$$

The Distance Formula

The distance between two points (x_1, y_1) and (x_2, y_2) is $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

The Standard Form of a Circle

$(x - h)^2 + (y - k)^2 = r^2$ with center (h, k) and radius r

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Properties of Real Numbers

Commutative Property of Addition	$a + b = b + a$
Commutative Property of Multiplication	$ab = ba$
Associative Property of Addition	$(a + b) + c = a + (b + c)$
Associative Property of Multiplication	$(ab)c = a(bc)$
Distributive Property of Multiplication over Addition	$a(b + c) = ab + ac$
Identity Property of Addition	0 is the **identity element for addition** because $a + 0 = 0 + a = a$
Identity Property of Multiplication	1 is the **identity element for multiplication** because $a \cdot 1 = 1 \cdot a = a$
Inverse Property of Addition	a and $(-a)$ are **additive inverses** because $a + (-a) = 0$ and $(-a) + a = 0$
Inverse Property of Multiplication	a and $\frac{1}{a}$ are **multiplicative inverses** because $a \cdot \frac{1}{a} = 1$ and $\frac{1}{a} \cdot a = 1$ (provided $a \neq 0$)

Sets of Real Numbers

Natural numbers: $\{1, 2, 3, \ldots\}$

Whole numbers: $\{0, 1, 2, 3, \ldots\}$

Integers: $\{\ldots -3, -2, -1, 0, 1, 2, 3, \ldots\}$

Rational numbers: $\{\frac{p}{q} | p$ and q are integers and q does not equal $0\}$

Irrational numbers: $\{x | x$ is a real number that is not rational$\}$

Application Formulas

Sales tax = (cost of merchandise)(tax rate)

Commission = (dollars in sales)(commission rate)

Simple interest = (principal)(rate)(time): $I = Prt$

Distance = (rate)(time): $d = rt$

Compound interest: $A(t) = P\left(1 + \frac{r}{n}\right)^{nt}$

Continuous compound interest: $A(t) = Pe^{rt}$,

where $A(t)$ = balance of account after t years,
P = principal, r = annual interest rate, t = time in years,
n = number of compound periods per year

Proportions

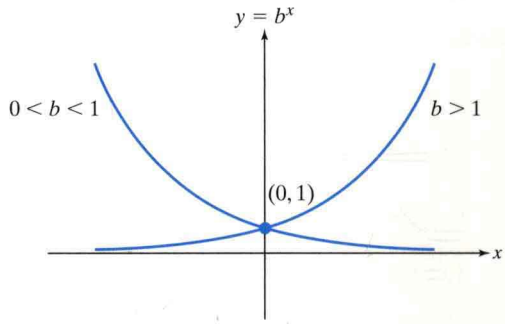
An equation that equates two ratios is called a proportion:

$$\frac{a}{b} = \frac{c}{d} \quad (b \neq 0, d \neq 0)$$

The cross products are equal: $ad = bc$.

Exponential Functions

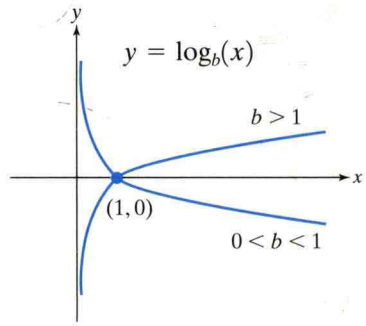
A function defined by $y = b^x$ $(b > 0, b \neq 1)$ is an exponential function.



Logarithmic Functions

A function defined by $y = \log_b(x)$ is a logarithmic function.

$y = \log_b(x) \Leftrightarrow b^y = x \quad (x > 0, b > 0, b \neq 1)$



Direct Variation:

y varies directly as x. $y = kx$

y is directly proportional to x.

Inverse Variation:

y varies inversely as x. $y = \frac{k}{x}$

y is inversely proportional to x.

Joint Variation:

y varies jointly as w and z. $y = kwz$

y is jointly proportional to w and z.

Properties of Logarithms

Let b, x, and y be positive real numbers where $b \neq 1$, and let p be a real number. Then the following properties are true.

1. $\log_b(1) = 0$
2. $\log_b(b) = 1$
3. $\log_b(b^p) = p$
4. $b^{\log_b(x)} = x$
5. $\log_b(xy) = \log_b(x) + \log_b(y)$
6. $\log_b\left(\frac{x}{y}\right) = \log_b(x) - \log_b(y)$
7. $\log_b(x^p) = p \log_b(x)$

Change-of-Base Formula:

$$\log_b(x) = \frac{\log_a(x)}{\log_a(b)} \quad a > 0, a \neq 1, b > 0, b \neq 1$$

Properties and Definitions of Radicals

Let a be a real number and n be an integer such that $n > 1$. If $\sqrt[n]{a}$ exists, then

$$a^{1/n} = \sqrt[n]{a}; \qquad a^{m/n} = (\sqrt[n]{a})^m = \sqrt[n]{a^m}$$

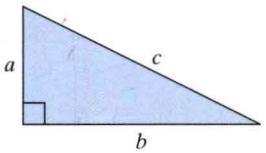
Let a and b represent real numbers such that $\sqrt[n]{a}$ and $\sqrt[n]{b}$ are both real. Then

$\sqrt[n]{ab} = \sqrt[n]{a} \cdot \sqrt[n]{b}$ Multiplication property

$\sqrt[n]{\frac{a}{b}} = \frac{\sqrt[n]{a}}{\sqrt[n]{b}}$ Division property

The Pythagorean Theorem:

$a^2 + b^2 = c^2$



Measure Abbreviations

Length

in.	inch
ft	foot
yd	yard
mm	millimeter
cm	centimeter
m	meter
km	kilometer

Volume/Capacity

pt	pint
gal	gallon
mL	milliliter
L	liter
cc	cubic centimeter (also written as cm^3)

Mass

mg	milligram
g	gram
kg	kilogram
oz	ounce

Force

lb	pound

Measure Conversion

Length	Area	Volume	Mass/Force
1 mile = 5280 ft	1 $in.^2$ = 6.452 cm^2	1 pt = 2 c	1 g = 1000 mg
1 mile = 1.609 km	1 yd^2 = 9 ft^2	1 qt = 2 pt	1 kg = 1000 g
1 in. = 2.54 cm	1 m^2 = 10.76 ft^2	1 gal = 4 qt	1 kg = 2.2 lb*
1 m = 3.281 ft	1 $mile^2$ = 640 acres	1 L = 1000 cm^3	1 lb = 16 oz
1 light-year = 9.46×10^{15} m		1 gal = 3.785 L	
1 m = 1000 mm		1 ft^3 = 7.481 gal	
1 m = 100 cm		1 L = 1000 mL	
1 km = 1000 m		1 mL = 1 cc	

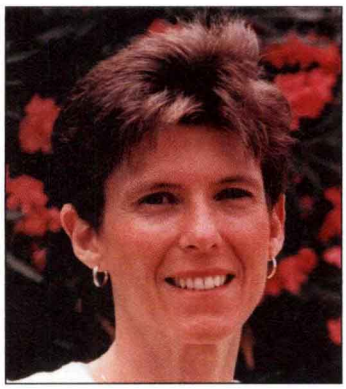
*1 kg = 2.2 lbs on Earth

Dedication

To my parents, Kent and Joanne Miller
—Julie Miller

In memory of my husband, T. Patrick O'Neill
—Molly O'Neill

About the Authors



JULIE MILLER

Julie Miller has been on the faculty of the Mathematics Department at Daytona Beach Community College for 14 years, where she has taught developmental and upper level courses. Prior to her work at DBCC, she worked as a software engineer for General Electric in the area of flight and radar simulation. Julie earned a bachelor of science in applied mathematics from Union College in Schenectady, New York and a master of science in mathematics from the University of Florida. In addition to this textbook, she has authored several course supplements for college algebra, trigonometry, and precalculus, as well as several short works of fiction and nonfiction for young readers.

MOLLY O'NEILL

Molly O'Neill is also from Daytona Beach Community College, where she has taught for 16 years in the Mathematics Department. She has taught a variety of courses from developmental mathematics to calculus. Before she came to Florida, Molly taught as an adjunct instructor at the University of Michigan—Dearborn, Eastern Michigan University, Wayne State University, and Oakland Community College. Molly earned a bachelor of science in mathematics and a master of arts and teaching from Western Michigan University in Kalamazoo, Michigan. Besides this textbook, she has authored several course supplements for college algebra, trigonometry, and precalculus and has reviewed texts for developmental mathematics.

HELP YOURSELF

To succeed in mathematics, as in any subject, you must be willing to devote some of your time and attention to complete the homework assignments and prepare for exams. You must set aside time for yourself on a regular basis to put any classroom notes to use and work through homework exercises. As you study your notes and work on homework, you may find that some concepts are easier to understand than others. For this reason, you may need to have a concept explained more than once or in different ways. In addition to the explanations you may receive in the classroom or from tutors, this textbook and its accompanying products will provide you with additional explanations, worked examples, and exercise sets to help you master concepts and practice what you learn. If you use the resources available to you, with a little self-discipline and patience you should find that you achieve a passing grade in the course and build the groundwork necessary for further studies in mathematics.

SUPPLEMENTS FOR THE STUDENT

The following products were developed in conjunction with your textbook to offer you additional support in your course.

Student Learning Site—Online Learning Center

The Student Learning Site of the Online Learning Center (OLC), located at www.mhhe.com/miller_oneill, contains valuable resources that will help you improve your understanding of the topics presented in your course.

The Student Learning Site is passcode-protected. A passcode can be found at the front of your newly purchased text and *is free when you purchase a new text.*

When you enter the Student Learning Site, you will find materials for a Student Portfolio, a downloadable formula card, access to NetTutor™, access to tutorials, and more!

NetTutor

NetTutor is a revolutionary system that enables you to interact with a live tutor over the World Wide Web by using NetTutor's Web-based, graphical chat capabilities. You can also submit questions and receive answers, browse previously answered questions, and view previous live chat sessions. Access to NetTutor can be made from home or school regardless of the type of Internet browser or computer you are using.

To learn more about NetTutor and to register, visit the Student Learning Site of the Online Learning Center.

Miller/O'Neill Tutorial CD-ROM

The interactive CD-ROM that accompanies *Intermediate Algebra* is a self-paced tutorial specifically linked to the text, that reinforces topics through unlimited opportunities to review concepts and practice problem-solving. The CD-ROM provides section-specific animated lessons with accompanying audio, practice exercises that enable you to work through problems with step-by-step guidance available, concept-matching problems that test vocabulary skills as well as identification of properties and rules, and more. This browser-based CD requires almost no computer training and will run on both Windows and Macintosh computers. The CD-ROM is available free to students who purchase a *new* text.

Miller/O'Neill Video Series (Videotapes or Video CDs)

The video series is based on problems taken directly from the Practice Exercises. The Practice Exercises contain icons that show which problems from the text appear in the video series. A mathematics instructor presents selected problems and works through them, following the solution methodology employed in the text. The video series is also available on video CDs.

Student's Solutions Manual

The *Student's Solutions Manual* contains comprehensive, worked-out solutions to odd-numbered exercises in the Practice Exercise sets, the Midchapter Reviews, the end-of-chapter Review Exercises, the Chapter Tests, and the Cumulative Review Exercises.

PUTTING IT ALL TOGETHER

This text and its accompanying supplements have been designed to offer you the kind of support that will help you succeed in your course. Here are a few suggestions for using the text and its accompanying materials.

To prepare for exams, rework assigned homework problems to practice. Also, work through the Chapter Tests and compare your answers with those in the back of the text. You can use the Student Portfolio, available on the Student Learning Site of the Online Learning Center, to keep your notes and other class-related papers such as quizzes and tests organized. If you save your tests, you can rework problems from the tests in preparation for other exams. You can also use the Vocabulary Worksheets from the Student Portfolio to review terms that might appear on your quizzes or exams.

If you are looking for extra help and are not able to get help in school due to conflicting schedules with your instructor or tutoring center, you can use NetTutor. The Student Learning Site of the Online Learning Center contains many other valuable elements such as "e-professors." The e-professors are tutorials based on topics selected from each section of the text. These tutorials present worked-out solutions to problems, similar to those found in your text. Another valuable source of help is the video series. If you cannot attend a class on a particular day or if you would just like more explanation, refer to the selected problems from the Practice Exercises of your text that have a video icon. Once you identify these problems,

you can use the videotapes or videos on CD to watch an instructor present the solutions. If you would like a reminder or hint as to how various problems in the text are solved, refer to the solutions manual which offers worked-out solutions.

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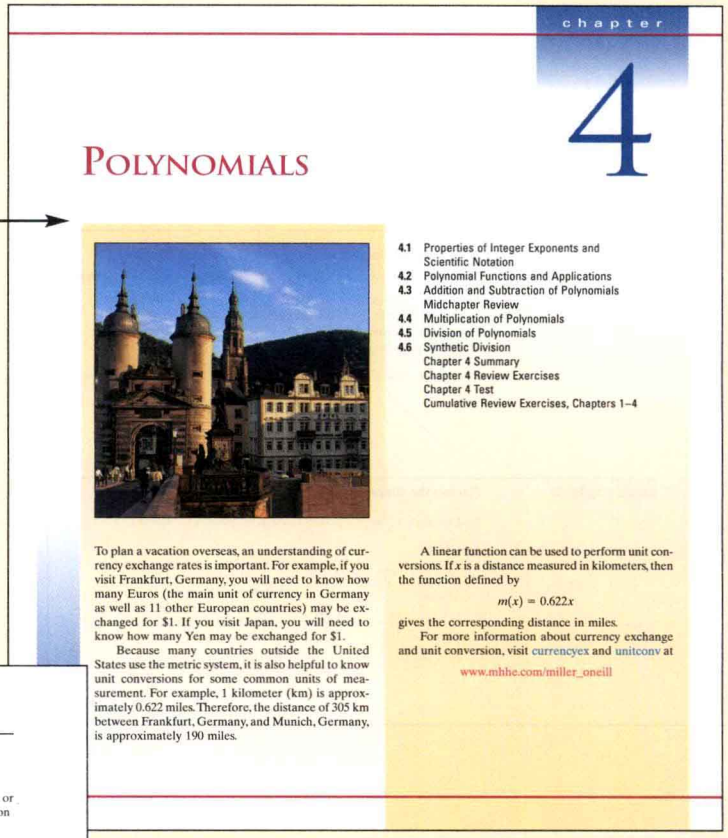
Julie Miller and Molly O'Neill

KEY FEATURES

To get the most use out of your textbook, take a few minutes to familiarize yourself with its features.

Chapter Openers

Each chapter opens with an application relating to topics presented in the chapter. The Chapter Openers also contain website references for **Technology Connections**, Internet activities found in the Student Learning Site of the Online Learning Center, which further the scope of the application.



chapter 4

POLYNOMIALS

To plan a vacation overseas, an understanding of currency exchange rates is important. For example, if you visit Frankfurt, Germany, you will need to know how many Euros (the main unit of currency in Germany as well as 11 other European countries) may be exchanged for $1. If you visit Japan, you will need to know how many Yen may be exchanged for $1.

Because many countries outside the United States use the metric system, it is also helpful to know unit conversions for some common units of measurement. For example, 1 kilometer (km) is approximately 0.622 miles. Therefore, the distance of 305 km between Frankfurt, Germany, and Munich, Germany, is approximately 190 miles.

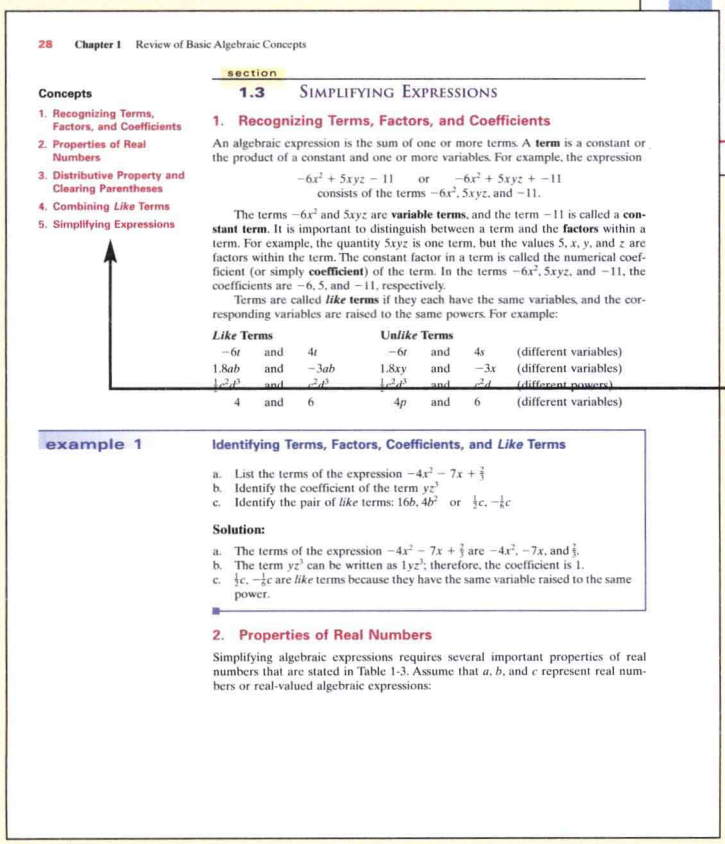
A linear function can be used to perform unit conversions. If x is a distance measured in kilometers, then the function defined by

$$m(x) = 0.622x$$

gives the corresponding distance in miles.

For more information about currency exchange and unit conversion, visit currencyex and unitconv at

www.mhhe.com/miller_oneill



28 Chapter 1 Review of Basic Algebraic Concepts

Concepts

1. Recognizing Terms, Factors, and Coefficients
2. Properties of Real Numbers
3. Distributive Property and Clearing Parentheses
4. Combining *Like* Terms
5. Simplifying Expressions

section 1.3 SIMPLIFYING EXPRESSIONS

1. Recognizing Terms, Factors, and Coefficients

An algebraic expression is the sum of one or more terms. A **term** is a constant or the product of a constant and one or more variables. For example, the expression

$$-6x^2 + 5xyz - 11 \quad \text{or} \quad -6x^2 + 5xyz + -11$$

consists of the terms $-6x^2$, $5xyz$, and -11.

The terms $-6x^2$ and $5xyz$ are **variable terms**, and the term -11 is called a **constant term**. It is important to distinguish between a term and the **factors** within a term. For example, the quantity $5xyz$ is one term, but the values 5, x, y, and z are factors within the term. The constant factor in a term is called the numerical coefficient (or simply **coefficient**) of the term. In the terms $-6x^2$, $5xyz$, and -11, the coefficients are -6, 5, and -11, respectively.

Terms are called ***like* terms** if they each have the same variables, and the corresponding variables are raised to the same powers. For example:

Like Terms			Un*like* Terms			
$-6t$	and	$4t$	$-6t$	and	$4s$	(different variables)
$1.8ab$	and	$-3ab$	$1.8xy$	and	$-3x$	(different variables)
$\frac{1}{2}c^2d^3$	and	c^2d^3	$\frac{1}{2}c^2d^3$	and	c^2d	(different powers)
4	and	6	$4p$	and	6	(different variables)

example 1 **Identifying Terms, Factors, Coefficients, and *Like* Terms**

a. List the terms of the expression $-4x^2 - 7x + \frac{2}{3}$
b. Identify the coefficient of the term yz^3
c. Identify the pair of *like* terms: $16b$, $4b^2$ or $\frac{1}{2}c$, $-\frac{1}{6}c$

Solution:

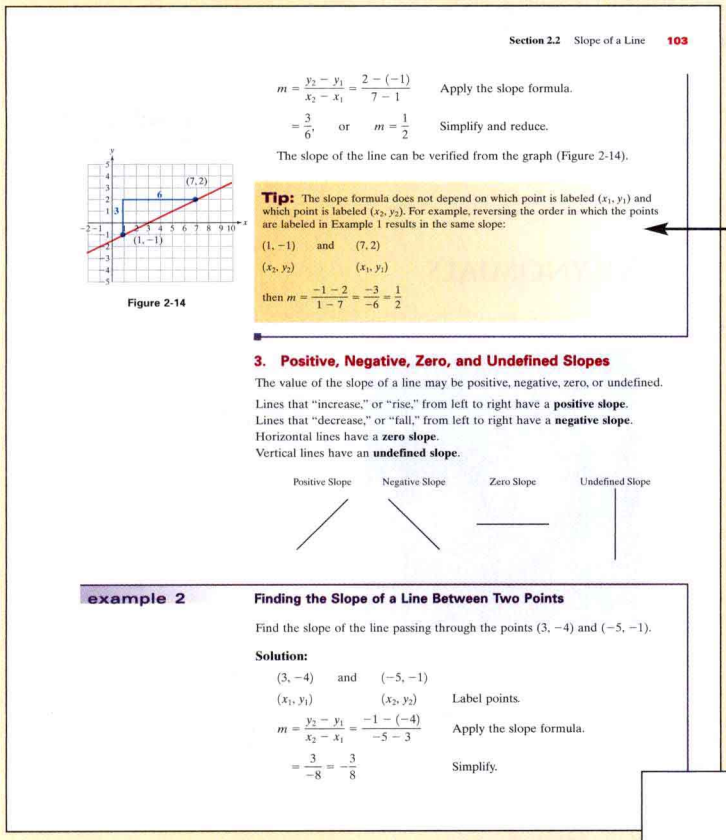
a. The terms of the expression $-4x^2 - 7x + \frac{2}{3}$ are $-4x^2$, $-7x$, and $\frac{2}{3}$.
b. The term yz^3 can be written as $1yz^3$; therefore, the coefficient is 1.
c. $\frac{1}{2}c$, $-\frac{1}{6}c$ are *like* terms because they have the same variable raised to the same power.

2. Properties of Real Numbers

Simplifying algebraic expressions requires several important properties of real numbers that are stated in Table 1-3. Assume that a, b, and c represent real numbers or real-valued algebraic expressions:

Concepts

A list of important concepts is provided at the beginning of each section. Each concept corresponds to a heading within the section, making it easy to locate topics as you study or work through homework exercises.



Section 2.2 Slope of a Line 103

$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{2 - (-1)}{7 - 1}$ Apply the slope formula.

$= \frac{3}{6}$, or $m = \frac{1}{2}$ Simplify and reduce.

The slope of the line can be verified from the graph (Figure 2-14).

Figure 2-14

Tip: The slope formula does not depend on which point is labeled (x_1, y_1) and which point is labeled (x_2, y_2). For example, reversing the order in which the points are labeled in Example 1 results in the same slope:

$(1, -1)$ and $(7, 2)$

(x_2, y_2) (x_1, y_1)

then $m = \frac{-1 - 2}{1 - 7} = \frac{-3}{-6} = \frac{1}{2}$

3. Positive, Negative, Zero, and Undefined Slopes

The value of the slope of a line may be positive, negative, zero, or undefined.

Lines that "increase," or "rise," from left to right have a **positive slope**.
Lines that "decrease," or "fall," from left to right have a **negative slope**.
Horizontal lines have a **zero slope**.
Vertical lines have an **undefined slope**.

Positive Slope Negative Slope Zero Slope Undefined Slope

example 2 **Finding the Slope of a Line Between Two Points**

Find the slope of the line passing through the points $(3, -4)$ and $(-5, -1)$.

Solution:

$(3, -4)$ and $(-5, -1)$

(x_1, y_1) (x_2, y_2) Label points.

$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-1 - (-4)}{-5 - 3}$ Apply the slope formula.

$= \frac{3}{-8} = -\frac{3}{8}$ Simplify.

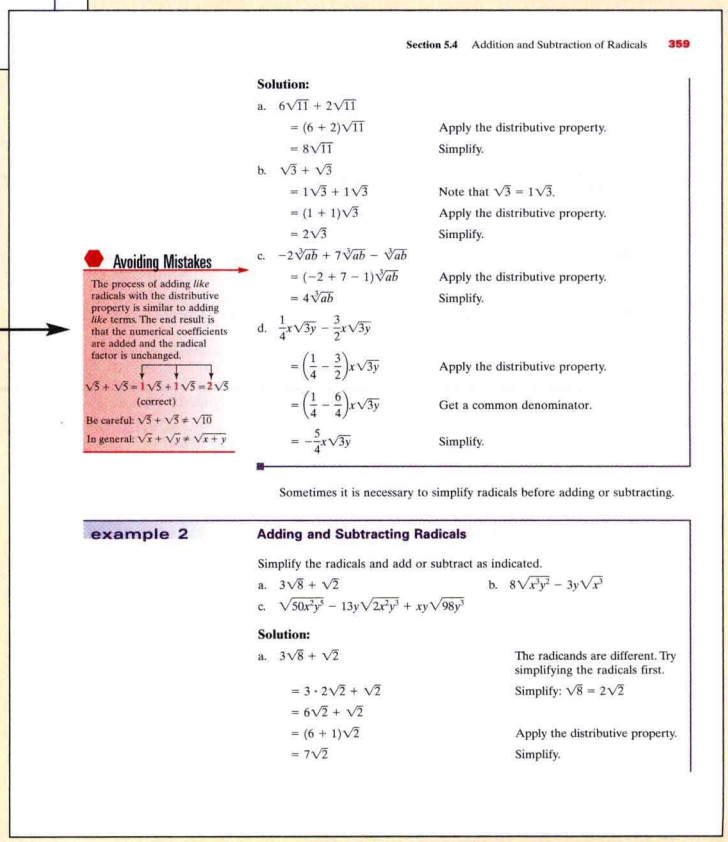
Special Elements

Tips

Tip boxes appear throughout the text and offer helpful hints and insight.

Avoiding Mistakes

Through marginal notes labeled Avoiding Mistakes you are alerted to common errors and are shown methods to avoid them.



Section 5.4 Addition and Subtraction of Radicals 359

Solution:

a. $6\sqrt{11} + 2\sqrt{11}$

$= (6 + 2)\sqrt{11}$ Apply the distributive property.

$= 8\sqrt{11}$ Simplify.

b. $\sqrt{3} + \sqrt{3}$

$= 1\sqrt{3} + 1\sqrt{3}$ Note that $\sqrt{3} = 1\sqrt{3}$.

$= (1 + 1)\sqrt{3}$ Apply the distributive property.

$= 2\sqrt{3}$ Simplify.

c. $-2\sqrt[3]{ab} + 7\sqrt[3]{ab} - \sqrt[3]{ab}$

$= (-2 + 7 - 1)\sqrt[3]{ab}$ Apply the distributive property.

$= 4\sqrt[3]{ab}$ Simplify.

d. $\frac{1}{4}x\sqrt{3y} - \frac{3}{2}x\sqrt{3y}$

$= \left(\frac{1}{4} - \frac{3}{2}\right)x\sqrt{3y}$ Apply the distributive property.

$= \left(\frac{1}{4} - \frac{6}{4}\right)x\sqrt{3y}$ Get a common denominator.

$= -\frac{5}{4}x\sqrt{3y}$ Simplify.

Avoiding Mistakes

The process of adding *like* radicals with the distributive property is similar to adding *like* terms. The end result is that the numerical coefficients are added and the radical factor is unchanged.

$\sqrt{5} + \sqrt{5} = 1\sqrt{5} + 1\sqrt{5} = 2\sqrt{5}$

(correct)

Be careful: $\sqrt{3} + \sqrt{3} \neq \sqrt{10}$

In general: $\sqrt{x} + \sqrt{y} \neq \sqrt{x + y}$

Sometimes it is necessary to simplify radicals before adding or subtracting.

example 2 **Adding and Subtracting Radicals**

Simplify the radicals and add or subtract as indicated.

a. $3\sqrt{8} + \sqrt{2}$ b. $8\sqrt{x^3y^2} - 3y\sqrt{x^3}$

c. $\sqrt{50x^2y^3} - 13y\sqrt{2x^2y^3} + xy\sqrt{98y^3}$

Solution:

a. $3\sqrt{8} + \sqrt{2}$ The radicands are different. Try simplifying the radicals first.

$= 3 \cdot 2\sqrt{2} + \sqrt{2}$ Simplify: $\sqrt{8} = 2\sqrt{2}$

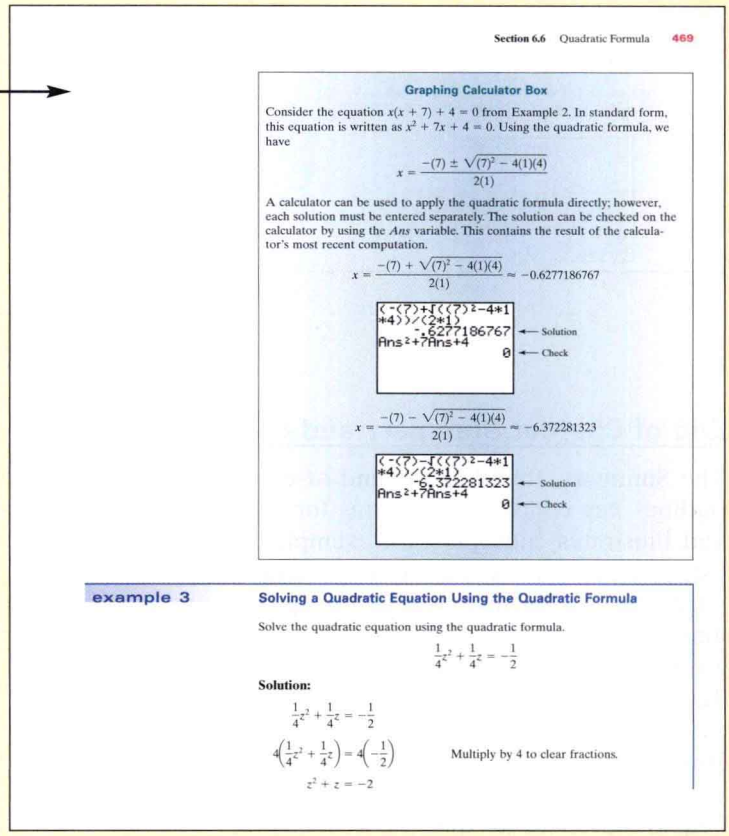
$= 6\sqrt{2} + \sqrt{2}$

$= (6 + 1)\sqrt{2}$ Apply the distributive property.

$= 7\sqrt{2}$ Simplify.

Graphing Calculator Boxes

Optional Graphing Calculator Boxes appear throughout the text. These boxes appear for your reference and may be included as part of your reading assignment, depending on the amount of emphasis your instructor places on the graphing calculator in your course. The boxes include screen captures and show how various techniques, such as analyzing and evaluating functions, can be performed.



Section 6.6 Quadratic Formula 469

Graphing Calculator Box

Consider the equation $x(x + 7) + 4 = 0$ from Example 2. In standard form, this equation is written as $x^2 + 7x + 4 = 0$. Using the quadratic formula, we have

$$x = \frac{-(7) \pm \sqrt{(7)^2 - 4(1)(4)}}{2(1)}$$

A calculator can be used to apply the quadratic formula directly; however, each solution must be entered separately. The solution can be checked on the calculator by using the *Ans* variable. This contains the result of the calculator's most recent computation.

$$x = \frac{-(7) + \sqrt{(7)^2 - 4(1)(4)}}{2(1)} \approx -0.6277186767$$

(-(7)+√((7)²-4*1*4))/(2*1)
-.6277186767 ← Solution
Ans²+7Ans+4
0 ← Check

$$x = \frac{-(7) - \sqrt{(7)^2 - 4(1)(4)}}{2(1)} \approx -6.372281323$$

(-(7)-√((7)²-4*1*4))/(2*1)
-6.372281323 ← Solution
Ans²+7Ans+4
0 ← Check

example 3 **Solving a Quadratic Equation Using the Quadratic Formula**

Solve the quadratic equation using the quadratic formula.

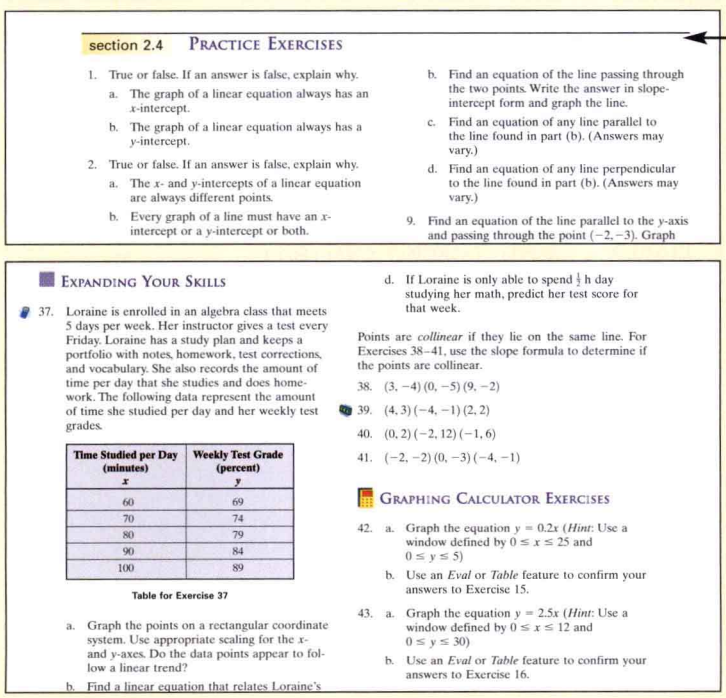
$$\frac{1}{4}z^2 + \frac{1}{4}z = -\frac{1}{2}$$

Solution:

$$\frac{1}{4}z^2 + \frac{1}{4}z = -\frac{1}{2}$$

$$4\left(\frac{1}{4}z^2 + \frac{1}{4}z\right) = 4\left(-\frac{1}{2}\right)$$ Multiply by 4 to clear fractions.

$$z^2 + z = -2$$



section 2.4 PRACTICE EXERCISES

1. True or false. If an answer is false, explain why.
   a. The graph of a linear equation always has an x-intercept.
   b. The graph of a linear equation always has a y-intercept.
2. True or false. If an answer is false, explain why.
   a. The x- and y-intercepts of a linear equation are always different points.
   b. Every graph of a line must have an x-intercept or a y-intercept or both.

b. Find an equation of the line passing through the two points. Write the answer in slope-intercept form and graph the line.
c. Find an equation of any line parallel to the line found in part (b). (Answers may vary.)
d. Find an equation of any line perpendicular to the line found in part (b). (Answers may vary.)

9. Find an equation of the line parallel to the y-axis and passing through the point $(-2, -3)$. Graph

EXPANDING YOUR SKILLS

37. Loraine is enrolled in an algebra class that meets 5 days per week. Her instructor gives a test every Friday. Loraine has a study plan and keeps a portfolio with notes, homework, test corrections, and vocabulary. She also records the amount of time per day that she studies and does homework. The following data represent the amount of time she studied per day and her weekly test grades.

Time Studied per Day (minutes) x	Weekly Test Grade (percent) y
60	69
70	74
80	79
90	84
100	89

Table for Exercise 37

a. Graph the points on a rectangular coordinate system. Use appropriate scaling for the x- and y-axes. Do the data points appear to follow a linear trend?
b. Find a linear equation that relates Loraine's
d. If Loraine is only able to spend $\frac{1}{2}$ h day studying her math, predict her test score for that week.

Points are *collinear* if they lie on the same line. For Exercises 38–41, use the slope formula to determine if the points are collinear.

38. $(3, -4)\ (0, -5)\ (9, -2)$
39. $(4, 3)\ (-4, -1)\ (2, 2)$
40. $(0, 2)\ (-2, 12)\ (-1, 6)$
41. $(-2, -2)\ (0, -3)\ (-4, -1)$

GRAPHING CALCULATOR EXERCISES

42. a. Graph the equation $y = 0.2x$ (*Hint*: Use a window defined by $0 \le x \le 25$ and $0 \le y \le 5$)
    b. Use an *Eval* or *Table* feature to confirm your answers to Exercise 15.
43. a. Graph the equation $y = 2.5x$ (*Hint*: Use a window defined by $0 \le x \le 12$ and $0 \le y \le 30$)
    b. Use an *Eval* or *Table* feature to confirm your answers to Exercise 16.

Practice Exercises

The Practice Exercises contain a variety of problem types.

- **Applications** are based on real-world facts and figures. Working through these problems will help you improve your problem-solving skills.
- **Exercises keyed to video** are labeled with an icon to help you identify those exercises that appear in the video series that accompanies this text.
- **Calculator Exercises** cover situations when a calculator can be used to help you perform calculations that might be overly time-consuming if done by hand. They are designed for use with either a scientific or a graphing calculator.
- **Expanding Your Skills**, found near the end of most Practice Exercise sets, are exercises that challenge your knowledge of the concepts presented.
- **Graphing Calculator Exercises**, also found at the end of appropriate exercise sets, offer you an opportunity to use a graphing calculator to explore concepts.