

Terms

ary pages 651–657

ay wish to preteach some of the key s used in this chapter. Particularly for sh Language Learners (ELL), enting the vocabulary before the ter or lesson begins gives students a start into understanding the new rial. Writing new words on poster r, pointing to the words as you say 1, then displaying the poster for a od of time is a useful technique.

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 ociative properties (p. 20)
 3 (p. 15)
 imutative properties (p. 9)
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What You'll Learn in Chapter 1

- How to evaluate algebraic expressions
- How to use exponential notation
- How to use properties of numbers in algebra
- How to write expressions and evaluate formulas

CHAPTER 1

Skills & Concepts You Need for Chapter 1

Add or subtract. Simplify answers if possible.

$$1. \frac{3}{7} + \frac{2}{7} \quad 2. \frac{3}{8} + \frac{1}{6} \quad 3. 6\frac{3}{4} + 9\frac{5}{8} \quad 4. 3\frac{1}{2} + 4\frac{2}{3} + 7\frac{1}{4}$$

$$5. \frac{5}{9} - \frac{2}{9} \quad 6. \frac{5}{6} - \frac{2}{5} \quad 7. 1\frac{7}{8} - \frac{3}{4} \quad 8. 7 - \frac{5}{8}$$

Multiply. Simplify answers if possible.

$$9. \frac{3}{4} \times \frac{3}{4} \quad 10. \frac{5}{8} \times 18 \quad 11. 4\frac{1}{5} \times 3\frac{5}{7} \quad 12. 2\frac{3}{10} \times 3\frac{1}{3}$$

Divide. Simplify answers if possible.

$$13. \frac{7}{12} \div \frac{7}{12} \quad 14. \frac{3}{4} \div 2 \quad 15. 3\frac{1}{3} \div 1\frac{1}{4} \quad 16. 3 \div \frac{1}{3}$$

Add.

$$17. 0.5 + 0.35 + 1.5 \quad 18. 14 + 3.75 + 8.6 \quad 19. 1 + 0.02 + 0.2$$

Subtract.

$$20. 7 - 4.38 \quad 21. 11.2 - 6.09 \quad 22. 8.9 - 0.76$$

Multiply.

$$23. \begin{array}{r} 8.75 \\ \times 6 \\ \hline \end{array} \quad 24. \begin{array}{r} 0.75 \\ \times 0.003 \\ \hline \end{array} \quad 25. \begin{array}{r} 7.82 \\ \times 7.9 \\ \hline \end{array} \quad 26. \begin{array}{r} 0.0004 \\ \times 57 \\ \hline \end{array}$$

Divide. Round answers to the nearest hundredth, if necessary.

$$27. 7 \overline{)8.1} \quad 28. 0.08 \overline{)396.7} \quad 29. 1.1 \overline{)0.44}$$

$$30. \begin{array}{r} 5.82 \\ 0.6 \overline{)5.82} \end{array} \quad 31. 0.065 \overline{)333} \quad 32. 8 \overline{)0.91}$$

2

Skills & Concepts You Need for Chapter 1

$$1. \frac{5}{7}$$

$$2. \frac{13}{24}$$

$$3. 16\frac{3}{8}$$

$$4. 15\frac{5}{12}$$

$$5. \frac{1}{3}$$

$$6. \frac{13}{30}$$

$$7. 1\frac{1}{8}$$

$$8. 6\frac{3}{8}$$

$$9. \frac{9}{16}$$

$$10. \frac{45}{4} \text{ or } 11\frac{1}{4}$$

$$11. 15\frac{3}{5}$$

$$12. 7\frac{2}{3}$$

$$13. 1$$

$$14. \frac{3}{8}$$

$$15. 2\frac{2}{3}$$

$$16. 9$$

$$17. 2.35$$

$$18. 26.35$$

$$19. 1.22$$

$$20. 2.62$$

$$21. 5.11$$

$$22. 8.14$$

$$23. 52.5$$

$$24. 0.00225$$

$$25. 61.778$$

$$26. 0.0228$$

$$27. 1.16$$

$$28. 4958.75$$

$$29. 0.4$$

$$30. 9.7$$

$$31. 5123.08$$

$$32. 0.11$$

Order of Operations

You should determine whether or not your calculator follows the Order of Operations. Calculate $3 + 4(2)$.

$$3 \quad + \quad 4 \quad \times \quad 2 \quad = \quad \rightarrow ?$$

If your calculator displays 11, the correct answer, your calculator is programmed to follow the Order of Operations.

If your calculator displays 14, you must always enter the operations in the correct order to get the correct answer.

$$4 \quad \times \quad 2 \quad + \quad 3 \quad = \quad \rightarrow 11$$

1-1 Exercises

A

Mental Math Evaluate.

- $x + 6$ for $x = 7$
- $3 + y$ for $y = 9$
- $m - 2$ for $m = 12$
- $9 - h$ for $h = 3$
- $t + 24$ for $t = 11$
- $18 + x$ for $x = 30$
- $12 - x$ for $x = 5$
- $k - 6$ for $k = 15$
- $4 - x - x$ for $x = 1$
- $k + 8 - k$ for $k = 10$
- $4h$ for $h = 12$
- $8m$ for $m = 3$
- $3t$ for $t = 9$
- $6y$ for $y = 12$
- $\frac{12}{y}$ for $y = 2$
- $\frac{p}{5}$ for $p = 30$
- $\frac{h}{7}$ for $h = 63$
- $\frac{x}{y}$ for $x = 16$ and $y = 4$
- $a - b$ for $a = 12$ and $b = 3$
- mn for $m = 3$ and $n = 7$
- $p + q$ for $p = 7$ and $q = 9$
- $\frac{m}{n}$ for $m = 36$ and $n = 9$

Simplify.

- $13 + 54 \div 9$
- $64 \div 16 + 8$
- $12 + 3 - 7 \cdot 2 + 8$
- $12 \div 2 \times 3 + 9$
- $4 + 12 \times 2 - 8 \div 4$
- $15 \div 5 \times 5 \times 0$
- $32 \div 8 + 4 \times 3$
- $18 \times 2 \div 9 - 3$



Extra Help On the Web

Look for worked-out examples at the Prentice Hall Web site.

www.phschool.com

Exercises

- | | | |
|--------|--------|--------|
| 1. 13 | 14. 72 | 28. 0 |
| 2. 12 | 15. 6 | 29. 16 |
| 3. 10 | 16. 6 | 30. 1 |
| 4. 6 | 17. 9 | |
| 5. 35 | 18. 4 | |
| 6. 48 | 19. 9 | |
| 7. 7 | 20. 21 | |
| 8. 9 | 21. 16 | |
| 9. 2 | 22. 4 | |
| 10. 8 | 23. 19 | |
| 11. 48 | 24. 12 | |
| 12. 24 | 25. 9 | |
| 13. 27 | 26. 2 | |
| | 27. 26 | |

Evaluate.

31. $2x + y$ for $x = 5$ and $y = 4$

32. $x + 4y$ for $x = 2$ and $y = 3$

33. $3m + 4n$ for $m = 2$ and $n = 6$

34. $\frac{x+y}{4}$ for $x = 4$ and $y = 8$

35. $\frac{a+3b}{5}$ for $a = 4$ and $b = 2$

36. $\frac{4p}{3q}$ for $p = 6$ and $q = 8$

B

Evaluate.

37. $\frac{n}{3m}$ for $n = 12$ and $m = 4$

38. $\frac{ab}{8}$ for $a = 5$ and $b = 8$

39. $\frac{3x}{2y+1}$ for $x = 7$ and $y = 3$

40. $\frac{a+b}{2a}$ for $a = 5$ and $b = 15$

41. $2x + 3x - 4x$ for $x = 5$

42. $\frac{24}{2x} + \frac{36}{3x} + \frac{6}{x}$ for $x = 6$

43. $\frac{x+y}{4} + \frac{x-y}{4}$ for $x = 12$ and $y = 8$

44. $\frac{4y}{4y} + (2x + y) - 3z$ for $x = 3$, $y = 2$, and $z = 1$

45. $\frac{y+x}{2} + \frac{3y}{x}$ for $x = 2$ and $y = 4$

46. **Critical Thinking** Use each of the numbers 2, 4, 6, 8, and 10 exactly once, with any operation signs and grouping symbols, to write an expression equal to 0.

47. **Error Analysis** When Rob simplified the expression $72 \div 6 + 3$, his answer was 8. What was Rob's error?

48. **TEST PREP** For what value of x will $\frac{4x+2}{2} - x$ equal 7?
A. 4 B. 5 C. 6 D. 7

Challenge

49. The sum of two numbers, $a + b$, is 17, and the product of these numbers, ab , is 60. What numbers do a and b represent?

50. Write as many of the whole numbers from 0 to 10 as you can, using only the digit 4 with operation signs and grouping symbols as many or as few times as you need to. For example, $\frac{(4+4)}{4} = 2$.

Mixed Review

Calculate. 51. $251 - 179$ 52. $307 + 94$ 53. $1824 \div 32$

54. $2.66 - 0.93$ 55. $5.74 + 8.36$ 56. $(4.9)(3.04)$ 57. $\frac{3}{4} + \frac{2}{7}$

58. $\frac{5}{8} - \frac{1}{3}$ 59. $2\frac{5}{6} - \frac{2}{3}$ 60. $4 \div \frac{1}{2}$ 61. $1\frac{1}{4} \div 2\frac{1}{3}$ Pre-Course

44. 6

45. 9

46. Answers may vary.
Ex: $10(2 + 8 - 4 - 6) = 0$

47. Rob did not use the order of operations. He added before dividing.

48. C

49. 12 and 5

50. $\frac{4}{4} - 4 = 0$

$\frac{4}{4} = 1$

$\frac{4+4}{4} = 2$

$4 - \frac{4}{4} = 3$

$4 = 4$

$4 + \frac{4}{4} = 5$

$4 + \frac{4+4}{4} = 6$

$4 + 4 - \frac{4}{4} = 7$

$4 + 4 = 8$

$4 + 4 + \frac{4}{4} = 9$

$4 + 4 + \frac{4+4}{4} = 10$

Mixed Review

51. 72

52. 401

53. 57

54. 1.73

55. 14.1

56. 14.896

57. $1\frac{1}{28}$

58. $\frac{7}{24}$

59. $2\frac{1}{6}$

60. 8

61. $\frac{15}{28}$

Hint
For Analysis exercises, encourage students to consider specific misuse of either the properties or the order of operations could lead to the incorrect results.

Complete list of Error Analysis see the Index.

Exercises:

- 31. 14
- 32. 14
- 33. 30
- 34. 3
- 35. 2
- 36. 1
- 37. 1
- 38. 5
- 39. 3
- 40. 2
- 41. 5
- 42. 5
- 43. 0

ACTICE/ASSESS

QUIZ

commutative property to write an equivalent expression for each.

$$v \cdot v + u$$

$$xy$$

$$1 \text{ or } 1 + yx \text{ or } yx + 1$$

multiply $\frac{5}{5}$ by 1 to get an equivalent expression. Use $\frac{3}{3}$ for 1.

$$\frac{3}{3} = \frac{15}{5 \cdot 3} = \frac{15}{35}$$

simplify $\frac{18}{15}$.

$$= \frac{3 \cdot 6}{3 \cdot 5} = \frac{6}{5}$$

simplify $\frac{4x}{2y}$.

$$= \frac{2 \cdot 2 \cdot x}{1 \cdot 2 \cdot y} = \frac{2x}{y}$$

simplify $\frac{x}{9x}$.

$$= \frac{1 \cdot x}{9 \cdot x} = \frac{1}{9}$$

simplify $\frac{2abx}{4acx}$.

$$\frac{2x}{x} = \frac{2ax \cdot b}{2ax \cdot 2c} = \frac{b}{2c}$$

Assignment Guide

provide flexible scheduling, this lesson can be split into parts.

Core 1–8

Extension 30, 31, 40

Core 9–14

Extension 32–35

Core 15–29

Extension 36–39

see Mixed Review to maintain skills.

Math Point

For Exercise 40, urge students to first review the commutative properties on page 9 and then state what they think a commutative property for division would say. Emphasize that, for their assertion to be a property, it would have to be true for any numbers a and b . Thus, to show it is not a property, they need to find only one example of two numbers for which the assertion is not true. Give an example that is appropriately called a counterexample.

EXERCISES

$$1. 8 + y$$

$$2. 3 + x$$

$$3. nm$$

$$4. ba$$

$$5. 9 + yx \text{ or } yx + 9 \text{ or } xy + 9$$

$$6. ab + 11 \text{ or } ba + 11 \text{ or } 11 + ba$$

$$7. ctab \text{ or } c + ba \text{ or } ba + c$$

$$8. t + rs$$

$$t + sr$$

$$sr + t$$

$$9. \frac{40}{48}$$

$$10. \frac{99}{110}$$

$$11. \frac{600}{700}$$

$$12. \frac{yz}{10z}$$

$$13. \frac{st}{20t}$$

$$14. \frac{mp}{3np}$$

$$15. \frac{1}{8}$$

$$16. 8$$

$$17. 12$$

$$18. y$$

$$19. \frac{a}{9}$$

$$20. \frac{1}{9y}$$

$$21. \frac{1}{8p}$$

$$22. \frac{8}{3b}$$

$$23. \frac{9}{17q}$$

$$24. \frac{p}{2}$$

$$25. \frac{3}{5}$$

$$26. \frac{9z}{19t}$$

$$27. \frac{13r}{3h}$$

$$28. 3c$$

$$29. 8$$

$$30. \text{No}$$

$$31. \text{No}$$

$$32. \text{Yes}$$

$$33. \text{No}$$

$$34. \text{No}$$

$$35. \text{Yes}$$

$$36. \frac{3sb}{2}$$

$$37. \frac{8r}{3g}$$

$$38. \frac{5}{2}$$

39. Answers may vary.

$$\frac{8ab}{2c}, \frac{4abd}{cd}$$

$$40. \text{No, } 12 \div 4 \neq 4 \div 12$$

Mixed Review

$$41. 16$$

$$42. 1$$

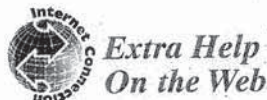
$$43. 42$$

$$44. \frac{31}{40}$$

$$45. \frac{15}{16}$$

$$46. 0.062$$

$$47. 0.48$$



Look for worked-out examples at the Prentice Hall Web site.

www.phschool.com

1-2 Exercises

A

Write an equivalent expression using a commutative property.

$$1. y + 8$$

$$2. x + 3$$

$$3. mn$$

$$4. ab$$

$$5. 9 + xy$$

$$6. 11 + ab$$

$$7. ab + c$$

$$8. rs + t$$

Write an equivalent expression. Use the indicated expression for 1.

$$9. \frac{5}{6} \text{ Use } \frac{8}{8} \text{ for 1.}$$

$$10. \frac{9}{10} \text{ Use } \frac{11}{11} \text{ for 1.}$$

$$11. \frac{6}{7} \text{ Use } \frac{100}{100} \text{ for 1.}$$

$$12. \frac{y}{10} \text{ Use } \frac{z}{z} \text{ for 1.}$$

$$13. \frac{s}{20} \text{ Use } \frac{t}{t} \text{ for 1.}$$

$$14. \frac{m}{3n} \text{ Use } \frac{p}{p} \text{ for 1.}$$

Simplify.

$$15. \frac{13}{104}$$

$$16. \frac{56}{7}$$

$$17. \frac{132}{11}$$

$$18. \frac{5y}{5}$$

$$19. \frac{ab}{9b}$$

$$20. \frac{x}{9xy}$$

$$21. \frac{q}{8pq}$$

$$22. \frac{8a}{3ab}$$

$$23. \frac{9p}{17pq}$$

$$24. \frac{3pq}{6q}$$

$$25. \frac{51d}{17sd}$$

$$26. \frac{9nz}{19in}$$

$$27. \frac{13rv}{3vh}$$

$$28. \frac{9abc}{3ab}$$

$$29. \frac{32prq}{4qrp}$$

B

Tell whether each pair of expressions is equivalent.

$$30. 3t + 5 \text{ and } 3 \cdot 5 + t$$

$$31. 4x \text{ and } x + 4$$

$$32. bxy + bx \text{ and } yxb + bx$$

$$33. ab + bc \text{ and } ac + db$$

$$34. a + c + e + g \text{ and } ea + cg$$

$$35. abc \cdot de \text{ and } a \cdot b \cdot c \cdot ed$$

Simplify.

$$36. \frac{33sba}{2 \cdot (11a)}$$

$$37. \frac{36 \cdot 2rh}{3 \cdot (9hg)}$$

$$38. \frac{3 \cdot (4xy) \cdot (5)}{2 \cdot (3x) \cdot (4y)}$$

$$39. \text{Critical Thinking} \text{ Find two expressions that simplify to } \frac{4ab}{c}.$$

Challenge

40. **Mathematical Reasoning** Is there a commutative property for division of whole numbers? If not, give a counterexample. A **counterexample** is one case where a rule is false.

Mixed Review

$$\text{Simplify. } 41. 12 + 8 \div 2 \quad 42. 16 \div 8 \cdot 2 \div 4 \quad 43. (3 + 4)6 \quad 1-1$$

$$\text{Calculate. } 44. \frac{2}{5} + \frac{3}{8} \quad 45. \frac{5}{8} \div \frac{2}{3} \quad 46. (3.1)(0.02) \quad 47. \frac{4.8}{10} \quad \text{Pre-Course}$$

EXAMPLES Evaluate each expression.

11 $y^4 + 3$ for $y = 2$
 $y^4 + 3 = 2^4 + 3$
 $= 2 \cdot 2 \cdot 2 \cdot 2 + 3$
 $= 16 + 3$
 $= 19$

12 $m^3 + 5$ for $m = 4$
 $m^3 + 5 = 4^3 + 5$
 $= 4 \cdot 4 \cdot 4 + 5$
 $= 64 + 5$
 $= 69$

Try This Evaluate each expression.

m. $x^3 + 2$ for $x = 3$ **n.** $n^5 + 8$ for $n = 2$

When an expression inside parentheses is raised to a power, everything inside the parentheses is the base. Compare $3a^3$ and $(3a)^3$.

$3a^3$ means $3 \cdot a \cdot a \cdot a$ a is the base
 $(3a)^3$ means $(3a)(3a)(3a)$ $3a$ is the base

EXAMPLES Evaluate.

13 $(3a)^3$ for $a = 2$
 $(3a)^3 = (3a)(3a)(3a)$
 $= (3 \cdot 2)(3 \cdot 2)(3 \cdot 2)$
 $= 6 \cdot 6 \cdot 6$
 $= 216$

14 $3a^3$ for $a = 2$
 $3a^3 = 3 \cdot a \cdot a \cdot a$
 $= 3 \cdot 2 \cdot 2 \cdot 2$
 $= 24$

Try This Evaluate.

o. $(2x)^2$ for $x = 4$ **p.** $(5y)^3$ for $y = 2$ **q.** $3x^2$ for $x = 3$

Evaluating Expressions Involving Exponents

You can evaluate expressions like $y^3 + 3$ for $y = 2$ on a calculator with an exponent key. Calculate $2^3 + 3$.

2 y^x 3 $=$ + 3 $=$ → 11

1-3 Exercises

A

What is the meaning of each expression?

1. 2^4 2. 5^3 3. 3^1 4. 1^3 5. a^3 6. $5y^4$

Write using exponential notation.

7. $10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10$ 8. $6 \cdot 6 \cdot 6 \cdot 6 \cdot 6$ 9. $x \cdot x \cdot x \cdot x \cdot x$
 10. $4 \cdot y \cdot y \cdot y$ 11. $5 \cdot m \cdot m \cdot m \cdot m$ 12. $2 \cdot n \cdot n \cdot n \cdot n \cdot n \cdot n$

Try This

- m. 29
 n. 40
 o. 64
 p. 1000
 q. 27

Exercises

1. $2 \cdot 2 \cdot 2 \cdot 2$
 2. $5 \cdot 5 \cdot 5$
 3. 3
 4. $1 \cdot 1 \cdot 1$
 5. $a \cdot a \cdot a$
 6. $5 \cdot y \cdot y \cdot y \cdot y$
 7. 10^6
 8. 6^4
 9. x^5
 10. $4y^3$
 11. $5m^4$
 12. $2n^6$

3. PRACTICE/ASSESS

LESSON QUIZ

Write an equivalent expression with exponents.

- 5^3
 $5 \cdot 5 \cdot 5$
- $2a^3$
 $2 \cdot a \cdot a \cdot a$
- Write using exponential notation.
 $t \cdot t \cdot t \cdot t$
 t^4
- Write using exponential notation.
 $3 \cdot 3 \cdot a \cdot a \cdot b$
 $3^2 a^2 b$
- Simplify to a form without parentheses. $(3z)^2$
 $(3z) \cdot (3z) = 3z \cdot 3z = 3 \cdot z \cdot 3 \cdot z$
 $3 \cdot 3 \cdot z \cdot z = 9z^2$
- Evaluate s^6 for $s = 2$.
 $2^6 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = 64$
- Evaluate $u^2 + 1$ for $u = 4$.
 $4^2 + 1 = 16 + 1 = 17$

Assignment Guide

To provide flexible scheduling, lesson can be split into parts.

- ▼ Core 1–12, 30–33
Extension 36, 37, 40
- ▼ Core 13–29, 34, 35
Extensions 38, 39, 41

Use Mixed Review to maintain s



Extra Help On the Web

Look for worked-out examples at the Prentice Hall Web site.
www.phschool.com

Evaluate each expression.

13. m^3 for $m = 3$ 14. x^6 for $x = 2$ 15. p^1 for $p = 19$
 16. x^{19} for $x = 0$ 17. $x^4 - 8$ for $x = 4$ 18. $y^{15} + 4$ for $y = 1$
 19. $x^3 + 2$ for $x = 4$ 20. $y^2 - 3$ for $y = 5$ 21. $3m^3$ for $m = 1$
 22. $4x^2$ for $x = 3$ 23. $2n^4$ for $n = 2$ 24. $(4x)^3$ for $x = 2$
 25. $(2a)^4$ for $a = 3$ 26. $(5n)^2$ for $n = 6$ 27. $(6y)^4$ for $y = 2$

B

28. Evaluate $(2ab)^3$ for $a = 2$ and $b = 4$.
 29. Evaluate $(3mn)^3$ for $m = 2$ and $n = 0$.

Write with a single exponent.

For example, $\frac{3^5}{3^3} = \frac{3 \cdot 3 \cdot 3 \cdot 3 \cdot 3}{3 \cdot 3 \cdot 3} = 3 \cdot 3 = 3^2$

30. $\frac{10^5}{10^3}$ 31. $\frac{10^7}{10^2}$ 32. $\frac{5^4}{5^2}$ 33. $\frac{8^6}{8^2}$
 34. Evaluate $x^3y^2 + zx$ for $x = 2, y = 1, z = 3$.
 35. **Critical Thinking** Does $x^y = y^x$ for all whole numbers x and y ? If yes, justify your answer. If no, provide a counterexample.
 36. **Mathematical Reasoning** Square any number, then double the result. Is your answer *always, sometimes, or never* greater than the result of doubling the number, then squaring it? Justify your answer.
 37. **Error Analysis** Elaine wrote in her math journal "The square of any number is always greater than the number." Find a counterexample to show that Elaine's statement is incorrect.

Challenge

38. Find yx^{149} for $x = 13$ and $y = 0$.
 39. Find $x^{410}y^2$ for $x = 1$ and $y = 3$.
 40. 10^{127} is 1 followed by how many zeros?
 41. Find $(x^2)^2$ if $x = 3$.

Mixed Review

- Calculate. 42. $8\frac{1}{3} + 2\frac{2}{3}$ 43. $1\frac{5}{8} - \frac{3}{4}$ 44. $\frac{3}{8} \div 3$ 45. $5 \times 2\frac{1}{2}$ *Pre-Course*
 Evaluate. 46. $2(m + n)$ for $m = 7, n = 1$ 47. $(3 + n)n$ for $n = 2$ *1-1*
 Simplify. 48. $\frac{7}{56}$ 49. $\frac{96}{12}$ 50. $\frac{r}{8rs}$ 51. $\frac{18x}{2xy}$ 52. $\frac{3ab}{12b}$ *1-2*

Point

Exercise 36 students must decide whether a mathematical relationship is case, $2x^2 = (2x)^2$ true for *all* values of x , true for *some* values of x and false for *some* other values of x , or true for *no* values of x . You may wish to point out that saying "always true" or "never true" requires a convincing argument about all possible cases. Saying "sometimes true," requires only one true example and one true counterexample.

For a complete list of "sometimes, never" exercises, see the Index.

Exercises

13. 27
 14. 04
 15. 19
 16. 0
 17. 248
 18. 5
 19. 66
 20. 22
 21. 3

22. 36
 23. 32
 24. 512
 25. 1296
 26. 900
 27. 20,736
 28. 4096
 29. 0
 30. 10^2
 31. 10^5
 32. 5^2
 33. 8^4

34. 14
 35. No; for example, $2^3 = 8$ and $3^2 = 9$.
 36. Never; $(2x)^2 = 4x^2$ and $4x^2 \geq 2x^2$ for all x .
 37. Answers may vary. Sample: 1; $1^2 = 1$.
 38. 0
 39. 9
 40. 127
 41. 81

Mixed Review

42. 11 51. $\frac{9}{y}$
 43. $\frac{7}{8}$ 52. $\frac{a}{4}$
 44. $\frac{1}{8}$
 45. $12\frac{1}{2}$
 46. 16
 47. 10
 48. $\frac{1}{8}$
 49. 8
 50. $\frac{1}{8s}$

PRACTICE/ASSESS

QUIZ

- ite.
 5^2
 $25 = 75$
 $-1)^3$
 $= 8$
 te.
 $+ 2)$ for $a = 4$
 $(4 + 2) = 5 \cdot 6 = 30$
 $- 3)(x - 5)$ for $x = 7$
 $- 3)(7 - 5) = 4 \cdot 2 = 8$
 $\frac{+ 3}{x}$ for $x = 4$
 $\frac{+ 3}{4} = \frac{16 + 3}{8} = \frac{19}{8}$
 e associative property to write an
 alent expression.
 $+ (3 + c)$
 $+ 3) + c$
 $\rangle y$
 $\langle y$

Assignment Guide

provide flexible scheduling, this
 lesson can be split into parts.
 Core 1–16, 17–29 odd
 Extension 50–53
 Core 18–30 even, 31–34
 Extension 55, 56
 Core 35–49
 Extension 54, 57

Use Mixed Review to maintain skills.



Extra Help On the Web

Look for worked-out
 examples at the Prentice
 Hall Web site.
www.phschool.com

EXAMPLE 8

Use the commutative and associative properties to write
 three expressions equivalent to $(3 \cdot x) \cdot y$.

$$(3 \cdot x) \cdot y = 3 \cdot (x \cdot y)$$

Using the associative property first
 and then the commutative property

$$(3 \cdot x) \cdot y = y \cdot (x \cdot 3)$$

Using the commutative property twice

$$(3 \cdot x) \cdot y = x \cdot (y \cdot 3)$$

Using the commutative property, then the
 associative property, and then the
 commutative property again

Try This

Use the commutative and associative properties to write three
 equivalent expressions.

p. $4 \cdot (t \cdot u)$

q. $r + (2 + 5)$

1-4 Exercises

A

Mental Math Calculate.

1. $(5 \cdot 4)^2$

2. $(6 \cdot 3)^2$

3. $5 \cdot 4^2$

4. $6 \cdot 3^2$

5. $7 + 2^2$

6. $5 + 3^2$

7. $(7 + 2)^2$

8. $(5 + 3)^2$

9. $(5 - 2)^2$

10. $(3 - 2)^2$

11. $10 - 3^2$

12. $16 - 4^2$

13. $12 - 2^3$

14. $30 - 3^3$

15. $(2 + 3)^3$

16. $3 \cdot 2^3$

Evaluate each expression.

17. $5x^2 - 4$ for $x = 4$

18. $3a^3 + 2$ for $a = 1$

19. $(5y)^3 - 75$ for $y = 2$

20. $(7x)^2 + 59$ for $x = 3$

21. $3(a + 10)$ for $a = 12$

22. $b(7 + b)$ for $b = 5$

23. $(t + 3)^3$ for $t = 4$

24. $(12 - w)^3$ for $w = 7$

25. $(x + 5)(12 - x)$ for $x = 7$

26. $(y - 4)(y + 6)$ for $y = 10$

27. $\frac{y + 3}{2y}$ for $y = 5$

28. $\frac{(4x) + 2}{2x}$ for $x = 5$

29. $\frac{w^2 + 4}{5w}$ for $w = 4$

30. $\frac{b^2 + b}{2b}$ for $b = 5$

Use the associative properties to write an equivalent expression.

31. $(a + b) + 3$ 32. $(5 + x) + y$ 33. $3 \cdot (a \cdot b)$ 34. $(6 \cdot x) \cdot y$

Use the commutative and associative properties to write three equivalent
 expressions.

35. $(a + b) + 2$

36. $(3 + x) + y$

37. $5 + (v + w)$

38. $6 + (x + y)$

39. $(x \cdot y) \cdot 3$

40. $(a \cdot b) \cdot 5$

41. $7 \cdot (a \cdot b)$

42. $5 \cdot (x \cdot y)$

43. $2 \cdot c \cdot d$

Try This

p. Ex. $4 \cdot (u \cdot t)$ or $u \cdot (4 \cdot t)$ or
 $t \cdot (4 \cdot u)$

q. Ex. $r + (5 + 2)$ or $(2 + 5) + r$
 or $(r + 5) + 2$

Exercises

1. 400

2. 324

3. 80

4. 54

5. 11

6. 14

7. 81

8. 64

9. 9

10. 1

11. 1

12. 0

13. 4

14. 3

15. 125

16. 24

17. 76

18. 5

19. 925

20. 500

21. 66

22. 60

23. 343

24. 125

25. 60

26. 96

27. $\frac{4}{5}$

28. $\frac{11}{5}$

29. 1

30. 3

31. $a + (b + 3)$

32. $5 + (x + y)$

33. $(3 \cdot a) \cdot b$

34. $6 \cdot (x \cdot y)$

B

Use the commutative and associative properties to write two expressions equivalent to each expression.

44. $(4a + 2) + b$ 45. $(7 \cdot m) \cdot n + 3$ 46. $(5x^3 + 2) + 6$
 47. $(6m)(np)$ 48. $2(x + 3)y$ 49. $5 + (3 + 7y) + 4$

Find a replacement for the variable for which the two expressions are *not* equivalent.

50. $3x^2; (3x)^2$ 51. $(a + 2)^3; a^3 + 2^3$
 52. $\frac{x+2}{2}; x$ 53. $\frac{y^6}{y^3}; y^2$

54. **Critical Thinking** If it is true that $A + B = 25$ and $(A + C) + B = 85$, what is the value of $A + (C + B)$? of C ?

Challenge

55. **Mathematical Reasoning** Evaluate $a - (b - c)$ and $(a - b) - c$ for $a = 12, b = 7, c = 4$. Is there an associative property for subtraction?
 56. **Mathematical Reasoning** Evaluate $a \div (b \div c)$ and $(a \div b) \div c$ for $a = 32, b = 8,$ and $c = 4$. Is there an associative property for division?
 57. **Mathematical Reasoning** Suppose we define a new operation @ on the set of whole numbers as follows: $a @ b = 2a + b$. For example, $4 @ 5 = 2(4) + 5 = 13$.
 a. Determine whether @ is commutative for whole numbers. That is, does $a @ b = b @ a$ for all whole numbers a and b ?
 b. Determine whether @ is associative for whole numbers. That is, does $(a @ b) @ c = a @ (b @ c)$ for all whole numbers $a, b,$ and c ?

Mixed Review

- Calculate. 58. $12\frac{1}{4} + 7\frac{3}{8}$ 59. $3\frac{3}{5} + 5\frac{1}{2}$ 60. $8\frac{1}{3} + 3\frac{3}{5}$
 61. $3\frac{3}{4} - 2\frac{1}{3}$ 62. $\frac{7}{8} \times \frac{2}{3}$ 63. $1\frac{1}{5} \times 1\frac{1}{3}$ 64. 3.75×0.3 *Pre-Course*
 Simplify. 65. $\frac{6x}{7xy}$ 66. $\frac{12t}{24t}$ 67. $\frac{6mn}{11mt}$ 68. $\frac{14n}{28ny}$ *1-2*
 Evaluate. 69. $(3a^3)$ for $a = 5$ 70. $4y^2$ for $y = 7$
 71. $2w^3 - 9$ for $w = 2$ 72. $4r + \frac{3t}{6}$ for $r = 4$ and $t = 8$
 73. $3(m + 2n)$ for $m = 4$ and $n = 3$ 74. $2a + 5b$ for $a = 2$ and $b = 6$
 75. $\frac{3x+7}{t}$ for $s = 1$ and $t = 5$ 76. $\frac{x+x}{7}$ for $x = 7$
 77. $\frac{w+2z}{z}$ for $w = 6$ and $z = 3$ 78. $\frac{6+3x}{6y}$ for $x = 4$ and $y = 1$ *1-3*

Math Point

Use Exercises 55 and 56 to reinforce the idea of "counterexample" (see p. 14, Exercise 40). Remind students that to be a "property," an assertion must be true for *all* possible examples. A single counterexample proves that the assertion is false.

**Self-Test On the Web**

Check your progress. Look for a self-test at the Prentice Hall Web site. www.phschool.com

51. Any number except 0 or -2
 52. Any number except 2
 53. Any number except 1. 0 is not acceptable.
 54. 85, 60
 55. 9; 1; No, $9 \neq 1$
 56. 16; 1; No, $16 \neq 1$
 57. a. No; $2 @ 3 = 7$ and $3 @ 2 = 8$
 b. No; $(1 @ 2) @ 3 = (4 @ 3) = 11$ and $1 @ (2 @ 3) = 1 @ 7 = 9$

Mixed Review

58. $19\frac{5}{8}$
 59. $9\frac{1}{10}$
 60. $11\frac{14}{15}$
 61. $1\frac{5}{12}$
 62. $\frac{7}{12}$
 63. $\frac{8}{5}$ or $1\frac{3}{5}$
 64. 1.125
 65. $\frac{6}{7y}$
 66. $\frac{1}{2}$
 67. $\frac{6n}{11t}$
 68. $\frac{1}{2y}$
 69. 375
 70. 196
 71. 7
 72. 20
 73. 30
 74. 34
 75. 2
 76. 2
 77. 4
 78. 3

Exercises

35. $(2 + b) + a$
 $(2 + a) + b$
 $b + (a + 2)$
 36. $(y + 3) + x$
 $3 + (y + x)$
 $x + (3 + y)$
 37. $v + (w + 5)$
 $(5 + w) + v$
 $w + (5 + v)$
 38. $x + (y + 6)$
 $y + (6 + x)$
 $(x + 6) + y$
 39. $(y \cdot 3) \cdot x$
 $x \cdot (3 \cdot y)$
 $y \cdot (x \cdot 3)$
 40. $(5 \cdot a) \cdot b$
 $b \cdot (a \cdot 5)$
 $a \cdot (5 \cdot b)$
 41. $a \cdot (b \cdot 7)$
 $(a \cdot 7) \cdot b$
 $b \cdot (7 \cdot a)$
 42. $(x \cdot 5) \cdot y$
 $(5 \cdot y) \cdot x$
 $y \cdot (5 \cdot x)$
 43. $c \cdot (2 \cdot d)$
 $d \cdot (c \cdot 2)$
 $2 \cdot (d \cdot c)$
 44. $(a \cdot 4 + b) + 2$
 $(b + 4a) + 2$
 45. $7 \cdot (n \cdot m) + 3$
 $3 + m \cdot (7 \cdot n)$
 46. $(2 + 6) + 5x^3$
 $2 + (5x^3 + 6)$
 47. $6(mp)n$
 $m(6n)p$
 48. $(x + 3)2y$
 $(x + 3)y \cdot 2$
 49. $(3 + 5) + 7y + 4$
 $5 + 3 + (4 + 7y)$
 Answers may vary.
 50. Any number except 0

1-5 Exercises

A

Use the distributive property to write an equivalent expression.

- | | | |
|-----------------|---------------------|----------------------|
| 1. $2(b + 5)$ | 2. $4(x + 3)$ | 3. $(1 + t)7$ |
| 4. $6(v + 4)$ | 5. $3(x + 1)$ | 6. $(x + 8)7$ |
| 7. $4(1 + y)$ | 8. $9(s + 1)$ | 9. $6(5x + 2)$ |
| 10. $9(6m + 7)$ | 11. $7(x + 4 + 6y)$ | 12. $(5x + 8 + 3p)4$ |

Factor.

- | | | |
|---------------------|---------------------|---------------------|
| 13. $2x + 4$ | 14. $5y + 20$ | 15. $30 + 5y$ |
| 16. $7x + 28$ | 17. $14x + 21y$ | 18. $18a + 24b$ |
| 19. $5x + 10 + 15y$ | 20. $9a + 27b + 81$ | 21. $14c + 63d + 7$ |
| 22. $4y + 10 + 8x$ | 23. $9r + 27s + 18$ | 24. $24x + 72y + 8$ |

Factor and check by multiplying.

- | | |
|-----------------------|---------------------|
| 25. $9x + 27$ | 26. $6x + 24$ |
| 27. $9x + 3y$ | 28. $15x + 5y$ |
| 29. $8a + 16b + 64$ | 30. $5 + 20x + 35y$ |
| 31. $11x + 44y + 121$ | 32. $7 + 14b + 56w$ |
| 33. $5x + 10y + 45z$ | 34. $9p + 3q + 27r$ |

Collect like terms.

- | | |
|-----------------------------------|-----------------------------------|
| 35. $9a + 10a$ | 36. $12x + 2x$ |
| 37. $10a + a$ | 38. $16x + x$ |
| 39. $2x + 9z + 6x$ | 40. $3a + 5b + 7a$ |
| 41. $7x + 6y^2 + 9y^2$ | 42. $12m^2 + 6q + 9m^2$ |
| 43. $41a + 90 + 60a + 2$ | 44. $42x + 6 + 4x + 2$ |
| 45. $8a + 8b + 3a + 3b$ | 46. $100y + 200z + 190y + 400z$ |
| 47. $8u^2 + 3t + 10t + 6u^2 + 2$ | 48. $5 + 6h + t + 8 + 9h$ |
| 49. $23 + 5t + 7y + t + y + 27$ | 50. $45 + 90d + 87 + 9d + 3 + 7d$ |
| 51. $\frac{1}{2}b + \frac{1}{2}b$ | 52. $\frac{2}{3}x + \frac{1}{3}x$ |

53. $2y + \frac{1}{4}y + y$

Simplify each expression. Collect like terms as needed.

- | | |
|-----------------------------|-------------------------------|
| 55. $4x + 5y + 6x$ | 56. $6z + 3k + 9z$ |
| 57. $4p^2 + 2p + 4p + 8p^2$ | 58. $2m + 3mn + 2m + mn$ |
| 59. $7xy + 3y + 6x + 2xy$ | 60. $6tp + 3t^2 + 9t^2 + 2tp$ |



Extra Help On the Web

Look for worked-out examples at the Prentice Hall Web site.
www.phschool.com



Practice Multiple Choice

Choose the best answer.

- Which property is shown by this equation?
 $5 \cdot (3 \cdot 4) = (5 \cdot 3) \cdot 4$
A Commutative property of multiplication
B Associative property of multiplication
C Commutative property of addition
D Associative property of addition
- Simplify the expression
 $3(2x + 7) + 7(5x + 2)$.
F $17x + 24$
G $41x + 35$
H $41x + 9$
J $76x$

1. B; Algebra 1.0
2. G; Algebra 1.0

1-5 The Distributive Property of Multiplication Over Addition 27

Exercises

- $2b + 10$
- $4x + 12$
- $7 + 7t$
- $6v + 24$
- $3x + 3$
- $7x + 56$
- $4 + 4y$
- $9s + 9$
- $30x + 12$
- $54m + 63$
- $7x + 28 + 42y$
- $20x + 32 + 12p$
- $2(x + 2)$

- $5(y + 4)$
- $5(6 + y)$
- $7(x + 4)$
- $7(2x + 3y)$
- $6(3a + 4b)$
- $5(x + 2 + 3y)$
- $9(a + 3b + 9)$
- $7(2c + 9d + 1)$
- $2(2y + 5 + 4x)$
- $9(r + 3s + 2)$
- $8(3x + 9y + 1)$
- $9(x + 3)$
- $6(x + 4)$
- $3(3x + y)$

- $5(3x + y)$
- $8(a + 2b + 8)$
- $5(1 + 4x + 7y)$
- $11(x + 4y + 11)$
- $7(1 + 2b + 8w)$
- $5(x + 2y + 9z)$
- $3(3p + q + 9r)$
- $19a$
- $14x$
- $11a$
- $17x$
- $8x + 9z$
- $10a + 5b$
- $7x + 15y^2$

Assignment Guide

- To provide flexible scheduling, lesson can be split into parts
- ▼ Core 1–12
Extension 67–68
 - ▼ Core 13–34
Extension 65, 66, 69, 70, 7
 - ▼ Core 35–60
Extension 61–64, 72–75

Use Mixed Review to maintain

- $21m^2 + 6q$
- $101a + 92$
- $46x + 8$
- $11a + 11b$
- $290y + 600z$
- $14u^2 + 13t + 2$
- $13 + 15h + t$
- $50 + 6t + 8y$
- $135 + 106d$
- $1b$ or b
- $1x$ or x
- $\frac{13}{4}y$ or $3\frac{1}{4}y$
- $\frac{13}{2}a$ or $6\frac{1}{2}a$
- $10x + 5y$
- $15z + 3k$
- $12p^2 + 6p$
- $4mn + 4m$
- $9xy + 6x + 3y$
- $8pt + 12t^2$

B

Simplify each expression.

61. $4(x + 3) + 5(x + 3)$

62. $7(m^2 + 2) + 7(m^2 + 2)$

63. $8(a + b) + 4(a + 2b)$

64. $4(5x + 6y + 3) + 2(x + 2y)$

65. a. The money you deposit in a bank is called the principal. When you deposit money in a bank and earn interest, the new principal is given by the expression $P + Prt$, where P is the principal, r is the rate of interest, and t is the time. Factor the expression $P + Prt$.
- b. If \$400 is invested at 3% interest, find the new principal at the end of one year by substituting $P = 400$, $r = 0.03$, and $t = 1$ in the expression in part (a).
66. a. Factor $17x + 34$. Then evaluate both expressions when $x = 10$.
- b. Do you get the same answer for both expressions? Why?
67. **Critical Thinking** Does $(x + y)^2 = x^2 + y^2$ for all whole numbers? When are the expressions equal? Explain.
68. **Critical Thinking** You know that $a(b + c) = ab + ac$ for any numbers a , b , and c . Use this fact and the properties introduced earlier to write a paragraph explaining why $(b + c)a = ba + ca$ is also true for any numbers a , b , and c .
69. **Mathematical Reasoning** A student factored $ax + ay + bx + by$ as $a(x + y) + b(x + y)$. Another student factored the same expression as $x(a + b) + y(a + b)$. Are both answers correct, or is one of them incorrect? Justify your answer.

Challenge

70. Find a simpler expression equivalent to $\frac{3a + 6}{2a + 4}$.

71. Find a simpler expression equivalent to $\frac{4x + 12y}{3x + 9y}$.

Collect like terms, if possible, and factor the result.

72. $x + 2x^2 + 3x^3 + 4x^2 + 5x$

73. $q + qr + qrs +qrst$

74. $21x + 44xy + 15y - 16x - 8y - 38xy + 2x + xy$

75. Simplify $a[1 + b[1 + c(1 + d)]]$. (Hint: Begin with $c(1 + d)$ and work outwards.)

Mixed Review

Calculate. 76. $(4 \cdot 3)^2$ 77. $6 \cdot 2^3$ 78. $(3 - 2)^3$ 79. $8 - 2^3$ 1-4

Simplify. 80. $\frac{8xy}{2x}$ 81. $\frac{6b}{18ab}$ 82. $\frac{15c}{30c}$ 83. $\frac{24xy}{3y}$ 1-2

Evaluate. 84. $6(t + 4)$ for $t = 2$ 85. $w(5 + w)$ for $w = 3$

86. k^1 for $k = 5$ 87. $(x + 3) \cdot (5 - x)$ for $x = 2$ 1-1

28 Chapter 1 Introduction to Algebra**Exercises**

1. $9x + 27$
2. $14m^2 + 28$
3. $12a + 16b$
4. $22x + 28y + 12$
5. a. $P(1 + rt)$
b. \$412
6. a. $17(x + 2)$;
 $17(10 + 2) = 17(12) = 204$;
 $17(10) + 34 = 170 + 34 = 204$
b. Yes; distributive property
7. No; when either x or y is 0.
8. $(b + c)a = a(b + c)$ by the commutative property of multiplication;

$a(b + c) = ab + ac$ by the distributive property;
 $ab + ac = ba + ca$ by the commutative property of multiplication. Thus,
 $(b + c)a = ba + ca$.

69. Both answers are correct.
 $ax + ay + bx + by = a(x + y) + b(x + y)$ and
 $ax + ay + bx + by = ax + bx + ay + by = xa + xb + ya + yb = x(a + b) + y(a + b)$.

70. $\frac{3}{2}$

71. $\frac{4}{3}$

72. $6x + 6x^2 + 3x^3 = 3x(2 + 2x + x^2)$

73. $q(1 + r + rs + rst)$

74. $7x + 7xy + 7y = 7(x + xy + y)$

75. $a + ab + abc + abcd$

80. $4y$

81. $\frac{1}{3a}$

82. $\frac{1}{2}$

83. $8x$

84. 36

85. 24

86. 5

87. 15

Mixed Review

76. 144

77. 48

78. 1

79. 0

1-15
29-30
49-51

chalkboard Examples

Write as an algebraic expression.

- the sum of x and 2
 $x + 2$
- the sum of a number and 3
 $n + 3$
Other variables could be used instead of n .
- six more than a number
 $n + 6$
- nine less than a number
 $n - 9$
- twice a number
 $2n$
- half of a number
 $\frac{1}{2}n$ or $\frac{n}{2}$
- the product of u and v
 uv
- Let d be the number of dimes. There are 7 fewer nickels than dimes. Write an expression for the number of nickels.
 $d - 7$
- Let w be the width of the table. The length is three times the width. Write an expression for the length.
 $3w$

I. PRACTICE/ASSESS

LESSON QUIZ

Write as an algebraic expression.

- five more than x
 $x + 5$
- seven less than a number
 $n - 7$
- five times a number
 $5n$
- a number divided by 2
 $\frac{n}{2}$
- Let m be the number of miles Malia ran. Laurel ran 3 miles further than Malia. Write an expression for the distance Laurel ran.
 $m + 3$

Assignment Guide

▼ Core 1-51
Extension 52-63

Use Mixed Review to maintain skills.

**a Help
the Web**

ad-out
examples at the Prentice
Hall Web site.
www.phschool.com

Try This

- Let a be the amount of money Barbara has. Barbara divides her money among 7 people. Write an expression for the amount each person receives
- Let c be the number of coins. Ilene has 24 fewer stamps than coins. Write an expression for the number of stamps she has.

1-6 Exercises

A

Write as an algebraic expression.

- 6 more than b
 - 8 more than t
 - 9 less than c
 - 4 less than d
 - 6 greater than q
 - 11 greater than z
 - b more than a
 - c more than d
 - x less than y
 - c less than h
 - x added to w
 - s added to t
 - m subtracted from n
 - p subtracted from q
 - the sum of r and s
 - the sum of d and f
 - twice x
 - three times p
 - 5 multiplied by t
 - 9 multiplied by d
 - the product of 3 and b
 - x divided among 5
 - double h
 - half of x
 - y fewer than x
 - n more than 6
 - 5 less than m
 - q less than p
- Let a be Connie's age. Robin is 5 years older than Connie. Write an expression for Robin's age.
 - Let p be the number of points the Tigers scored. The Lions scored double the number of points the Tigers scored. Write an expression for the number of points the Lions scored.
 - Let m be the amount of money Bob had before he went shopping. Bob spent \$4.50 while shopping. Write an expression for the amount Bob had left after shopping.
 - Let t be the total amount Rosalie spent for blouses. Each of the 5 blouses cost the same. Write an expression for the cost of each blouse.
 - Let a be the amount Greg earned last week. Greg earned \$45 more this week than last week. Write an expression for the amount he earned this week.

Try This

- $\frac{a}{7}$
- $c - 24$

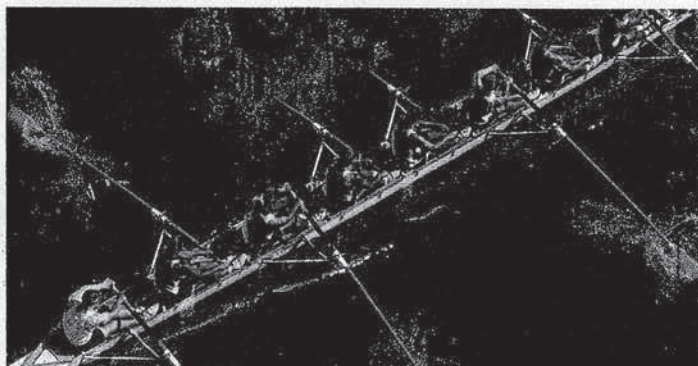
Exercises

- $b + 6$
- $t + 8$
- $c - 9$
- $d - 4$
- $q + 6$
- $z + 11$
- $a + b$
- $d + c$
- $y - x$

- $h - c$
- $w + x$
- $t + s$
- $n - m$
- $q - p$
- $r + s$
- $d + f$
- $2x$
- $3p$
- $5t$
- $9d$
- $3b$
- $\frac{x}{5}$
- $2h$

- $\frac{x}{2}$
- $x - y$
- $n + 6$
- $m - 5$
- $p - q$
- $a + 5$
- $2p$
- $m - \$4.50$
- $\frac{t}{5}$
- $a + \$45$

34. Let n be the number of magazines Scotty sold. Sherry sold half as many magazines as Scotty. Write an expression for the number of magazines that Sherry sold.
35. Let w be Tom's weight last week. Tom lost 2 pounds this week. Write an expression for Tom's weight this week.
36. Let a be the amount Gil has left after buying a record. The record cost \$8. Write an expression for the amount he had before buying the record.
37. Let K be the amount Kelly earns. Geri earns three times as much as Kelly. Write an expression for the amount Geri earns.
38. Let w be the width of a racing-eight crew shell. A racing-eight shell is 32 times as long as it is wide. Write an expression for the length of a racing-eight crew shell.
39. Let t be the total amount of money collected. The total amount was divided evenly among 4 charities. Write an expression for the amount received by each charity.
40. Let d be the distance Paul ran. Steve ran a third as far as Paul. Write an expression for the distance Steve ran.
41. Let R be Randy's age 3 years from now. Write an expression for Randy's age now.



A racing-eight shell is 32 times as long as it is wide. How long is a 22 in.-wide shell? (See Exercise 38.)

B

Write as an algebraic expression.

42. a number x increased by three times y
43. a number y increased by twice x
44. a number a increased by 2 more than b
45. a number that is 3 less than twice x
46. a number x increased by itself
47. the area of a rectangle with length l and width w
48. the perimeter of a square with side s

Evaluate.

49. $\frac{256y}{32x}$ for $y = 1$ and $x = 4$
50. $\frac{y+x}{2} + \frac{3 \cdot y}{x}$ for $x = 2$ and $y = 4$
51. $\frac{a+b}{4} + \frac{a \cdot b}{2}$ for $a = 3$ and $b = 4$

Exercises

- | | |
|-------------------------------------|---------------------|
| 34. $\frac{n}{2}$ | 44. $a + (b + 2)$ |
| 35. $w - 2$ | 45. $2x - 3$ |
| 36. $a + \$8$ | 46. $x + x$ or $2x$ |
| 37. $3K$ | 47. lw |
| 38. $32w$ | 48. $4s$ |
| Photo caption: 58 ft 8 in. | 49. 2 |
| 39. $\frac{1}{4}t$ or $\frac{t}{4}$ | 50. 9 |
| 40. $\frac{1}{3}d$ or $\frac{d}{3}$ | 51. $\frac{31}{4}$ |
| 41. $R - 3$ | |
| 42. $x + 3y$ | |
| 43. $y + 2x$ | |

Evaluate $\frac{x+y}{4}$ when

52. $y = 2$ and x is 14.

53. $x = 9$ and y is three times x .

54. $y = 8$ and x is twice y .

55. $x = 64$ and y is half of x .

56. **Critical Thinking** Describe a real-world situation that could be translated to the expression $25a + 10b$.

57. **Multi-Step Problem** Let x be the number of students in the art club.

- All but 6 students in the club went on a field trip. Write an expression for the number of students on the field trip.
- When the students got to the museum, they were divided into three groups of equal size. Write an expression for the number of students in each group.
- Four students from another school joined the group that Ed was in. Write an expression for the number of students in Ed's group.
- Before lunch, some students (not including Ed) left Ed's group to go to a special exhibit. The number of students that left was equal to one-ninth of the number of students in the art club. Write an expression for the number of students that remained in Ed's group.
- There are 27 students in the art club. How many students were in Ed's group at lunchtime?

58. **Critical Thinking** Let n be a whole number. Tell whether each expression always represents an odd number. Justify your answers.

- a. $2(n + 1)$ b. $2n + 1$ c. $10n - 1$ d. $11n$

Challenge

59. Let $w + 3$ represent a whole number. Give an expression for the next whole number after it.
60. Let $d + 2$ represent an odd whole number. Give an expression for the preceding odd number.
61. The difference between two numbers is 3. One number is t . What are two possible values for the other number?
62. Two numbers are $v + 2$ and $v - 2$. What is their sum?
63. Two numbers are $2 + w$ and $2 - w$. What is their sum?

Mixed Review

Evaluate. 64. $4c^2$ for $c = 6$ 65. $3t^4$ for $t = 2$ 66. $(4x)^2$ for $x = 3$

Factor. 67. $3x + 6$ 68. $20a + 30b$ 69. $8 + 16x + 40y$

Collect like terms. 70. $14c + 8c$ 71. $4a + 7b + 8a$ 72. $\frac{1}{3}c + \frac{2}{3}c$

73. $3y + 7y + y$ 74. $\frac{1}{4}d + \frac{3}{4}d$ 75. $5 + 7c + 4$

Exercises

52. 4
53. 9
54. 6
55. 24
56. Answers may vary. Sample: The total cost in cents of a items at 25¢ each and b items at 10¢ each.

57. a. $x - 6$

b. $\frac{x-6}{3}$

c. $\frac{x-6}{3} + 4$

d. $\frac{x-6}{3} + 4 - \frac{x}{9}$

e. 8 students

58. a. No; let $n = 9$; $2(9 + 1) = 20$

b. Yes; $2n$ is always even because it has a factor of 2, so $2n + 1$ is always odd.

c. Yes; $10n$ is always even, so $10n - 1$ is always odd.

d. No; let $n = 10$; $11(10) = 110$

59. $w + 4$

60. d

61. $t + 3$, $t - 3$

62. $2v$

63. 4

Mixed Review

64. 144

65. 48

66. 144

67. $3(x + 2)$

68. $10(2a + 3b)$

69. $8(1 + 2x + 5y)$

70. $22c$

71. $12a + 7b$

72. c

73. 11y

74. d

75. $9 + 7c$

PRACTICE/ASSESS

ON QUIZ

whether the following sentences are false, or open.

$$= 20$$

open

$$(4 + 2) = 20$$

else

solve $3x - 7 = \frac{20}{x}$ for the replacement

set $\{2, 4, 5\}$.

The solution set is $\{4\}$.

mentally. The replacement set is all

le numbers.

$$+ 6 = 8 \quad x = 2$$

$$x = 36 \quad x = 6$$

$$x + 1 = 3 \quad x = 1$$

his pair of equations is equivalent.

What was done to the first equation

o get the second one?

$$2 - 3 = x$$

$$2 - 3 - 3 = x - 3$$

was subtracted from both sides.

Assignment Guide

o provide flexible scheduling, this

esson can be split into parts.

Core 1-3

Core 4-18, 28-36

Extension 45-49

Core 19-27, 37-42

Extension 43, 44

Use Mixed Review to maintain skills.

EXAMPLES

Each pair of equations is equivalent. What was done to the first equation to get the second one?

$$\begin{aligned} 8 \quad 4x &= 20 \\ x &= 5 \quad \frac{4x}{4} = \frac{20}{4} \end{aligned}$$

Both sides of the first equation were divided by 4 to get the second equation.

$$\begin{aligned} 9 \quad \frac{1}{3}x &= 8 \\ \frac{2}{3}x &= 16 \quad 2 \cdot \frac{1}{3}x = 2 \cdot 8 \end{aligned}$$

Both sides of the first equation were multiplied by 2 to get the second equation.

Try This

Each pair of equations is equivalent. What was done to the first equation to get the second one?

$$\begin{array}{lll} \text{j. } x + 8 = 20 & \text{k. } 2x - 4 = 56 & \text{l. } 6x = 42 \\ x + 12 = 24 & 2x - 9 = 51 & 3x = 21 \end{array}$$



Extra Help On the Web

Look for worked-out examples at the Prentice Hall Web site.

www.phschool.com

1-7 Exercises

A

State whether each sentence is true, false, or open.

$$1. 2 + 3 \cdot 5 = 25 \quad 2. 3a - 4 = 5 \quad 3. 2^3 + 8 = 16$$

Solve for the given replacement set.

$$4. 3n + 2 = 23 \{5, 7, 9\} \quad 5. 6u - 2 = 46 \{5, 6, 8\}$$

$$6. 2m^2 - 1 = 7 \left\{1, \frac{3}{2}, 2\right\} \quad 7. x^2 + x = 0 \{0, 100, 1000\}$$

$$8. 8 - n = 2n \{1, 2, 4\} \quad 9. t - 8 = 4t - 44 \{8, 12, 18\}$$

Mental Math Solve mentally. The replacement set is all whole numbers.

$$10. x + 10 = 20 \quad 11. m + 7 = 30 \quad 12. x - 7 = 12$$

$$13. y - 8 = 19 \quad 14. 6a = 54 \quad 15. 8y = 72$$

$$16. \frac{x}{6} = 5 \quad 17. \frac{c}{8} = 6 \quad 18. d + 98 = 100$$

Each pair of equations is equivalent. Tell what was done to the first equation to get the second equation.

$$\begin{array}{lll} 19. 3x - 5 = 12 & 20. 4r + 3 = 12 & 21. x + 5 = 12 \\ 3x = 17 & 4r = 9 & x - 5 = 2 \end{array}$$

Try This

j. 4 was added to both sides of the equation.

k. 5 was subtracted from both sides of the equation.

l. Both sides of the equation were divided by 2.

Exercises

- False
- Open
- True
- $\{7\}$
- $\{8\}$

$$6. \{2\}$$

$$7. \{0\}$$

8. No solution

$$9. \{12\}$$

$$10. x = 10$$

$$11. m = 23$$

$$12. x = 19$$

$$13. y = 27$$

$$14. a = 9$$

$$15. y = 9$$

$$16. x = 30$$

$$17. c = 48$$

$$18. d = 2$$

19. 5 was added to both sides.

20. 3 was subtracted from both sides.

21. 10 was subtracted from both sides.

22. $12x = 36$
 $4x = 12$
23. $\frac{r}{4} = 6$
 $r = 24$
24. $\frac{3y}{5} = 3$
 $3y = 15$
25. $\frac{x}{8} = 4$
 $x = 32$
26. $5 = \frac{n}{3}$
 $15 = n$
27. $7 = \frac{2y}{4}$
 $28 = 2y$

B

Mental Math Simplify; then solve mentally. The replacement set is all whole numbers.

28. $5x + 3x = 24$ 29. $9y + 4y = 26$ 30. $6t + 3t = 0$
31. $\frac{y}{2} + \frac{y}{2} = 31$ 32. $\frac{2}{3}y + \frac{1}{3}y = 2$ 33. $20x - 6x = 7$
34. $\frac{10d}{5} = 10$ 35. $\frac{20k}{4} = 10$ 36. $4t^2 = 0$

What can be done to each side of the equation to get the variable alone on one side of the equal sign?

37. $x - 12 = 34$ 38. $g + 34 = 60$ 39. $3x = 23$
40. $5v = 35$ 41. $\frac{l}{8} = 12$ 42. $\frac{m}{5} = 14$

Error Analysis A student made the claim that each pair of equations below is equivalent. Explain why the student is incorrect.

43. $n - 5 = 21$ 44. $\frac{x}{6} = 12$
 $n - 5 + 5 = 21 - 5$ $12 \cdot \frac{x}{6} = 6 \cdot 12$

45. **TEST PREP** For which replacement set does the equation $25 = \frac{n}{5}$ have a solution?

A. {5, 25} B. {25, 75} C. $\{\frac{1}{5}, 5\}$ D. {10, 125}

46. **Critical Thinking** Write an equation with no solution if the replacement set is the set of all odd whole numbers. *

Challenge

47. Write an equation that has *no* whole number solution.
48. Write an equation for which *every* whole number is a solution.
49. Write an equation of the type $ax = b$ where $x = 0$ is a solution. *



Mixed Review

Write using exponential notation. 50. $m \cdot m \cdot m$ 51. $n \cdot n \cdot 5 \cdot n \cdot n \cdot n$ 1-3

Calculate. 52. $(3 \cdot 2)^2$ 53. $(4 + 4)^2$ 54. $9 + 3^2$ 55. $(9 - 6)^3$ 1-4

Factor. 56. $4x + 12$ 57. $13t + 52$ 58. $10t + 25m$

59. $16 + 8y$ 60. $8a + 16b$ 61. $9x + 3$ 62. $8 + 24c$ 1-5

Exercises

22. Both sides were divided by 3.
23. Both sides were multiplied by 4.
24. Both sides were multiplied by 5.
25. Both sides were multiplied by 8.
26. Both sides were multiplied by 3.
27. Both sides were multiplied by 4.
28. $x = 3$
29. $y = 2$
30. $t = 0$
31. $y = 31$
32. $y = 2$
33. $x = \frac{1}{2}$
34. $d = 5$
35. $k = 2$
36. $t = 0$
37. Add 12 to both sides.
38. Subtract 34 from both sides.
39. Divide both sides by 3.
40. Divide both sides by 5.
41. Multiply both sides by 8.
42. Multiply both sides by 5.

43. 5 was added to the left side, but subtracted from the right side.
44. The left side was multiplied by 12, but the right side was multiplied by 6.
45. D
46. Ex. $x + 2 = 8$
47. Ex. $3x = 2$
48. Ex. $x - x = 0$
49. Ex. $12x = 0$

Mixed Review

50. m^3
51. $5n^5$
52. 36
53. 64
54. 18
55. 27
56. $4(x + 3)$
57. $13(t + 4)$
58. $5(2t + 5m)$
59. $8(2 + y)$
60. $8(a + 2b)$
61. $3(3x + 1)$
62. $8(1 + 3c)$

CTICE/ASSESS

QUIZ

$$T \text{ for } R = 8 \text{ mi/s}, T = 3 \text{ sec}$$

$$3 \frac{\text{mi}}{\text{s}} \cdot s = 24 \text{ mi}$$

$$WH \text{ for } L = 6 \text{ ft}, W = 3 \text{ ft}$$

$$3 \cdot 5 \text{ ft} \cdot \text{ft} \cdot \text{ft} = 90 \text{ ft}^3$$

$$WH \text{ for } L = 1 \text{ yd}, W = 5 \text{ ft}$$

$$1 \text{ yd} \cdot 3 \text{ ft/yd} (5 \text{ ft}) (2 \text{ ft})$$

$$30 \text{ ft}^2$$

$$(AB - 1) \text{ for } A = 10 \text{ m}$$

$$[(10 \text{ m})(3 \text{ m}) - 1] = 58 \text{ m}^2$$

$$(X + Y)(X - Y) \text{ for } X = 7 \text{ ft}$$

$$(7 \text{ ft} - 4 \text{ ft})(7 \text{ ft} + 4 \text{ ft})$$

$$(11 \text{ ft})(3 \text{ ft}) = 33 \text{ ft}^2$$

Assignment Guide

Exercises 1–23

Exercises 24–28

Mixed Review to maintain skills.



Extra Help On the Web

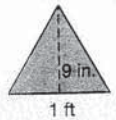
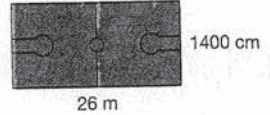
Look for worked-out examples at the Prentice Hall Web site.

www.phschool.com

1-9 Exercises

A

- Find the distance (d) traveled by a truck moving at a rate (r) of 55 mi/h for the time (t) of 8 h using the formula $d = rt$.
- Find the approximate area (A) of a circle with a radius (r) of 4 m using the formula $A = 3.14 r^2$.
- Find the amount of sales tax (T) paid on an item selling for a price (p) of \$170 using the formula $T = 0.04p$ (4% tax rate).
- Find the number of kilometers (km) in 2500 meters (m) using the formula $\text{km} = \frac{\text{m}}{1000}$.
- Find the speed of a supersonic airplane (a) traveling at Mach (M) 1.4 at an altitude where the speed of sound (s) is 1025 ft/s using the formula $a = Ms$.
- Find the speed of a supersonic airplane (a) traveling at Mach (M) 2.3 at an altitude where the speed of sound (s) is 714 mi/h using the formula $a = Ms$.
- Find the area (A) of a basketball court with length (l) of 26 m and width (w) of 1400 cm using the formula $A = lw$.
- Find the area (A) of a triangle with a base (b) of 1 ft and a height (h) of 9 in. using the formula $A = \frac{1}{2}bh$.



- Find the perimeter (P) of an ice skating rink with length (l) of 66 yd and width (w) of 99 ft using the formula $P = 2(l + w)$.
- Find the temperature in degrees Celsius (C) given a temperature 75° Fahrenheit (F) using the formula $C = \frac{5}{9}(F - 32)$.
- Find the amount of simple interest (I) paid on a principal (p) amount of \$2000 at a rate (r) of 0.15 (15% interest rate) for a term (t) of 3 years using the formula $I = prt$.
- Find the unit price of (U) of a 40 oz (n) box of rice selling for a price (P) of \$2.50 using the formula $U = \frac{P}{n}$.

The formula below gives a rule for the amount of medicine a child should have if you know the age of the child (a) and the amount, or dosage, (D) of the medicine an adult would take. Find the child's dosage (d) for the given values of a and D . Round answers to the nearest tenth.

$$d = \frac{a}{a + 12} \cdot D$$

13. $a = 5 \text{ yr}, D = 2.5 \text{ mL}$

14. $a = 10 \text{ yr}, D = 8 \text{ mL}$

15. $a = 2 \text{ yr}, D = 4 \text{ mL}$

16. $a = 1 \text{ yr}, D = 1.5 \text{ mL}$

42 Chapter 1 Introduction to Algebra

Exercises

- 440 mi
- 50.24 m^2
- \$6.80
- 2.5 km
- 1435 ft/s
- 1642.2 mi/h
- 364 m^2
- 54 in.^2 or $\frac{3}{8} \text{ ft}^2$
- 198 yd or 594 ft
- $\approx 24^\circ\text{C}$
- \$900
- \$0.0625 per oz

- 0.7 mL
- 3.6 mL
- 0.6 mL
- 0.1 mL

B

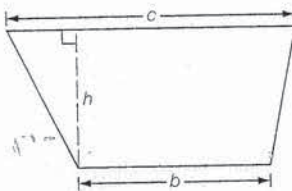
The formula below gives the approximate stopping distance (d) in feet for an automobile driving at x miles per hour (mi/h). Find the approximate stopping distance for each speed given.

$$d = x + \frac{x^2}{20}$$

17. $x = 25$ mi/h 18. $x = 10$ mi/h 19. 55 mi/h 20. 50 mi/h

The formula below gives the area of a trapezoid. As shown in the picture, h is the height, b is the length of one base, and c is the length of the other base. Use this formula to find the area for the different values given below.

$$A = \frac{1}{2}h(b + c)$$



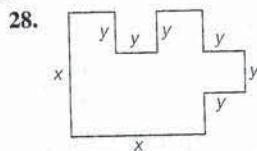
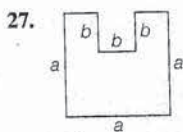
21. $h = 2$ ft, $b = 5$ ft, $c = 12$ ft
 22. $h = 10$ in., $b = 8$ in., $c = 14$ in.
 23. $h = 4$ m, $b = \frac{1}{2}$ m, $c = \frac{3}{4}$ m

24. **Critical Thinking** The length and width of a rectangle are each whole numbers. Find possible areas for this rectangle if its perimeter is 14 cm. Use the formulas $A = lw$ and $P = 2l + 2w$.
25. **Error Analysis** A rectangular field is 150 m wide and 0.5 km long. To find the area, Andrew and Marie each used the formula $A = lw$. Andrew found the area of the field to be 75 m^2 . Marie found the area of the field to be 75 km^2 . Both of these answers are incorrect.
- Identify each student's error.
 - Find the actual area of the field.

Challenge

26. Find the length of a rectangle (l) with area (A) 64 cm^2 and width (w) 16 cm. Use the formula $A = lw$.

Write a formula for the area of each figure.

**Mixed Review**

- Write as an algebraic expression.
29. 5 more than t
30. the sum of x and y 31. 3 times k 32. 3 less than m 1-6
- Collect like terms. 33. $15c + c$ 34. $3x + 4 + 5x$ 1-5
- Solve mentally. 35. $x + 6 = 15$ 36. $6m = 42$ 1-7

Exercises

17. 56.25 ft
 18. 15 ft
 19. 206.25 ft
 20. 175 ft
 21. 17 ft^2
 22. 110 in.^2
 23. $2\frac{1}{2} \text{ m}^2$
24. $P = 2(l + w)$, so $l + w = 7$ cm. The dimensions of the rectangle could be $1 \text{ cm} \times 6 \text{ cm}$, $2 \text{ cm} \times 5 \text{ cm}$, or $3 \text{ cm} \times 4 \text{ cm}$. Thus, the area could be 6 cm^2 , 10 cm^2 , or 12 cm^2 .
25. a. Andrew did not convert 0.5 km to meters. Marie did not convert 150 m to kilometers.
 b. $75,000 \text{ m}^2$ or 0.075 km^2
26. 4 cm
 27. Answers may vary. Ex: $a^2 - b^2$.
 28. Answers may vary. Ex: $x^2 + y^2 - y^2 = x^2$.

Mixed Review

29. $t + 5$
 30. $x + y$
 31. $3k$
 32. $m - 3$
 33. $16c$
 34. $8x + 4$
 35. 9
 36. 7

1-1

To evaluate an **algebraic expression**, **substitute** a number for each variable and calculate the results. When an expression contains grouping symbols, any operation inside the grouping symbols must be done first. When an expression contains a fraction bar, all computations above and below the bar must be done before dividing. When no grouping symbols are used, follow the **Order of Operations**.

Evaluate.

- $y + 7$ for $y = 4$
- $n - 6$ for $n = 15$
- $\frac{30}{x}$ for $x = 6$
- $4t$ for $t = 8$
- ab for $a = 8$ and $b = 9$
- $x - y$ for $x = 19$ and $y = 11$
- $\frac{a}{3b}$ for $a = 18$ and $b = 3$
- $p(6 + q)$ for $p = 3$ and $q = 5$

Simplify.

- $15 \div 3 + 6 \cdot 8$
- $2 \cdot 10 \div 5 + 6$

Evaluate.

- $\frac{4a}{2b+3}$ for $a = 7$ and $b = 2$
- $6x + \frac{3y}{2}$ for $x = 8$ and $y = 4$

1-2

The **commutative properties**, $a + b = b + a$ and $ab = ba$, and **identity properties**, $1 \cdot a = a$ and $0 + a = a$, are used to write **equivalent expressions** and to **simplify** expressions.

Write an equivalent expression using a commutative property.

- $x + 8$
- $11 + ab$

Write an equivalent expression. Use the indicated expression for 1.

- $\frac{4}{5}$ Use $\frac{9}{9}$ for 1.
- $\frac{2x}{y}$ Use $\frac{z}{z}$ for 1.

Simplify.

- $\frac{6}{18}$
- $\frac{56}{16}$
- $\frac{35ab}{105bc}$
- $\frac{96z}{24xyz}$
- $\frac{mn}{6m}$
- $\frac{9pq}{72p}$

Key Terms

additive identity (p. 10)
 algebraic expression (p. 4)
 associative properties (p. 20)
 base (p. 15)
 commutative properties (p. 9)
 counterexample (p. 14)
 dimensional analysis (p. 41)
 distributive property (p. 24)
 equation (p. 33)
 equivalent (p. 35)
 equivalent expressions (p. 9)
 evaluate (p. 4)
 exponent (p. 15)
 exponential notation (p. 15)
 factor (p. 12)
 formula (p. 40)
 grouping symbols (p. 5)
 identity properties (p. 10)
 like terms (p. 26)
 multiplicative identity (p. 10)
 natural numbers (p. 5)
 open sentence (p. 33)
 power (p. 15)
 rational numbers (p. 5)
 replacement set (p. 34)
 simplest form (p. 12)
 simplifying (p. 12)
 solution (p. 34)
 solution set (p. 34)
 solve (p. 34)
 substitute (p. 13)
 substituting (p. 4)
 terms (p. 26)
 variable (p. 4)
 whole numbers (p. 5)

Chapter 1 Wrap Up

- 11
- 9
- 5
- 32
- 72
- 8
- 2
- 33
- 53
- 10
- 4
- 54
- $8 + x$
- $ab + 11, ba + 11, \text{ or } 11 + ba$
- $\frac{36}{45}$
- $\frac{2xz}{yz}$
- $\frac{1}{3}$
- $\frac{7}{2}$
- $\frac{a}{3c}$
- $\frac{4}{xy}$
- $\frac{n}{6}$
- $\frac{q}{8}$



Internet Activity On the Web

Look for extension problems for this chapter at the Prentice Hall Web site. www.phschool.com

1-3

We write $10 \times 10 \times 10 \times 10$ using **exponential notation** as 10^4 . The **exponent**, 4, tells how many times the **base**, 10, is used as a factor. When an expression inside parentheses is raised to a power, everything inside the parentheses is the base.

Write using exponential notation.

23. $6 \cdot 6 \cdot 6 \cdot 6 \cdot 6$

24. $3 \cdot y \cdot y \cdot y \cdot y$

Evaluate each expression.

25. y^3 for $y = 4$

26. $2x^2$ for $x = 6$

27. $a^2 - 2$ for $a = 8$

28. $b^4 + 3$ for $b = 2$

29. $(2a)^3$ for $a = 3$

30. $(5t)^5$ for $t = 2$

1-4

The **associative properties**, $(a + b) + c = a + (b + c)$ and $(ab)c = a(bc)$, are used to write equivalent expressions. When evaluating an expression, you must use the order of operations correctly.

Calculate.

31. $(4 \cdot 5)^2$

32. $6 + 7^2$

Evaluate.

33. $6 + (4y)^2$ for $y = 2$

34. $(6 + a) \cdot (b - 4)$ for $a = 8$ and $b = 6$

Use an associative property to write an equivalent expression.

35. $(a + b) + 6$

36. $(7 \cdot y) \cdot x$

Use the commutative and associative properties to write three equivalent expressions.

37. $(1 + m) + n$

38. $4 \cdot (x \cdot y)$

1-5

The **distributive property of multiplication over addition**, $a(b + c) = ab + ac$, is used to write equivalent expressions and to collect like terms. We can multiply: $3(4x + 3) = 12x + 9$; factor expressions: $3xy + 9 = 3(xy + 3)$; and collect like terms: $4y + 7y = 11y$.

Use the distributive property to write an equivalent expression.

39. $7(y + 5)$

40. $(6m + 4n + 5)3$

Factor.

41. $18x + 6y$

42. $4 + 12b + 36a$

Collect like terms.

43. $3a + 2b + 5a + 7b$

44. $15m^2 + 12m + 4m^2$

Chapter 1 Wrap Up

23. 6^5

24. $3y^4$

25. 64

26. 72

27. 62

28. 19

29. 216

30. 100,000

31. 400

32. 55

33. 70

34. 28

35. $a + (b + 6)$

36. $7 \cdot (y \cdot x)$

37. $1 + (n + m)$

$n + (m + 1)$

Answers may vary.

$m + (1 + n)$

38. $4 \cdot (y \cdot x)$

$y \cdot (x \cdot 4)$

$x(y \cdot 4)$

Answers may vary.

39. $7y + 35$

40. $18m + 12n + 15$

41. $6(3x + y)$

42. $4(1 + 3b + 9a)$

43. $8a + 9b$

44. $19m^2 + 12m$

1-6

It is often necessary to translate data given in words into algebraic expressions. We use a variable to represent each unknown number.

Write as an algebraic expression.

45. five times a number
46. seven less than a number
47. four more than a number
48. twice a number
49. Suppose x is the amount of money Jenny earned on Monday, and she earned twice that amount on Tuesday. Write an expression for the amount Jenny earned on those two days.
50. Suppose a was Robert's age 12 years ago. Write an expression for Robert's age now.

1-7

An equation that contains only numbers may be either true or false. An equation that contains at least one variable is called an **open sentence**. A replacement for a variable that makes an equation true is called a **solution**. The collection of all the solutions is called the **solution set**. Two equations are **equivalent** if one can be obtained from the other by a sequence of steps listed on page 35. Equivalent equations have the same solution set.

Solve for the given replacement set.

51. $3n + 7 = 16$ $\{1, 3, 5\}$ 52. $x^2 - x = 0$ $\{0, 1, 10\}$

Solve mentally. The replacement set is all whole numbers.

53. $5a = 35$ 54. $\frac{c}{4} = 6$

Each pair of equations is equivalent. What was done to the first equation to get the second one?

55. $2x - 8 = 20$ 56. $\frac{r}{5} = 10$
 $2x - 13 = 15$ $2r = 100$

1-9

To evaluate a **formula**, substitute the given numerical values for the variables and calculate the results.

57. Find the area (A) of a figure with base (b) of 12.5 cm and height (h) of 7.5 cm using the formula $A = bh$.
58. Find the approximate area (A) of a circle with radius (r) of 3 ft using the formula $A = 3.14r^2$.

1-8, 1-10

There are many strategies involved in solving all kinds of problems. You will use a variety of reasoning strategies throughout your study of algebra.

Chapter 1 Wrap Up

45. $5n$
46. $n - 7$
47. $n + 4$
48. $2n$
49. $x + 2x$ or $3x$
50. $a + 12$
51. $\{3\}$
52. $\{0, 1\}$
53. $a = 7$
54. $c = 24$
55. 5 was subtracted from both sides.
56. Both sides were multiplied by 10.

57. 93.75 cm^2
58. 28.26 ft^2

| | Lesson |
|---|--------|
| | 1-1 |
| 6 | 1-2 |
| 6 | 1-3 |
| 2 | 1-4 |
| 9 | 1-5 |
| 5 | 1-6 |
| 8 | 1-7 |
| 0 | 1-7 |
| 2 | 1-9 |

1 Chapter Assessment

Evaluate.

- $p - 11$ for $p = 25$
- $\frac{40}{x}$ for $x = 8$
- $\frac{3x}{y}$ for $x = 10$ and $y = 5$
- $a - 2b$ for $a = 16$ and $b = 3$

Simplify.

- $16 \div 8 + 8$
- $3 \cdot 4 + 2 \cdot 8$

Evaluate.

- $3(2a + b)$ for $b = 4$ and $a = 2$
- $\frac{2x + y}{4}$ for $x = 3$ and $y = 6$

Write an equivalent expression using a commutative property.

- $xy + 3$
- $a + 6$

Write an equivalent expression. Use the indicated expression for 1.

- $\frac{3}{7}$ Use $\frac{4}{4}$ for 1.
- $\frac{6}{3y}$ Use $\frac{x}{x}$ for 1.

Simplify.

- $\frac{16}{24}$
- $\frac{81}{45}$
- $\frac{xy}{12x}$
- $\frac{9xy}{15yz}$

What is the meaning of each expression?

- 2^4
- $5x^3$

Write in exponential notation.

- $7 \cdot 7 \cdot 7 \cdot 7$
- $8 \cdot x \cdot x \cdot x \cdot x \cdot x$

Evaluate each expression.

- $(5x)^2$ for $x = 4$
- $(3y)^4$ for $y = 0$
- x^3 for $x = 3$
- $3y^2$ for $y = 4$
- $b^2 - 5$ for $b = 7$
- $(4t)^3$ for $t = 2$

Calculate.

- $(3 \cdot 6)^2$
- $6 + 3^3$

Evaluate.

- $(3x)^3 + 4$ for $x = 2$
- $(r + 5)(s - 4)$ for $r = 5$ and $s = 10$

50 Chapter 1 Introduction to Algebra

Chapter 1 Assessment

- | | | |
|-----------------------------|---------------------------------|---------|
| 1. 14 | 13. $\frac{2}{3}$ | 25. 44 |
| 2. 5 | 14. $\frac{9}{5}$ | 26. 512 |
| 3. 6 | 15. $\frac{y}{12}$ | 27. 324 |
| 4. 10 | 16. $\frac{3x}{5z}$ | 28. 33 |
| 5. 10 | 17. $2 \cdot 2 \cdot 2 \cdot 2$ | 29. 220 |
| 6. 28 | 18. $5 \cdot x \cdot x \cdot x$ | 30. 60 |
| 7. 24 | 19. 7^4 | |
| 8. 3 | 20. $8x^5$ | |
| 9. $3 + xy, 3 + yx, yx + 3$ | 21. 400 | |
| 10. $6 + a$ | 22. 0 | |
| 11. $\frac{12}{28}$ | 23. 27 | |
| 12. $\frac{6x}{3yx}$ | 24. 48 | |

Use an associative property to write an equivalent expression.

31. $(x + y) + 5$

Use the commutative and associative properties to write three equivalent expressions.

32. $3 \cdot (a \cdot b)$

Use the distributive property to write an equivalent expression.

33. $6(4y + 3)$

Factor.

34. $8a + 12b$

35. $18x + 6y + 12$

36. $3 + 12b + 36a$

37. $8a + 4 + 12c$

Collect like terms.

38. $7a + 3b + 8a + 4b$

39. $6m + 9m^2 + 3m + 7m^2$

Write as an algebraic expression.

40. 11 fewer than x

41. half of a number

42. twice a number

43. six more than a number

44. Suppose w was Lisa's weight last year. Lisa lost 7 pounds this year. Write an expression for Lisa's weight this year.

45. Suppose t is the total amount of tickets sold to the dance. If each of the ninth, tenth, and eleventh grades sold the same number of tickets, write an expression for the number of tickets sold by each grade.

Solve for the given replacement set.

46. $5n - 4 = 11$ $\{2, 3, 4\}$

47. $x^2 - x = 2$ $\{0, 2, 4\}$

48. $7.2y = 36$ $\{5, 50, 500\}$

Each pair of equations is equivalent. What was done to the first equation to get the second one?

49. $\frac{2}{5}m = 3$

50. $2x = 10$

$\frac{4}{5}m = 6$

$2x + 4 = 14$

Evaluate.

51. Find the distance (d) traveled by a train moving at the rate (r) of 50 mi/h for the time (t) of 3 h using the formula $d = rt$.

52. Find the temperature in degrees Celsius (C) given a temperature of 77° Fahrenheit (F) using the formula $C = \frac{5}{9}(F - 32)$.

Chapter 1 Assessment

31. $x + (y + 5)$

32. $3 \cdot (b \cdot a)$

$b \cdot (a \cdot 3)$

$a \cdot (b \cdot 3)$

33. $24y + 18$

34. $4(2a + 3b)$

35. $6(3x + y + 2)$

36. $3(1 + 4b + 12a)$

37. $4(2a + 3c + 1)$

38. $15a + 7b$

39. $9m + 16m^2$

40. $x - 11$

41. $\frac{9}{2}$

42. $2n$

43. $6 + n$

44. $w - 7$

45. $\frac{t}{3}$

46. $\{3\}$

47. $\{2\}$

48. $\{5\}$

49. Both sides were multiplied by 2.

50. 4 was added to both sides.

51. 150 mi

52. 25°C