

Unit 1

Algebra and Functions

FOCUS

Use appropriate operations to solve problems and linear equations.

CHAPTER 1 Introduction to Algebra and Functions

BIG Idea Represent relationships in numerical, verbal, geometric and symbolic form.

CHAPTER 2 Integers

BIG Idea Know the properties of, and compute with, integers.

CHAPTER 3 Algebra: Linear Equations and Functions

BIG Idea Solve linear equations in one variable.



Mike Powell/Getty Images



Problem Solving



Real-World Unit Project

Stand Up and Be Counted! Every 10 years, the U.S. Census takes a count of the U.S. population. How does the U.S. Census affect the number of members in the House of Representatives from each state? You're on a mission to find out! Along the way, you will create a map of the United States, make a line plot, and write a paragraph about these changes. Don't forget to bring your math tool kit. This adventure will appeal to your "census."

IN Math Online

Log on to glencoe.com to begin.



CHAPTER 1

Introduction to Algebra and Functions

Indiana Academic Standards

7.2.1 Use variables and appropriate operations to write an expression, equation or inequality that represents a verbal description.

7.2.3 Evaluate numerical expressions and simplify algebraic expressions involving rational and irrational numbers.

Key Vocabulary

algebra (p. 44)

defining the variable (p. 50)

evaluate (p. 31)

numerical expression (p. 38)

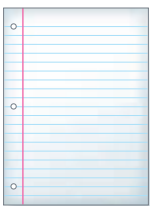
Real-World Link

PARKS Admission to the Kentucky Horse Park in Lexington, Kentucky, costs \$15 for each adult and \$8 for each child. You can use the four-step problem-solving plan to determine the cost of admission for a family of 2 adults and 3 children.

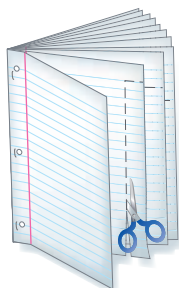
FOLDABLES[®] Study Organizer

Introduction to Algebra and Functions Make this Foldable to help you organize your notes. Begin with eleven sheets of notebook paper.

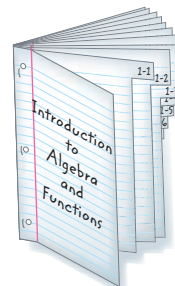
1 Staple the eleven sheets together to form a booklet.



2 Cut tabs. Make each one 2 lines longer than the one before it.



3 Write the chapter title on the cover and label each tab with the lesson number.



GET READY for Chapter 1

Diagnose Readiness You have two options for checking Prerequisite Skills.

Option 2

IN Math Online

Take the Online Readiness Quiz at glencoe.com.

Option 1

Take the Quick Quiz below. Refer to the Quick Review for help.

QUICK Quiz

Add. (Prior Grade)

1. $89.3 + 16.5$ 2. $7.9 + 32.45$

3. $54.25 + 6.39$ 4. $10.8 + 2.6$

5. **TECHNOLOGY** Patrick bought a personal electronic organizer for \$59.99 and a carrying case for \$12.95. What was his total cost, not including tax? (Prior Grade)

Subtract. (Prior Grade)

6. $24.6 - 13.3$ 7. $9.1 - 6.6$

8. $30.55 - 2.86$ 9. $17.4 - 11.2$

Multiply. (Prior Grade)

10. 4×7.7 11. 9.8×3

12. 2.7×6.3 13. 8.5×1.2

Divide. (Prior Grade)

14. $37.49 \div 4.6$ 15. $14.31 \div 2.7$

16. $6.16 \div 5.6$ 17. $11.15 \div 2.5$

18. **PIZZA** Four friends decided to split the cost of a pizza evenly. The total cost was \$25.48. How much does each friend need to pay? (Prior Grade)

QUICK Review

Example 1 Find $17.89 + 43.2$.

$$\begin{array}{r} 17.89 \\ + 43.20 \\ \hline 61.09 \end{array}$$

Line up the decimal points.
Annex a zero.

Example 2 Find $37.45 - 8.52$.

$$\begin{array}{r} 37.45 \\ - 8.52 \\ \hline 28.93 \end{array}$$

Line up the decimal points.

Example 3 Find 1.7×3.5 .

$$\begin{array}{r} 1.7 \leftarrow 1 \text{ decimal place} \\ \times 3.5 \leftarrow + 1 \text{ decimal place} \\ \hline 5.95 \leftarrow 2 \text{ decimal places} \end{array}$$

Example 4 Find $24.6 \div 2.5$.

$$\begin{array}{r} 2.5 \overline{)24.6} \rightarrow 25 \overline{)246.} \\ \underline{25} \\ 9.84 \\ 25 \overline{)246.00} \\ \underline{-225} \\ 210 \\ \underline{-200} \\ 100 \\ \underline{-100} \\ 0 \end{array}$$

Multiply both numbers by the same power of 10.

Annex zeros.

Divide as with whole numbers.

READING to SOLVE PROBLEMS

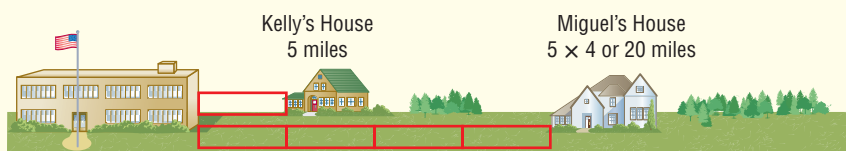
Making Sense

When you solve a word problem, the first thing to do is to read the problem carefully. The last thing to do is to see whether your answer makes sense. Sometimes a picture or diagram can help.

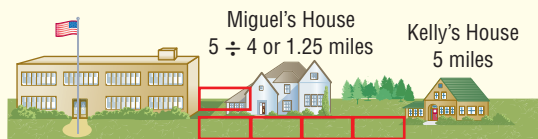
Academic Standards P.5.2 Select, apply, and translate among mathematical representations to solve problems.

Kelly lives 5 miles from school. This is 4 times as far as Miguel lives from school. How far does Miguel live from school?

If you look just at the key words in the problem, it might seem that 4 times 5 would give the solution.



But the important question is, "Does this solution make sense?" In this case, the solution does *not* make sense because Kelly lives farther away. This problem is solved by dividing.



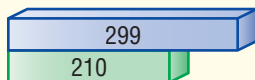
So, Miguel lives 1.25 miles away from school.

PRACTICE

For Exercises 1 and 2, choose the model that illustrates each problem. Explain your reasoning. Then solve.

- Jennifer has saved \$210 to purchase an MP3 player. She needs \$299 to buy it. How much more money does she need?

Model A

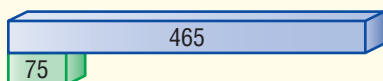


Model B

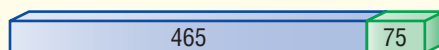


- The school cafeteria sold 465 lunches on Thursday. They expect to sell 75 more lunches on Friday because they serve pizza that day. How many lunches do they expect to sell on Friday?

Model C



Model D



1-1

A Plan for Problem Solving

MAIN IDEA

Solve problems using the four-step plan.

IN Academic Standards

7.3.4 Recognize, describe, or extend geometric patterns using tables, graphs, words, or symbols.

P.1.1 Build new mathematical knowledge through problem solving.

IN Math Online

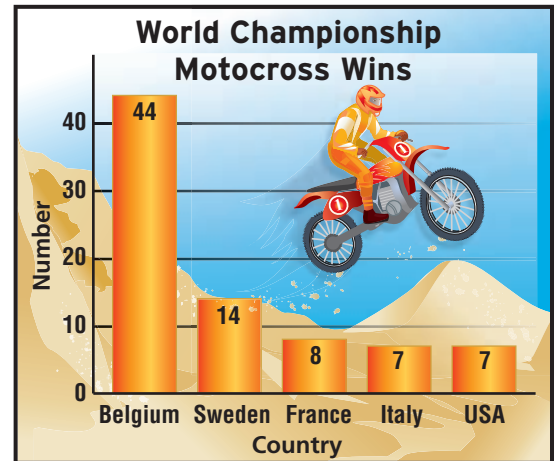
glencoe.com

- Extra Examples
- Personal Tutor
- Self-Check Quiz

▶ GET READY for the Lesson

ANALYZE GRAPHS The graph shows the countries with the most world championship motocross wins. What is the total number of wins for these five countries?

1. Do you have all of the information necessary to solve this problem?
2. Explain how you would solve this problem. Then solve it.
3. Does your answer make sense? Explain.
4. What can you do if your first attempt at solving the problem does not work?



In mathematics, there is a *four-step plan* you can use to help you solve any problem.

Understand

- Read the problem carefully.
- What information is given?
- What do you need to find out?
- Is enough information given?
- Is there any extra information?

Plan

- How do the facts relate to each other?
- Select a strategy for solving the problem. There may be several that you can use.
- Estimate the answer.

Solve

- Use your plan to solve the problem.
- If your plan does not work, revise it or make a new plan.
- What is the solution?

Check

- Does your answer fit the facts given in the problem?
- Is your answer reasonable compared to your estimate?
- If not, make a new plan and start again.



Real-World Link
 In a recent year, worldwide consumers purchased 8.8 million LCD (Liquid Crystal Display) TVs.
 Source: DisplaySearch

EXAMPLE Use the Four-Step Plan

1 TELEVISION There were about 268 million TVs in the U.S. in 2007. This amount increases by 4 million each year after 2007. In what year will there be at least 300 million TVs?

Understand *What are you trying to find?*
 In what year will there be at least 300 million TVs in the U.S.?

What information do you need to solve the problem?
 You know how many TVs there were in 2007. Also, the number increases by 4 million each year.

Plan Find the number of TVs needed to reach 300 million. Then divide this number by 4 to find the number of years that will pass before the total reaches 300 million TVs.

Solve The change in the number of TVs from 268 million to 300 million is $300 - 268$ or 32 million TVs. Dividing the difference by 4, you get $32 \div 4$ or 8.

You can also use the *make a table* strategy.

Year	'07	'08	'09	'10	'11	'12	'13	'14	'15
Number (millions)	268	272	276	280	284	288	292	296	300

$+4 \quad +4 \quad +4 \quad +4 \quad +4 \quad +4 \quad +4 \quad +4$

So, there will be at least 300 million TVs in the U.S. in the year 2015.

Check $8 \text{ years} \times 4 \text{ million} = 32 \text{ million}$
 $268 \text{ million} + 32 \text{ million} = 300 \text{ million}$ ✓

CHECK Your Progress

- a. **WHALES** A baby blue whale gains about 200 pounds each day. About how many pounds does a baby blue whale gain per hour?



Problems can be solved using different operations or strategies.

Problem-Solving Strategies

Concept Summary

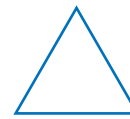
- | | |
|-------------------------|-----------------------------|
| guess and check | use a graph |
| look for a pattern | work backward |
| make an organized list | eliminate possibilities |
| draw a diagram | estimate reasonable answers |
| act it out | use logical reasoning |
| solve a simpler problem | make a model |



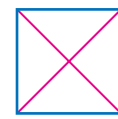
EXAMPLE

Use a Strategy in the Four-Step Plan

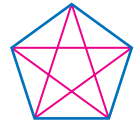
- 2 GEOMETRY** A *diagonal* connects two nonconsecutive vertices in a figure, as shown at the right. Find how many diagonals a figure with 7 sides would have.



3 sides
0 diagonals



4 sides
2 diagonals



5 sides
5 diagonals

Understand You know the number of diagonals for figures with three, four, and five sides.

Plan You can look for a pattern by organizing the information in a table. Then continue the pattern until you find the diagonals for an object with 7 sides.

Solve

Sides	3	4	5	6	7
Diagonals	0	2	5	9	14

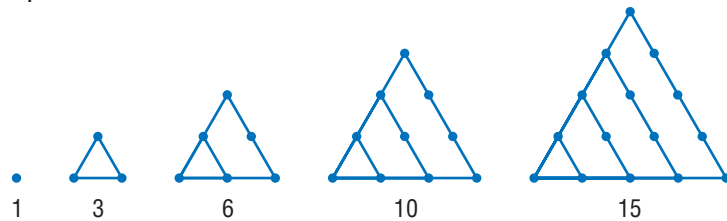
+2 +3 +4 +5

So, a 7-sided figure would have 14 diagonals.

Check Check your answer by making a drawing.

CHECK Your Progress

- b. **GEOMETRY** Numbers that can be represented by a triangular arrangement of dots are called *triangular numbers*. The first five triangular numbers are shown below. Write a sequence formed by the first eight triangular numbers. Write a rule for generating the sequence.



CHECK Your Understanding



Use the four-step plan to solve each problem.

Example 1
(p. 26)

- ANALYZE TABLES** The table lists the sizes of six of the largest lakes in North Carolina. About how many times as large is High Rock Lake than Hyco Lake?

Lake	Size (acres)
Lake Mattamuskeet	40,000
Falls Lake	12,000
Hyco Lake	3,750
Lake Gaston	20,000
Lake James	6,500
High Rock Lake	15,000

Example 2
(p. 27)

- ALGEBRA** What are the next two numbers in the pattern below?

1, 1, 2, 6, 24, ■, ■

Practice and Problem Solving

HOMework HELP

For Exercises	See Examples
3–6	1
7–10	2

Use the four-step plan to solve each problem.

- BIRDS** Most hummingbirds flap their wings about 50 times a second. How many times can a hummingbird flap its wings in one minute?
- PLANETS** Jupiter is about 3 times the size of Neptune. If the diameter of Jupiter is 88,736 miles, estimate the diameter of Neptune.
- FIELD TRIPS** To attend a field trip to a museum, each student will have to pay \$6.00 for transportation and \$5.75 for admission. If there are 65 students attending the field trip, how much money will their teacher need to collect?
- CANOE RENTALS** A state park took in \$12,000 in canoe rentals during March. June rentals are expected to double that amount. If canoes rent for \$40, how many canoe rentals are expected in June?
- GEOMETRY** What are the next two figures in the pattern?



- ALGEBRA** What are the next two numbers in the pattern below?
9, 27, 81, 243, 729, ■, ■



ANALYZE TABLES For Exercises 9 and 10, use the commuter train schedule shown.

A commuter train departs from a train station and travels to the city each day. The schedule shows the first five departure and arrival times.

Commuter Train Schedule	
Departure	Arrival
6:30 A.M.	6:50 A.M.
7:15 A.M.	7:35 A.M.
8:00 A.M.	8:20 A.M.
8:45 A.M.	9:05 A.M.
9:30 A.M.	9:50 A.M.

- How often does the commuter train arrive in the city?
- What is the latest time that passengers can depart from the train station if they need to arrive in the city no later than noon?
- HOMework** Angel has guitar practice at 7:00 P.M. He has homework in math, science, and history that will take him 30 minutes each to complete. He also has to allow 20 minutes for dinner. What is the latest time Angel can start his homework?
- ESTIMATION** Terry opened a savings account in December with \$132 and saved \$27 each month beginning in January. Estimate the value of Terry’s account in July. Then calculate the amount and evaluate the reasonableness of your estimate.
- FIND THE DATA** Refer to the Data File on pages 16–19 of your book. Choose some data and write a real-world problem in which you would use the four-step plan to solve the problem.



14. **ANALYZE TABLES** The sizes of Earth's oceans in millions of square kilometers are shown in the table. If the combined size of Earth's oceans is 367 million square kilometers, what is the size of the Pacific Ocean?

Earth's Oceans	
Ocean	Size (million km ²)
Arctic	45
Atlantic	77
Indian	69
Pacific	■
Southern	20

Source: *The World Factbook*

15. **MONEY** Meli wants to buy a pair of rollerblades that cost \$140.75. So far, she has saved \$56.25. If she saves \$6.50 every week, in how many weeks will she be able to purchase the rollerblades?

Academic Standards • ISTEP+

Extra Practice, pp. 668, 704



H.O.T. Problems

16. **CHALLENGE** Use the digits 5, 6, 7, and 8 to form two 2-digit numbers so that their product is as great as possible. Use each digit only once.
17. **OPEN ENDED** Create a real-world problem that can be solved by adding 79 and 42 and then multiplying the result by 3.
18. **WRITING IN MATH** Explain why it is important to plan before solving a problem.

ISTEP+ PRACTICE P.1.1

19. Sheryl has \$2 to spend at the school store. Based on the choices below, which three items from the table could Sheryl purchase?

Item	Cost
Folder	\$1.50
Pencil	\$0.20
Pen	\$0.50
Ruler	\$1.75
Highlighter	\$0.40

- A folder, pencil, pen
- B folder, highlighter, pencil
- C pencil, pen, highlighter
- D ruler, highlighter, pencil

20. Mr. Brooks went on a business trip. The trip was 380 miles, and the average price of gasoline was \$3.15 per gallon. What information is needed to find the amount Mr. Brooks spent on gasoline for the trip?

- F Number of times Mr. Brooks stopped to fill his tank with gasoline
- G Number of miles the car can travel using one gallon of gasoline
- H Number of hours the trip took
- J Average number of miles Mr. Brooks drove per day

GET READY for the Next Lesson

PREREQUISITE SKILL Multiply.

21. 10×10

22. $3 \times 3 \times 3$

23. $5 \times 5 \times 5 \times 5$

24. $2 \times 2 \times 2 \times 2 \times 2$

1-2

Powers and Exponents

MAIN IDEA

Use powers and exponents.

IN Academic Standards

7.1.2 Recognize and compute whole number powers of positive integers.

New Vocabulary

factors
exponent
base
powers
squared
cubed
evaluate
standard form
exponential form

IN Math Online

glencoe.com

- Extra Examples
- Personal Tutor
- Self-Check Quiz

▶ GET READY for the Lesson

TEXT MESSAGING Suppose you text message one of your friends. That friend then text messages two friends after one minute. The pattern continues.

1. How is doubling shown in the table?
2. How many text messages will be sent after 4 minutes?
3. What is the relationship between the number of 2s and the number of minutes?

Minutes	Number of Text Messages	
0	1	= 1
1	1 × 2	= 2
2	2 × 2	= 4
3	2 × 2 × 2	= 8

Two or more numbers that are multiplied together to form a product are called **factors**. When the same factor is used, you may use an exponent to simplify the notation. The **exponent** tells how many times the base is used as a factor. The common factor is called the **base**.

$$16 = 2 \cdot 2 \cdot 2 \cdot 2 = 2^4 \leftarrow \text{exponent}$$

↑
base

Powers	Words
5^2	five to the second power or five squared
4^3	four to the third power or four cubed
2^4	two to the fourth power

Numbers expressed using exponents are called **powers**.

EXAMPLES Write Powers as Products

Write each power as a product of the same factor.

1 7^5

Seven is used as a factor five times.

$$7^5 = 7 \cdot 7 \cdot 7 \cdot 7 \cdot 7$$

2 3^2

Three is used as a factor twice.

$$3^2 = 3 \cdot 3$$

✓ CHECK Your Progress

Write each power as a product of the same factor.

a. 6^4

b. 1^3

c. 9^5



You can **evaluate**, or find the value of, powers by multiplying the factors. Numbers written without exponents are in **standard form**.

EXAMPLES Write Powers in Standard Form



Vocabulary Link

Evaluate

Everyday Use to find what something is worth

Math Use find the value of

3

Evaluate each expression.

$$2^5$$

$$2^5 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \quad \begin{array}{l} 2 \text{ is used as a factor } 5 \text{ times.} \\ \text{Multiply.} \end{array}$$

$$= 32$$

4

$$4^3$$

$$4^3 = 4 \cdot 4 \cdot 4 \quad \begin{array}{l} 4 \text{ is used as a factor } 3 \text{ times.} \\ \text{Multiply.} \end{array}$$

$$= 64$$



CHECK Your Progress

Evaluate each expression.

d. 10^2

e. 7^3

f. 5^4

Numbers written with exponents are in **exponential form**.

EXAMPLE Write Numbers in Exponential Form

5

Write $3 \cdot 3 \cdot 3 \cdot 3$ in exponential form.

3 is the base. It is used as a factor 4 times. So, the exponent is 4.
 $3 \cdot 3 \cdot 3 \cdot 3 = 3^4$



CHECK Your Progress

Write each product in exponential form.

g. $5 \cdot 5 \cdot 5$

h. $12 \cdot 12 \cdot 12 \cdot 12 \cdot 12 \cdot 12$



CHECK Your Understanding

Examples 1, 2
(p. 30)

Write each power as a product of the same factor.

1. 9^3

2. 3^4

3. 8^5

Examples 3, 4
(p. 31)

Evaluate each expression.

4. 2^4

5. 7^2

6. 10^3

7. **POPULATION** There are approximately 5^{10} people living in North Carolina. About how many people is this?

Example 5
(p. 31)

Write each product in exponential form.

8. $5 \cdot 5 \cdot 5 \cdot 5 \cdot 5 \cdot 5$

9. $1 \cdot 1 \cdot 1 \cdot 1$

10. $4 \cdot 4 \cdot 4 \cdot 4 \cdot 4$



H.O.T. Problems

41. **CHALLENGE** Write two different powers that have the same value.
42. **Which One Doesn't Belong?** Identify the number that does not belong with the other three. Explain your reasoning.

121

361

576

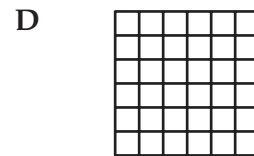
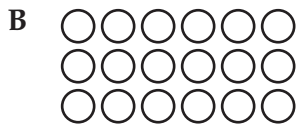
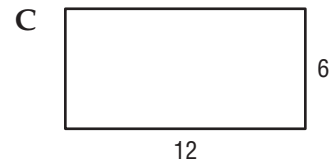
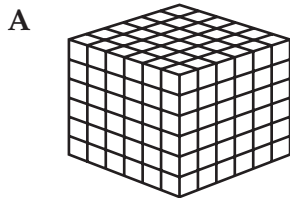
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43. **WRITING IN MATH** Analyze the number pattern shown at the right. Then write a convincing argument as to the value of 2^0 . Based on your argument, what do you think will be the value of 2^{-1} ?

$2^4 = 16$
 $2^3 = 8$
 $2^2 = 4$
 $2^1 = 2$
 $2^0 = ?$

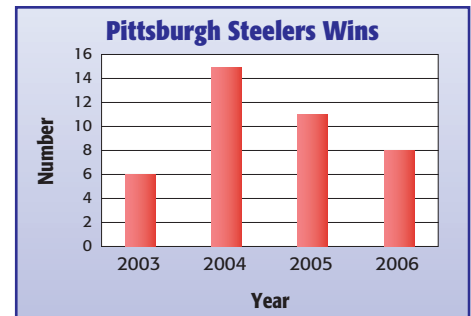
ISTEP+ PRACTICE 7.1.2

44. Which model represents 6^3 ?



Spiral Review

45. **FOOTBALL** The graph shows the number of wins the Pittsburgh Steelers had from 2003–2006. How many more wins did the Steelers have in 2004 than 2006? (Lesson 1-1)
46. **COOKING** Ms. Jackson is serving fried turkey at 5:00 P.M. The 12-pound turkey has to cook 3 minutes for every pound, and then cool for at least 45 minutes. What is the latest time she can start frying? (Lesson 1-1)



Source: National Football League

GET READY for the Next Lesson

PREREQUISITE SKILL Multiply.

47. $2 \cdot 2$

48. $3 \cdot 3$

49. $5 \cdot 5$

50. $7 \cdot 7$



The factors multiplied to form perfect squares are called **square roots**. A **radical sign**, $\sqrt{\quad}$, is the symbol used to indicate a square root of a number.

Reading Math

Square Roots Read $\sqrt{16} = 4$ as the square root of 16 is 4.

Square Root

Key Concept

Words A square root of a number is one of its two equal factors.

Examples

Numbers

Algebra

$$4 \cdot 4 = 16, \text{ so } \sqrt{16} = 4.$$

$$\text{If } x \cdot x \text{ or } x^2 = y, \text{ then } \sqrt{y} = x.$$

EXAMPLES

Find Square Roots

3 Find $\sqrt{81}$.

$$9 \cdot 9 = 81, \text{ so } \sqrt{81} = 9.$$

What number times itself is 81?

4 Find $\sqrt{225}$.

$$\boxed{2\text{nd}} \boxed{[\sqrt{\quad}]} \boxed{225} \boxed{\text{ENTER}} \boxed{15}$$

$$\text{So, } \sqrt{225} = 15.$$



CHECK Your Progress

Find each square root.

d. $\sqrt{64}$

e. $\sqrt{289}$



Real-World Link

The average lifespan of a major league baseball is 7 pitches.

Source: SuperKids



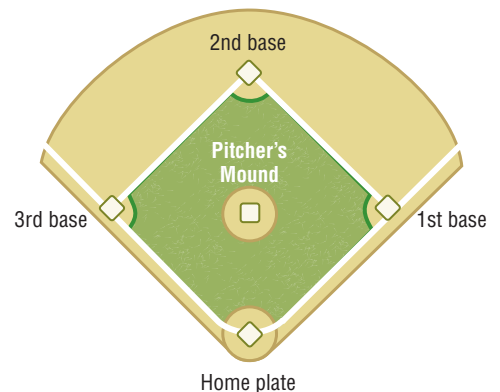
Real-World EXAMPLE

5 **SPORTS** The infield of a baseball field is a square with an area of 8,100 square feet. What are the dimensions of the infield?

The infield is a square. By finding the square root of the area, 8,100, you find the length of one side of the infield.

$$90 \cdot 90 = 8,100, \text{ so } \sqrt{8,100} = 90.$$

The length of one side of the infield is 90 feet. So, the dimensions of the infield are 90 feet by 90 feet.



CHECK Your Progress



f. **SPORTS** The largest ring in amateur boxing is a square with an area of 400 square feet. What are the dimensions of the ring?

CHECK Your Understanding

Examples 1, 2
(p. 34)

Find the square of each number.

1. 6 2. 10 3. 17 4. 30

Examples 3, 4
(p. 35)

Find each square root.

5. $\sqrt{9}$ 6. $\sqrt{36}$ 7. $\sqrt{121}$ 8. $\sqrt{169}$



Example 5
(p. 35)

9. **ROAD SIGNS** Historic Route 66 from Chicago to Los Angeles is known as the Main Street of America. If the area of a Route 66 sign measures 576 square inches and the sign is a square, what are the dimensions of the sign?



Practice and Problem Solving

HOMEWORK HELP

For Exercises	See Examples
10–17	1, 2
18–25	3, 4
26–27	5

Find the square of each number.

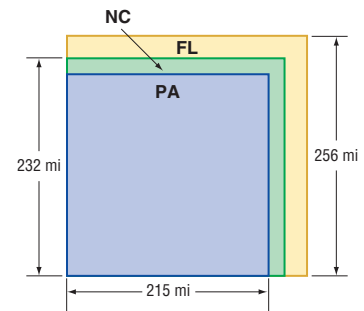
10. 4 11. 1 12. 7 13. 11
14. 16 15. 20 16. 18 17. 34

Find each square root.

18. $\sqrt{4}$ 19. $\sqrt{16}$ 20. $\sqrt{49}$ 21. $\sqrt{100}$
22. $\sqrt{144}$ 23. $\sqrt{256}$ 24. $\sqrt{529}$ 25. $\sqrt{625}$

26. **MEASUREMENT** Emma's bedroom is shaped like a square. What are the dimensions of the room if the area of the floor is 196 square feet?
27. **SPORTS** For the floor exercise, gymnasts perform their tumbling skills on a mat that has an area of 1,600 square feet. How much room does a gymnast have to run along one side of the mat?
28. What is the square of 12? 29. Find the square of 19.
30. **GARDENING** A square garden has an area of 225 square feet. How much fencing will a gardener need to buy in order to place fencing around the garden?

GEOGRAPHY For Exercises 31–33, refer to the squares in the diagram. They represent the approximate areas of Florida, North Carolina, and Pennsylvania.



31. What is the area of North Carolina in square miles?
32. How much larger is Florida than Pennsylvania?
33. The water areas of Florida, North Carolina, and Pennsylvania are 11,881 square miles; 5,041 square miles; and 1,225 square miles, respectively. Make a similar diagram comparing the water areas of these states.

Academic Standards • ISTEP+

Extra Practice, pp. 668, 704



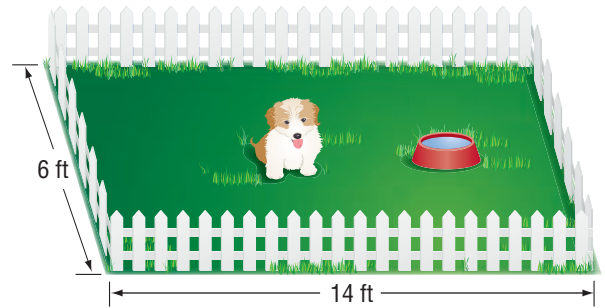
34. **MEASUREMENT** A chessboard has an area of 324 square inches. There is a 1-inch border around the 64 squares on the board. What is the length of one side of the region containing the small squares?
35. **MEASUREMENT** The area of a square that is 7 meters by 7 meters is how much greater than the area of a square containing 8 square meters? Explain.

**H.O.T. Problems**

36. **OPEN ENDED** Write a number whose square is between 100 and 150.

CHALLENGE For Exercises 37 and 38, use the diagram shown.

37. Could the area of the dog's pen be made larger using the same amount of fencing? Explain.
38. Describe the largest pen area possible using the same amount of fencing. How do the perimeter and area compare to the original pen?

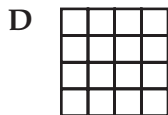
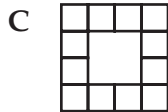


39. **WRITING IN MATH** Explain why raising a number to the second power is called *squaring* the number.

**ISTEP+ PRACTICE**

7.1.5

40. Which model represents the square of 4?



41. Which measure can be the area of a square if the measure of the side length is a whole number?

F 836 sq ft

G 949 sq ft

H 1,100 sq ft

J 1,225 sq ft

Spiral Review

Write each power as a product of the same factor. (Lesson 1-2)

42. 3^4

43. 8^5

44. 7^2

45. 2^6

46. **SHIPPING** Jocelyn spent a total of \$24 to ship 4 packages. If the packages are equal in size and weight, how much did it cost to ship each package? (Lesson 1-1)

▶ GET READY for the Next Lesson

PREREQUISITE SKILL Add, subtract, multiply, or divide.

47. $13 + 8$

48. $10 - 6$

49. 5×6

50. $36 \div 4$

1-4

Order of Operations

MAIN IDEA

Evaluate expressions using the order of operations.

IN Academic Standards

7.1.7 Solve problems that involve multiplication and division with integers, fractions, decimals and combinations of the four operations.

7.2.3 Evaluate numerical expressions and simplify algebraic expressions involving rational and irrational numbers. Also addresses 7.1.2.

New Vocabulary

numerical expression
order of operations

IN Math Online

glencoe.com

- Extra Examples
- Personal Tutor
- Self-Check Quiz
- Reading in the Content Area

▶ GET READY for the Lesson

SPORTS The Kent City football team made one 6-point touchdown and four 3-point field goals in its last game. Megan and Dexter each use an expression to find the total number of points the team scored.

$$\begin{array}{l} \text{Megan} \\ 6 + 4 \cdot 3 = 6 + 12 \\ \quad = 18 \\ \text{The team scored 18 points.} \end{array}$$

$$\begin{array}{l} \text{Dexter} \\ (6 + 4) \cdot 3 = 10 \cdot 3 \\ \quad = 30 \\ \text{The team scored 30 points.} \end{array}$$

1. List the differences between their calculations.
2. Whose calculations are correct?
3. Make a conjecture about what should be the first step in simplifying $6 + 4 \cdot 3$.

The expression $6 + 4 \cdot 3$ is a **numerical expression**. To evaluate expressions, use the **order of operations**. These rules ensure that numerical expressions have only one value.

Order of Operations

Key Concept

1. Evaluate the expressions inside grouping symbols.
2. Evaluate all powers.
3. Multiply and divide in order from left to right.
4. Add and subtract in order from left to right.

EXAMPLES Use Order of Operations

- 1** Evaluate $5 + (12 - 3)$. Justify each step.
$$5 + (12 - 3) = 5 + 9$$
 Subtract first, since $12 - 3$ is in parentheses.
$$= 14$$
 Add 5 and 9.
- 2** Evaluate $8 - 3 \cdot 2 + 7$. Justify each step.
$$8 - 3 \cdot 2 + 7 = 8 - 6 + 7$$
 Multiply 3 and 2.
$$= 2 + 7$$
 Subtract 6 from 8.
$$= 9$$
 Add 2 and 7.

✓ CHECK Your Progress

Evaluate each expression. Justify each step.

a. $39 \div (9 + 4)$

b. $10 + 8 \div 2 - 6$



CHECK Your Understanding

Evaluate each expression. Justify each step.

Examples 1, 2
(p. 38)

1. $8 + (5 - 2)$

2. $25 \div (9 - 4)$

3. $14 - 2 \cdot 6 + 9$

4. $8 \cdot 5 - 4 \cdot 3$

Examples 3, 4
(p. 39)

5. 4×10^2

6. $45 \div (4 - 1)^2$

7. $17 + 2(6 - 3) - 3 \times 4$

8. $22 - 3(8 - 2) + 12 \div 4$



Example 5
(p. 39)

9. **COINS** Isabelle has 3 nickels, 2 quarters, 2 dimes, and 7 pennies. Write an expression that can be used to find how much money Isabelle has altogether. How much money does Isabelle have?

Practice and Problem Solving

HOMEWORK HELP

For Exercises	See Examples
10–17	1, 2
18–23	3
24–27	4
28, 29	5

Evaluate each expression. Justify each step.

10. $(1 + 8) \times 3$

11. $10 - (3 + 4)$

12. $(25 \div 5) + 8$

13. $(11 - 2) \div 9$

14. $3 \cdot 2 + 14 \div 7$

15. $4 \div 2 - 1 + 7$

16. $12 + 6 \div 3 - 4$

17. $18 - 3 \cdot 6 + 5$

18. 6×10^2

19. 3×10^4

20. $5 \times 4^3 + 2$

21. $8 \times 7^2 - 6$

22. $8 \div 2 \times 6 + 6^2$

23. $9^2 - 14 \div 7 \cdot 3$

24. $(17 + 3) \div (4 + 1)$

25. $(6 + 5) \cdot (8 - 6)$

26. $6 + 2(4 - 1) + 4 \times 9$

27. $3(4 + 7) - 5 \cdot 4 \div 2$

For Exercises 28 and 29, write an expression for each situation. Then evaluate to find the solution.

28. **MP3 PLAYERS** Reina is buying an MP3 player, a case, three packs of batteries, and six songs. What is the total cost?

Item	Quantity	Unit Cost
MP3 player	1	\$200
case	1	\$30
pack of batteries	3	\$4
songs	6	\$2

29. **BOOKS** Ian goes to the library's used book sale. Paperback books are \$0.25, and hardback books are \$0.50. If Ian buys 3 paperback books and 5 hardback books, how much does he spend?

Evaluate each expression. Justify each step.

30. $(2 + 10)^2 \div 4$

31. $(3^3 + 8) - (10 - 6)^2$

32. $3 \cdot 4(5.2 + 3.8) + 2.7$

33. $7 \times 9 - (4 - 3.2) + 1.8$

34. **MONEY** Suppose that your family orders 2 pizzas, 2 orders of garlic bread, and 1 order of BBQ wings from Mario's Pizza Shop. Write an expression to find the amount of change you would receive from \$30. Then evaluate the expression.

Mario's Pizza Shop	
Item	Cost
14" pizza	\$8
garlic bread	\$2
BBQ wings	\$4

Academic Standards • ISTEP+

Extra Practice, pp. 669, 704

H.O.T. Problems

35. **FIND THE ERROR** Phoung and Peggy are evaluating $16 - 24 \div 6 \cdot 2$. Who is correct? Explain your reasoning.



Phoung

$$\begin{aligned} 16 - 24 \div 6 \cdot 2 \\ = 16 - 24 \div 12 \\ = 16 - 2 \text{ or } 14 \end{aligned}$$



Peggy

$$\begin{aligned} 16 - 24 \div 6 \cdot 2 \\ = 16 - 4 \cdot 2 \\ = 16 - 8 \text{ or } 8 \end{aligned}$$

36. **CHALLENGE** Insert parentheses to make $72 \div 9 + 27 - 2 = 0$ a true statement.
37. **WRITING IN MATH** Write a real-world problem in which you would need to use the order of operations or a scientific calculator to solve it.

ISTEP+ PRACTICE

7.1.7, 7.2.3

38. Simplify $3^2 + 9 \div 3 + 3$.
 A 3 C 15
 B 9 D 18
39. Grace has 2 boxes that contain 24 straws each and 3 boxes that contain 15 cups each. Which expression *cannot* be used to find the total number of items she has?
 F $2(24) + 3(15)$
 G $3 \times 15 + 2 \times 24$
 H $5 \times (24 + 15)$
 J $15 + 15 + 15 + 24 + 24$
40. The steps Alana took to evaluate the expression $4y + 4 \div 4$ when $y = 7$ are shown below.
- $$\begin{aligned} 4y + 4 \div 4 \text{ when } y = 7 \\ 4 \times 7 = 28 \\ 28 + 4 = 32 \\ 32 \div 4 = 8 \end{aligned}$$
- What should Alana have done differently in order to evaluate the expression correctly?
 A divided $(28 + 4)$ by (28×4)
 B divided $(28 + 4)$ by $(28 + 4)$
 C added $(4 \div 4)$ to 28
 D added 4 to $(28 \div 4)$

Spiral Review

Find each square root. (Lesson 1-3)

41. $\sqrt{64}$

42. $\sqrt{2,025}$

43. $\sqrt{784}$

44. **INTERNET** Each day, Internet users perform 2^5 million searches using a popular search engine. How many searches is this? (Lesson 1-2)

GET READY for the Next Lesson

45. **PREREQUISITE SKILL** A Chinese checkerboard has 121 holes. How many holes can be found on eight Chinese checkerboards? (Lesson 1-1)

1-5

Problem-Solving Investigation

MAIN IDEA: Solve problems using the guess and check strategy.

Academic Standards

7.3.4 Recognize, describe, or extend geometric patterns using tables, graphs, words, or symbols. **P.1.3** Apply and adapt a variety of appropriate strategies to solve problems. **P.1.4** Monitor and reflect on the process of mathematical problem solving. Also addresses P.2.1, P.2.4.

P.S.I. TEAM +

e-Mail: GUESS AND CHECK

TREVOR: My soccer team held a car wash to help pay for a trip to a tournament. We charged \$5 for a car and \$7 for an SUV. During the first hour, we washed 10 vehicles and earned \$58.



YOUR MISSION: Use **guess and check** to find how many of each type of vehicle were washed.

Understand	You know car washes are \$5 for cars and \$7 for SUVs. Ten vehicles were washed for \$58.
Plan	Make a guess and check it. Adjust the guess until you get the correct answer.
Solve	<p>Make a guess.</p> <p>5 cars and 5 SUVs $5(5) + 7(5) = \\$60$ too high</p> <p>Adjust the number of SUVs downward.</p> <p>5 cars and 4 SUVs $5(5) + 7(4) = \\$53$ too low</p> <p>Adjust the number of cars upward.</p> <p>6 cars and 4 SUVs $5(6) + 7(4) = \\$58$ correct ✓</p> <p>So, 6 cars and 4 SUVs were washed.</p>
Check	Six cars cost \$30, and four SUVs cost \$28. Since $\$30 + \$28 = \$58$, the guess is correct.

Analyze The Strategy

1. Explain why you should keep a careful record of each of your guesses.
2. **WRITING IN MATH** Write a problem that could be solved by guess and check. Then write the steps you would take to find the solution to your problem.

Use the *guess and check* strategy to solve Exercises 3–6.

- TICKET SALES** The total ticket sales for the school basketball game were \$1,625. Adult tickets were \$7, and student tickets were \$3. Twice as many students bought tickets as adults. How many adult and student tickets were sold?
- NUMBERS** A number is multiplied by 6. Then 4 is added to the product. The result is 82. What is the number?
- ANALYZE TABLES** Camila is transferring her home videos onto a DVD. Suppose the DVD holds 60 minutes. Which videos should Camila select to have the maximum time on the DVD without going over?

Video	Time
birthday	25 min 15 s
family picnic	18 min 10 s
holiday	15 min 20 s
vacation	19 min 20 s

- MONEY** Susan has \$1.60 in change in her purse. If she has an equal number of nickels, dimes, and quarters, how many of each does she have?



Use any strategy to solve Exercises 7–13. Some strategies are shown below.

PROBLEM-SOLVING STRATEGIES

- *Guess and check.*
- *Find a pattern.*

- BRIDGES** The total length of wire used in the cables supporting the Golden Gate Bridge in San Francisco is about 80,000 miles. This is 5,300 miles longer than three times the distance around Earth at the Equator. What is the distance around Earth at the Equator?

- GEOMETRY** What are the next two figures in the pattern?



- ALGEBRA** What are the next two numbers in the pattern?

16, 32, 64, 128, 256, ■, ■

- FRUIT** Mason places 4 apples and 3 oranges into each fruit basket he makes. If he has used 24 apples and 18 oranges, how many fruit baskets has he made?

- ANALYZE TABLES** The table gives the average snowfall, in inches, for Valdez, Alaska, for the months of October through April.

Month	Snowfall
October	11.6
November	40.3
December	73.0
January	65.8
February	59.4
March	52.0
April	22.7

Source: National Climatic Data Center

How many inches total of snowfall could a resident of Valdez expect to receive from October to April?

- ROLLER COASTERS** The Jackrabbit roller coaster can handle 1,056 passengers per hour. The coaster has 8 vehicles. If each vehicle carries 4 passengers, how many runs are made in one hour?
- NUMBERS** Della is thinking of 3 numbers from 1 through 9 with a product of 36. Find the numbers.

Algebra: Variables and Expressions

MAIN IDEA

Evaluate simple algebraic expressions.

IN Academic Standards

7.2.1 Use variables and appropriate operations to write an expression, equation or inequality that represents a verbal description. Also addresses 7.1.2, 7.3.4.

New Vocabulary

variable
algebra
algebraic expression
coefficient

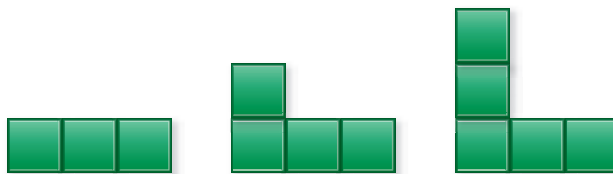
IN Math Online

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- Self-Check Quiz

MINI Lab

A pattern of squares is shown.



1. Draw the next three figures in the pattern.
2. Find the number of squares in each figure and record your data in a table like the one shown below. The first three are completed for you.

Figure	1	2	3	4	5	6
Number of Squares	3	4	5	■	■	■

3. Without drawing the figure, determine how many squares would be in the 10th figure. Check by making a drawing.
4. Find a relationship between the figure and its number of squares.



In the Mini Lab, you found that the number of squares in the figure is two more than the figure number. You can use a placeholder, or variable, to represent the number of squares. A **variable** is a symbol that represents an unknown quantity.

$$\text{figure number} \longrightarrow \underbrace{n + 2}_{\text{number of squares}}$$

The branch of mathematics that involves expressions with variables is called **algebra**. The expression $n + 2$ is called an **algebraic expression** because it contains variables, numbers, and at least one operation.

EXAMPLE

Evaluate an Algebraic Expression

- 1 Evaluate $n + 3$ if $n = 4$.

$$\begin{aligned} n + 3 &= 4 + 3 && \text{Replace } n \text{ with } 4. \\ &= 7 && \text{Add } 4 \text{ and } 3. \end{aligned}$$

CHECK Your Progress

Evaluate each expression if $c = 8$ and $d = 5$.

a. $c - 3$

b. $15 - c$

c. $c + d$



In algebra, the multiplication sign is often omitted.

$$\begin{array}{ccc} \mathbf{6d} & \mathbf{9st} & \mathbf{mn} \\ \uparrow & \uparrow & \uparrow \\ \mathbf{6 \text{ times } d} & \mathbf{9 \text{ times } s \text{ times } t} & \mathbf{m \text{ times } n} \end{array}$$

The numerical factor of a multiplication expression that contains a variable is called a **coefficient**. So, 6 is the coefficient of $6d$.

EXAMPLES Evaluate Expressions

- 2** Evaluate $8w - 2v$ if $w = 5$ and $v = 3$.

$$\begin{aligned} 8w - 2v &= 8(5) - 2(3) && \text{Replace } w \text{ with } 5 \text{ and } v \text{ with } 3. \\ &= 40 - 6 && \text{Do all multiplications first.} \\ &= 34 && \text{Subtract 6 from 40.} \end{aligned}$$

- 3** Evaluate $4y^2 + 2$ if $y = 3$.

$$\begin{aligned} 4y^2 + 2 &= 4(3)^2 + 2 && \text{Replace } y \text{ with } 3. \\ &= 4(9) + 2 && \text{Evaluate the power.} \\ &= 38 && \text{Multiply, then add.} \end{aligned}$$

CHECK Your Progress

Evaluate each expression if $a = 4$ and $b = 3$.

d. $9a - 6b$

e. $\frac{ab}{2}$

f. $2a^2 + 5$



The fraction bar is a grouping symbol. Evaluate the expressions in the numerator and denominator separately before dividing.

Real-World EXAMPLE

- 4 HEALTH** Use the formula at the left to find Latrina's minimum training heart rate if she is 15 years old.

$$\begin{aligned} \frac{3(220 - a)}{5} &= \frac{3(220 - 15)}{5} && \text{Replace } a \text{ with } 15. \\ &= \frac{3(205)}{5} && \text{Subtract 15 from 220.} \\ &= \frac{615}{5} && \text{Multiply 3 and 205.} \\ &= 123 && \text{Divide 615 by 5.} \end{aligned}$$

Latrina's minimum training heart rate is 123 beats per minute.

CHECK Your Progress

- g. MEASUREMENT** To find the area of a triangle, you can use the formula $\frac{bh}{2}$, where h is the height and b is the base. What is the area in square inches of a triangle with a height of 6 inches and base of 8 inches?



Real-World Link

Athletic trainers use the formula $\frac{3(220 - a)}{5}$, where a is a person's age, to find their minimum training heart rate.

Source: CMPMedica Ltd.



CHECK Your Understanding

Example 1 Evaluate each expression if $a = 3$ and $b = 5$.

(p. 44)

1. $a + 7$ 2. $8 - b$ 3. $b - a$

4. **HEALTH** The standard formula for finding your maximum heart rate is $220 - a$, where a represents a person's age in years. What is your maximum heart rate?

Examples 2–4 Evaluate each expression if $m = 2$, $n = 6$, and $p = 4$.

(p. 45)

5. $6n - p$ 6. $7m - 2n$ 7. $3m + 4p$
 8. $n^2 + 5$ 9. $15 - m^3$ 10. $3p^2 - n$
 11. $\frac{mn}{4}$ 12. $\frac{3n}{9}$ 13. $\frac{5n + m}{8}$

Practice and Problem Solving

HOMEWORK HELP

For Exercises	See Examples
14–29	1–3
30–31	4

Evaluate each expression if $d = 8$, $e = 3$, $f = 4$, and $g = 1$.

14. $d + 9$ 15. $10 - e$ 16. $4f + 1$ 17. $8g - 3$
 18. $f - e$ 19. $d + f$ 20. $10g - 6$ 21. $8 + 5d$
 22. $\frac{d}{5}$ 23. $\frac{16}{f}$ 24. $\frac{5d - 25}{5}$ 25. $\frac{(5 + g)^2}{2}$
 26. $6f^2$ 27. $4e^2$ 28. $d^2 + 7$ 29. $e^2 - 4$

30. **BOWLING** The expression $5n + 2$ can be used to find the total cost in dollars of bowling where n is the number of games bowled. How much will it cost Vincent to bowl 3 games?

31. **HEALTH** The expression $\frac{w}{30}$, where w is a person's weight in pounds, is used to find the approximate number of quarts of blood in the person's body. How many quarts of blood does a 120-pound person have?

Evaluate each expression if $x = 3.2$, $y = 6.1$, and $z = 0.2$.

32. $x + y - z$ 33. $14.6 - (x + y + z)$ 34. $xz + y^2$

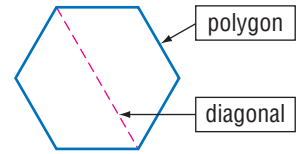
35. **CAR RENTAL** A car rental company charges \$19.99 per day and \$0.17 per mile to rent a car. Write an expression that gives the total cost in dollars to rent a car for d days and m miles.

36. **MUSIC** A Web site charges \$0.99 to download a song onto an MP3 player and \$12.49 to download an entire album. Write an expression that gives the total cost in dollars to download a albums and s songs.



37. **SCIENCE** The expression $\frac{32t^2}{2}$ gives the falling distance of an object in feet after t seconds. How far would a bungee jumper fall 2 seconds after jumping?

38. **GEOMETRY** To find the total number of diagonals for any given polygon, you can use the expression $\frac{n(n-3)}{2}$, where n is the number of sides of the polygon. What is the total number of diagonals for a 10-sided polygon?



Academic Standards • ISTEP+

Extra Practice, pp. 669, 704

H.O.T. Problems

39. **OPEN ENDED** Write an algebraic expression with the variable x that has a value of 3 when evaluated.
40. **CHALLENGE** Name values of x and y so that the value of $5x + 3$ is greater than the value of $2y + 14$.
41. **WRITING IN MATH** Tell whether the statement below is *sometimes*, *always*, or *never* true. Justify your reasoning.

The expressions $x - 3$ and $y - 3$ represent the same value.

ISTEP+ PRACTICE 7.2.1

42. Which expression could be used to find the cost of buying b books at \$7.95 each and m magazines at \$4.95 each?
- A $7.95b + 4.95m$
 B $7.95b - 4.95m$
 C $12.9(b + m)$
 D $12.9(bm)$
43. Tonya has x quarters, y dimes, and z nickels in her pocket. Which of the following expressions gives the total amount of change she has in her pocket?
- F $\$0.25x + \$0.05y + \$0.10z$
 G $\$0.25x + \$0.10y + \$0.05z$
 H $\$0.05x + \$0.25y + \$0.10z$
 J $\$0.10x + \$0.05y + \$0.25z$

Spiral Review

44. **SHOPPING** A grocery store sells hot dog buns in packages of 8 and 12. How many 8-packs and 12-packs could you buy if you needed 44 hot dog buns? Use the *guess and check* strategy. (Lesson 1-5)

Evaluate each expression. (Lesson 1-4)

45. $6(5) - 2$ 46. $9 + 9 \div 3$ 47. $4 \cdot 2(8 - 1)$ 48. $(17 + 3) \div 5$
49. Find $\sqrt{361}$. (Lesson 1-3)

GET READY for the Next Lesson

PREREQUISITE SKILL Determine whether each sentence is *true* or *false*. (Lesson 1-4)

50. $15 - 2(3) = 9$ 51. $20 \div 5 \times 4 = 1$ 52. $4^2 + 6 \cdot 7 = 154$



Mid-Chapter Quiz

Lessons 1-1 through 1-6

1. **MULTIPLE CHOICE** A cycling club is planning an 1,800-mile trip. The cyclers average 15 miles per hour. What additional information is needed to determine the number of days it will take them to complete the trip? (Lesson 1-1)

A The number of cyclists in the club
 B The number of miles of rough terrain
 C The number of hours they plan to cycle each day
 D Their average speed per minute

Write each power as a product of the same factor. (Lesson 1-2)

2. 4^5 3. 9^6



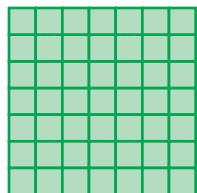
4. **OCEANS** The world's largest ocean, the Pacific Ocean, covers approximately 4^3 million square miles. Write this area in standard form. (Lesson 1-2)



5. **ZOOS** The Lincoln Park Zoo in Illinois is $2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$ years old. Write this age in exponential form. (Lesson 1-2)



6. **MULTIPLE CHOICE** The model below represents $\sqrt{49} = 7$.



Which arrangement of small squares can be used to model a large square that represents $\sqrt{324}$? (Lesson 1-3)

F 9 rows of 36 squares
 G 18 rows of 18 squares
 H 12 rows of 27 squares
 J 6 rows of 54 squares

Find the square of each number. (Lesson 1-3)

7. 4 8. 12

Find each square root. (Lesson 1-3)

9. $\sqrt{64}$ 10. $\sqrt{289}$



11. **LANDSCAPING** A bag of lawn fertilizer covers 2,500 square feet. Describe the largest square that one bag of fertilizer could cover. (Lesson 1-3)

Evaluate each expression. (Lesson 1-4)

12. $25 - (3^2 + 2 \times 5)$ 13. $\frac{2(7 - 3)}{2^2}$



14. **MEASUREMENT** The perimeter of a rectangle is 42 inches, and its area is 104 square inches. Find the dimensions of the rectangle. Use the *guess and check* strategy. (Lesson 1-5)



15. **MULTIPLE CHOICE** Ana buys some baseball bats at \$35 each and some baseball gloves at \$48 each. Which expression could be used to find the total cost of the sports items? (Lesson 1-6)

A $35b \cdot 48g$
 B $\frac{35b}{48g}$
 C $35b + 48g$
 D $48g - 35b$

Evaluate each expression if $x = 12$, $y = 4$, and $z = 8$. (Lesson 1-6)

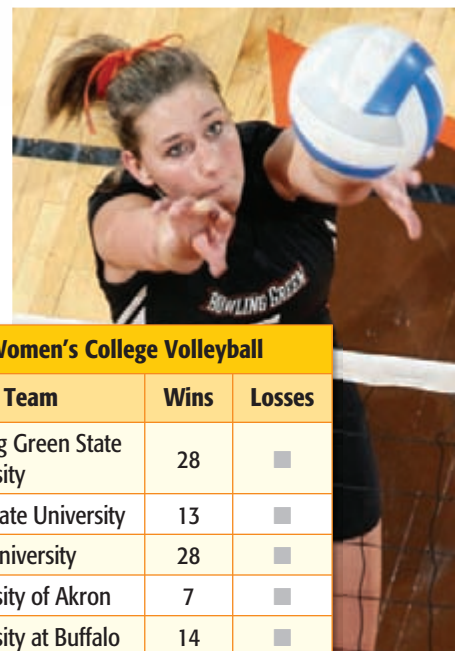
16. $x - 5$ 17. $3y + 10z$
 18. $\frac{yz}{2}$ 19. $\frac{(y + 8)^2}{x}$



20. **HEALTH** A nurse can use the expression $110 + \frac{A}{2}$, where A is a person's age, to estimate a person's normal systolic blood pressure. Estimate the normal systolic blood pressure for a 16-year-old. (Lesson 1-6)

1-7

Algebra: Equations



MAIN IDEA

Write and solve equations using mental math.

IN Academic Standards

Preparation for 7.2.2 Write and solve two-step linear equations and inequalities in one variable.

P.6.6 Recognize when the numbers involved in a computation allow for a mental computation strategy. Also addresses P.6.5.

New Vocabulary

equation
solution
solving an equation
defining the variable

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▶ GET READY for the Lesson

VOLLEYBALL The table shows the number of wins for six women's college volleyball teams.

1. Suppose each team played 34 games. How many losses did each team have?
2. Write a rule to describe how you found the number of losses.
3. Let w represent the number of wins and ℓ represent the number of losses. Rewrite your rule using numbers, variables, and an equals sign.

Women's College Volleyball		
Team	Wins	Losses
Bowling Green State University	28	■
Kent State University	13	■
Ohio University	28	■
University of Akron	7	■
University at Buffalo	14	■
Miami University	13	■

Source: Mid-American Conference



An **equation** is a sentence that contains two expressions separated by an equals sign, $=$. The equals sign tells you that the expression on the left is equivalent to the expression on the right.

$$7 = 8 - 1 \quad 3(4) = 12 \quad 17 = 13 + 2 + 2$$

An equation that contains a variable is neither true nor false until the variable is replaced with a number. A **solution** of an equation is a numerical value for the variable that makes the sentence true.

The process of finding a solution is called **solving an equation**. Some equations can be solved using mental math.

EXAMPLE Solve an Equation Mentally

1 Solve $18 = 14 + t$ mentally.

$18 = 14 + t$ Write the equation.

$18 = 14 + 4$ You know that $14 + 4$ is 18.

$18 = 18$ Simplify.

So, $t = 4$. The solution is 4.

✓ CHECK Your Progress

Solve each equation mentally.

a. $p - 5 = 20$

b. $8 = y \div 3$

c. $7h = 56$



Test-Taking Tip

Backsolving To find which answer choice is the solution, you can also substitute each value for x to see which answer choice makes the left side of the equation equal to the right side.



ISTEP+ EXAMPLE

Preparation for 7.2.2, P.6.6

- 2 Each day, Sierra cycles 3 miles on a bicycle trail. The equation $3d = 36$ represents how many days it will take her to cycle 36 miles. How many days d will it take her to cycle 36 miles?

A 10 B 12 C 15 D 20

Read the Item

Solve $3d = 36$ to find how many days it will take to cycle 36 miles.

Solve the Item

$3d = 36$ Write the equation.

$3 \cdot 12 = 36$ You know that $3 \cdot 12$ is 36.

Therefore, $d = 12$. The answer is B.



CHECK Your Progress

- d. Jordan has 16 video games. This is 3 less than the number Casey has. To find how many video games Casey has, the equation $v - 3 = 16$ can be used. How many video games v does Casey have?

F 13 G 15 H 18 J 19



Choosing a variable to represent an unknown quantity is called **defining the variable**.



Real-World EXAMPLE

- 3 **WHALES** Each winter, Humpback whales migrate 1,500 miles to the Indian Ocean. However, one whale migrated 5,000 miles in one season. How many miles farther than normal did this whale travel?

Words	normal migration	+	miles farther	=	farthest migration
Variable	Let m represent the number of miles farther.				
Equation	$1,500 + m = 5,000$				

$1,500 + m = 5,000$ Write the equation.

$1,500 + 3,500 = 5,000$ Replace m with 3,500 to make the equation true.

So, $m = 3,500$. The whale went 3,500 miles farther than normal.



CHECK Your Progress

- e. Aaron buys a movie rental, popcorn, and a soft drink for a total cost of \$6.25. What is the cost of the popcorn if the movie rental and soft drink cost \$4.70 together?

Study Tip

Defining the Variable Although any symbol can be used, it is a good idea to use the first letter of the word you are defining as a variable. For example, m stands for the number of miles.



CHECK Your Understanding

Example 1
(p. 49)

Solve each equation mentally.

1. $75 = w + 72$

2. $y - 18 = 20$

3. $\frac{r}{9} = 6$

Example 2
(p. 50)

4. **MULTIPLE CHOICE** Daniel scored 7 points in a football game. Together, he and Judah scored 28 points. Solve the equation $7 + p = 28$ to find how many points p Judah scored.

A 14

B 21

C 23

D 35

Example 3
(p. 50)

5. **MONEY** Jessica buys a notebook and a pack of pencils for a total of \$3.50. What is the cost of the notebook if the pack of pencils costs \$1.25?

Practice and Problem Solving

HOMEWORK HELP	
For Exercises	See Examples
6-17	1
18-19	1
33-34	2
20-21	3

Solve each equation mentally.

6. $b + 7 = 13$

7. $8 + x = 15$

8. $y - 14 = 20$

9. $a - 18 = 10$

10. $25 - n = 19$

11. $x + 17 = 63$

12. $77 = 7t$

13. $3d = 99$

14. $n = \frac{30}{6}$

15. $16 = \frac{u}{4}$

16. $20 = y \div 5$

17. $84 \div z = 12$

18. **MONEY** Rosa charges \$9 per hour of babysitting. Solve the equation $9h = 63$ to find how many hours h Rosa needs to babysit to earn \$63.
19. **SNACKS** A box initially contained 25 snack bars. There are 14 snack bars remaining. Solve the equation $25 - x = 14$ to find how many snack bars x were eaten.

For Exercises 20 and 21, define a variable. Then write and solve an equation.

20. **BASKETBALL** During one game of his rookie year, LeBron James scored 41 of the Cleveland Cavaliers' 107 points. How many points did the rest of the team score?
21. **EXERCISE** On Monday and Tuesday, Derrick walked a total of 6.3 miles. If he walked 2.5 miles on Tuesday, how many miles did he walk on Monday?

Solve each equation mentally.

22. $1.5 + j = 10.0$

23. $1.2 = m - 4.2$

24. $n - 1.4 = 3.5$

25. $13.4 - h = 9.0$

26. $9.9 + r = 24.2$

27. $w + 15.8 = 17.0$

28. **CATS** The table shows the average weight of lions. Write and solve an addition equation to find how much more male lions weigh than female lions.

Lions	Weight (lb)
Female	275
Male	372

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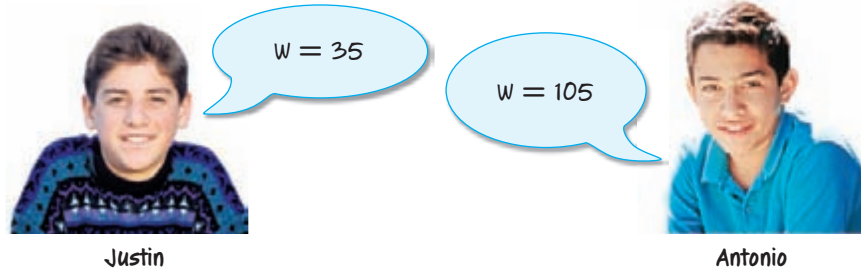
Extra Practice, pp. 670, 704



29. **FOOD** The total cost of a chicken sandwich and a drink is \$6.25. The drink costs \$1.75. Write and solve an equation that can be used to find how much the chicken sandwich is alone.

H.O.T. Problems

30. **CHALLENGE** Find the values of a and b if $0 \cdot a = b$. Explain your reasoning.
31. **FIND THE ERROR** Justin and Antonio each solved $w - 35 = 70$. Whose solution is correct? Explain your reasoning.

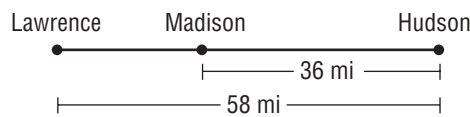


32. **WRITING IN MATH** Explain what it means to solve an equation.

ISTEP+ PRACTICE

Preparation for 7.2.2, P.6.6

33. The diagram shows the distance from Madison to Hudson and from Lawrence to Hudson. Which equation can be used to find how many more miles x Lawrence is from Madison?



- A $58 = x + 36$ C $36 \cdot 58 = x$
- B $58 = \frac{x}{36}$ D $x - 36 = 58$

34. **SHORT RESPONSE** What value of h makes the following equation true?

$$h \div 4 = 32$$

35. Solve $u + 8 = 15$.

- F 23 H 8
- G 22 J 7

Spiral Review

36. **ALGEBRA** Evaluate $3a + b^2$ if $a = 2$ and $b = 3$. (Lesson 1-6)

Evaluate each expression. (Lesson 1-4)

37. $11 \cdot 6 \div 3 + 9$ 38. $5 \cdot 13 - 6^2$ 39. $1 + 2(8 - 5)^2$

40. **FARMING** A farmer planted 389 acres of land with 78,967 corn plants. How many plants were planted per acre? (Lesson 1-1)

GET READY for the Next Lesson

PREREQUISITE SKILL Multiply. (Lesson 1-4)

41. $2 \cdot (4 + 10)$ 42. $(9 \cdot 1) \cdot 8$ 43. $(5 \cdot 3)(5 \cdot 2)$ 44. $(6 + 8) \cdot 12$

1-8

Algebra: Properties

MAIN IDEA

Use Commutative, Associative, Identity, and Distributive properties to solve problems.

IN Academic Standards

7.1.7 Solve problems that involve multiplication and division with integers, fractions, decimals and combinations of the four operations.

7.2.3 Evaluate numerical expressions and simplify algebraic expressions involving rational and irrational numbers. Also addresses P.3.4.

New Vocabulary

equivalent expressions properties

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▶ GET READY for the Lesson

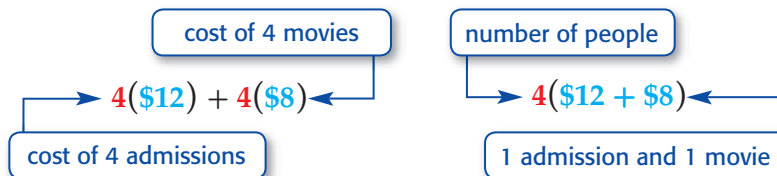
MUSEUMS The admission costs for the Louisville Science Center are shown.

Louisville Science Center Admission	
Admission	\$12
IMAX Movie	\$8

Source: Louisville Science Center

1. Find the total cost of admission and a movie ticket for a 4-person family.
2. Describe the method you used to find the total cost.

Here are two ways to find the total cost.



The expressions $4(\$12) + 4(\$8)$ and $4(\$12 + \$8)$ are **equivalent expressions** because they have the same value, \$80. This shows how the **Distributive Property** combines addition and multiplication.

Distributive Property

Key Concept

Words To multiply a sum by a number, multiply each addend of the sum by the number outside the parentheses.

Examples

Numbers

$$3(4 + 6) = 3(4) + 3(6)$$

$$5(7) + 5(3) = 5(7 + 3)$$

Algebra

$$a(b + c) = a(b) + a(c)$$

$$a(b) + a(c) = a(b + c)$$

EXAMPLES Write Sentences as Equations

Use the Distributive Property to rewrite each expression. Then evaluate it.

1 $5(3 + 2)$
 $5(3 + 2) = 5(3) + 5(2)$
 $= 15 + 10$ Multiply.
 $= 25$ Add.

2 $3(7) + 3(4)$
 $3(7) + 3(4) = 3(7 + 4)$
 $= 3(11)$ Add.
 $= 33$ Multiply.

✓ CHECK Your Progress

a. $6(1 + 4)$

b. $6(9) + 6(3)$



Real-World EXAMPLE

- 3 TOUR DE FRANCE** The Tour de France is a cycling race through France that lasts 22 days. If a cyclist averages 90 miles per day, about how far does he travel?

Use the Distributive Property to multiply 90×22 mentally.

$$\begin{aligned} 90(22) &= 90(20 + 2) && \text{Rewrite 22 as } 20 + 2. \\ &= 90(20) + 90(2) && \text{Distributive Property} \\ &= 1,800 + 180 && \text{Multiply.} \\ &= 1,980 && \text{Add.} \end{aligned}$$

The cyclist travels about 1,980 miles.

Real-World Link

American Lance Armstrong won the Tour de France seven times in a row from 1999 through 2005.

Source: Capital Sports Entertainment

CHECK Your Progress

- c. Jennifer saved \$120 each month for five months. How much did she save in all? Explain your reasoning.



Properties are statements that are true for all numbers.

Real Number Properties		Concept Summary
Commutative Properties	The order in which two numbers are added or multiplied does not change their sum or product.	
	$a + b = b + a$	$a \cdot b = b \cdot a$
Associative Properties	The way in which three numbers are grouped when they are added or multiplied does not change their sum or product.	
	$a + (b + c) = (a + b) + c$	$a \cdot (b \cdot c) = (a \cdot b) \cdot c$
Identity Properties	The sum of an addend and 0 is the addend. The product of a factor and 1 is the factor.	
	$a + 0 = a$	$a \cdot 1 = a$

EXAMPLE Use Properties to Evaluate Expressions

- 4** Find $4 \cdot 12 \cdot 25$ mentally. Justify each step.

$$\begin{aligned} 4 \cdot 12 \cdot 25 &= 4 \cdot 25 \cdot 12 && \text{Commutative Property of Multiplication} \\ &= (4 \cdot 25) \cdot 12 && \text{Associative Property of Multiplication} \\ &= 100 \cdot 12 \text{ or } 1,200 && \text{Multiply 100 and 12 mentally.} \end{aligned}$$

CHECK Your Progress

Find each of the following. Justify each step.

d. $40 \cdot (7 \cdot 5)$

e. $(89 + 15) + 1$

Study Tip

Mental Math Look for sums or products that end in zero. They are easy to compute mentally.



CHECK Your Understanding

Examples 1, 2
(p. 53)

Use the Distributive Property to rewrite each expression. Then evaluate it.

1. $7(4 + 3)$ 2. $5(6 + 2)$ 3. $3(9) + 3(6)$ 4. $6(17) + 6(3)$

Example 3
(p. 54)

5. **MENTAL MATH** Admission to a baseball game is \$12, and a hot dog costs \$5. Use the Distributive Property to mentally find the total cost for 4 tickets and 4 hot dogs. Explain your reasoning.

6. **MENTAL MATH** A cheetah can run 65 miles per hour at maximum speed. At this rate, how far could a cheetah run in 2 hours? Use the Distributive Property to multiply mentally. Explain your reasoning.

Example 4
(p. 54)

Find each expression mentally. Justify each step.

7. $44 + (23 + 16)$ 8. $50 \cdot (33 \cdot 2)$

Practice and Problem Solving

HOMEWORK HELP

For Exercises	See Examples
9–12	1, 2
13–22	4
23, 24	3

Use the Distributive Property to rewrite each expression. Then evaluate it.

9. $2(6 + 7)$ 10. $5(8 + 9)$ 11. $4(3) + 4(8)$ 12. $7(3) + 7(6)$

Find each expression mentally. Justify each step.

13. $(8 + 27) + 52$ 14. $(13 + 31) + 17$
 15. $91 + (15 + 9)$ 16. $85 + (46 + 15)$
 17. $(4 \cdot 18) \cdot 25$ 18. $(5 \cdot 3) \cdot 8$
 19. $15 \cdot (8 \cdot 2)$ 20. $2 \cdot (16 \cdot 50)$
 21. $5 \cdot (30 \cdot 12)$ 22. $20 \cdot (48 \cdot 5)$

MENTAL MATH For Exercises 23 and 24, use the Distributive Property to multiply mentally. Explain your reasoning.

23. **TRAVEL** Each year about 27 million people visit Paris, France. About how many people will visit Paris over a five-year period?
24. **ROLLER COASTERS** One ride on a roller coaster lasts 108 seconds. How long will it take to ride this coaster three times?

The Distributive Property also can be applied to subtraction. Use the Distributive Property to rewrite each expression. Then evaluate it.

25. $7(9) - 7(3)$ 26. $12(8) - 12(6)$ 27. $9(7) - 9(3)$ 28. $6(12) - 6(5)$

ALGEBRA Use one or more properties to rewrite each expression as an equivalent expression that does not use parentheses.

29. $(y + 1) + 4$ 30. $2 + (x + 4)$ 31. $4(8b)$ 32. $(3a)2$
 33. $2(x + 3)$ 34. $4(2 + b)$ 35. $6(c + 1)$ 36. $3(f + 4) + 2f$



MILEAGE For Exercises 37 and 38, use the table that shows the driving distance between certain cities in Pennsylvania.

37. Write a sentence that compares the mileage from Pittsburgh to Johnstown to Allentown, and the mileage from Allentown to Johnstown to Pittsburgh.

From	To	Driving Distance (mi)
Pittsburgh	Johnstown	55
Johnstown	Allentown	184

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Extra Practice, pp. 670, 704

38. Name the property that is illustrated by this sentence.

H.O.T. Problems

39. **OPEN ENDED** Write an equation that illustrates the Associative Property of Addition.
40. **NUMBER SENSE** Analyze the statement $(18 + 35) \times 4 = 18 + 35 \times 4$. Then tell whether the statement is *true* or *false*. Explain your reasoning.
41. **CHALLENGE** A *counterexample* is an example showing that a statement is not true. Provide a counterexample to the following statement.
Division of whole numbers is associative.
42. **WRITING IN MATH** Write about a real-world situation that can be solved using the Distributive Property. Then use it to solve the problem.

ISTEP+ PRACTICE 7.1.7, 7.2.3

43. Which expression can be written as $6(9 + 8)$?
- A $8 \cdot 6 + 8 \cdot 9$
 B $6 \cdot 9 + 6 \cdot 8$
 C $6 \cdot 9 \cdot 6 \cdot 8$
 D $6 + 9 \cdot 6 + 8$
44. Jared deposited \$5 into his savings account. Six months later, his account balance had doubled. If his old balance was b dollars, which of the following would be equivalent to his new balance of $2(b + 5)$ dollars?
- F $2b + 5$ H $b + 10$
 G $2b + 7$ J $2b + 10$

Spiral Review

Name the number that is the solution of the given equation. (Lesson 1-7)

45. $7.3 = t - 4$; 10.3, 11.3, 12.3 46. $35.5 = 5n$; 5.1, 7.1, 9.1
47. **CATS** It is believed that a cat ages 5 human years for every calendar year. This situation can be represented by the expression $5y$ where y is the age of the cat in calendar years. Find the human age of a cat that has lived for 15 calendar years. (Lesson 1-6)
48. Evaluate $(14 - 9)^4$. (Lesson 1-4)

GET READY for the Next Lesson

PREREQUISITE SKILL Find the next number in each pattern.

49. 2, 4, 6, 8, ■ 50. 10, 21, 32, 43, ■ 51. 1.4, 2.2, 3.0, 3.8, ■

1-9

Algebra: Arithmetic Sequences

MAIN IDEA

Describe the relationships and extend terms in arithmetic sequences.

IN Academic Standards

7.2.1 Use variables and appropriate operations to write an expression, equation or inequality that represents a verbal description.

7.3.4 Recognize, describe, or extend geometric patterns using tables, graphs, words, or symbols. Also addresses P.5.1, P.5.2.

New Vocabulary

sequence
term
arithmetic sequence

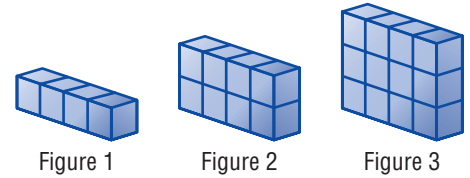
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MINI Lab

Use centimeter cubes to make the three figures shown.



- How many centimeter cubes are used to make each figure?
- What pattern do you see? Describe it in words.
- Suppose this pattern continues. Copy and complete the table to find the number of cubes needed to make each figure.

Figure	1	2	3	4	5	6	7	8
Cubes Needed	4	8	12					

- How many cubes would you need to make the 10th figure? Explain your reasoning.



A **sequence** is an ordered list of numbers. Each number in a sequence is called a **term**. In an **arithmetic sequence**, each term is found by adding the same number to the previous term. An example of an arithmetic sequence is shown.

$$8, 11, 14, 17, 20, \dots$$

$\begin{array}{ccccccc} & \nearrow & \nearrow & \nearrow & \nearrow & & \\ +3 & & +3 & & +3 & & +3 \end{array}$

Each term is found by adding 3 to the previous term.

EXAMPLE Describe and Extend Sequences

- Describe the relationship between the terms in the arithmetic sequence 8, 13, 18, 23, ... Then write the next three terms in the sequence.

$$8, 13, 18, 23, \dots$$

$\begin{array}{ccccccc} & \nearrow & \nearrow & \nearrow & & & \\ +5 & & +5 & & +5 & & \end{array}$

Each term is found by adding 5 to the previous term. Continue the pattern to find the next three terms.

$$23 + 5 = 28 \qquad 28 + 5 = 33 \qquad 33 + 5 = 38$$

The next three terms are 28, 33, and 38.



CHECK Your Progress

Describe the relationship between the terms in each arithmetic sequence. Then write the next three terms in the sequence.

a. 0, 13, 26, 39, ...

b. 4, 7, 10, 13 ...



Arithmetic sequences can also involve decimals.

EXAMPLE Describe and Extend Sequences

- 2 Describe the relationship between the terms in the arithmetic sequence 0.4, 0.6, 0.8, 1.0, Then write the next three terms in the sequence.

$$0.4, 0.6, 0.8, 1.0, \dots$$

$+0.2 +0.2 +0.2$

Each term is found by adding 0.2 to the previous term. Continue the pattern to find the next three terms.

$$1.0 + 0.2 = 1.2 \quad 1.2 + 0.2 = 1.4 \quad 1.4 + 0.2 = 1.6$$

The next three terms are 1.2, 1.4, and 1.6.

CHECK Your Progress

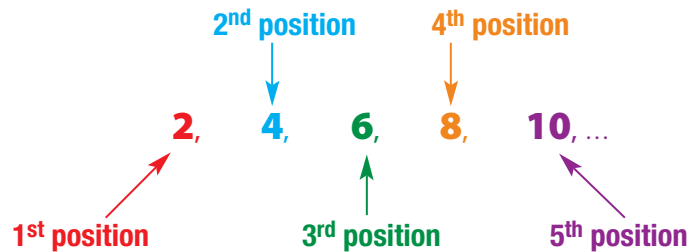
Describe the relationship between the terms in each arithmetic sequence. Then write the next three terms in the sequence.

c. 1.0, 1.3, 1.6, 1.9, ...

d. 2.5, 3.0, 3.5, 4.0, ...



In a sequence, each term has a specific position within the sequence. Consider the sequence 2, 4, 6, 8, 10, ...



The table below shows the position of each term in this sequence. Notice that as the position number increases by 1, the value of the term increases by 2.

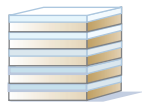
	Position	Operation	Value of Term
	1	$1 \cdot 2 = 2$	2
+1	2	$2 \cdot 2 = 4$	4
+1	3	$3 \cdot 2 = 6$	6
+1	4	$4 \cdot 2 = 8$	8
+1	5	$5 \cdot 2 = 10$	10

You can also write an algebraic expression to represent the relationship between any term in a sequence and its position in the sequence. In this case, if n represents the position in the sequence, the value of the term is $2n$.

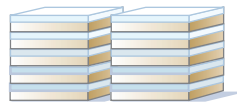


Real-World EXAMPLE

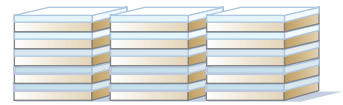
- 3 GREETING CARDS** The homemade greeting cards that Meredith makes are sold in boxes at a local gift store. Each week, the store sells five more boxes.



Week 1



Week 2



Week 3

If this pattern continues, what algebraic expression can be used to help her find the total number of boxes sold at the end of the 100th week? Use the expression to find the total.

Make a table to display the sequence.

Position	Operation	Value of Term
1	$1 \cdot 5$	5
2	$2 \cdot 5$	10
3	$3 \cdot 5$	15
n	$n \cdot 5$	$5n$

Each term is 5 times its position number. So, the expression is $5n$.

$5n$ Write the expression.

$5(100) = 500$ Replace n with 100.

So, at the end of 100 weeks, 500 boxes will have been sold.

Study Tip

Arithmetic Sequences
When looking for a pattern between the position number and each term in the sequence, it is often helpful to make a table.

CHECK Your Progress

- e. **GEOMETRY** If the pattern continues, what algebraic expression can be used to find the number of circles used in the 50th figure? How many circles will be in the 50th figure?



Figure 1



Figure 2



Figure 3

CHECK Your Understanding

Examples 1, 2
(pp. 57–58)

Describe the relationship between the terms in each arithmetic sequence. Then write the next three terms in each sequence.

- 0, 9, 18, 27, ...
- 4, 9, 14, 19, ...
- 1, 1.1, 1.2, 1.3, ...
- 5, 5.4, 5.8, 6.2, ...



Example 3
(p. 59)

5. **PLANTS** The table shows the height of a certain plant each month after being planted. If this pattern continues, what algebraic expression can be used to find the height of the plant at the end of twelve months? Find the plant's height after 12 months.

Month	Height (in.)
1	3
2	6
3	9
4	12



Practice and Problem Solving

HOMESCHOOL HELP

For Exercises	See Examples
6–11	1
12–17	2
18, 19	3

Describe the relationship between the terms in each arithmetic sequence. Then write the next three terms in each sequence.

6. 0, 7, 14, 21, ... 7. 1, 7, 13, 19, ... 8. 26, 34, 42, 50, ...
 9. 19, 31, 43, 55, ... 10. 6, 16, 26, 36, ... 11. 33, 38, 43, 48, ...
 12. 0.1, 0.4, 0.7, 1.0, ... 13. 2.4, 3.2, 4.0, 4.8, ... 14. 2.0, 3.1, 4.2, 5.3, ...
 15. 4.5, 6.0, 7.5, 9.0, ... 16. 1.2, 3.2, 5.2, 7.2, ... 17. 4.6, 8.6, 12.6, 16.6, ...

18. **COLLECTIONS** Hannah is starting a doll collection. Each year, she buys 6 dolls. Suppose she continues this pattern. What algebraic expression can be used to find the number of dolls in her collection after any number of years? How many dolls will Hannah have after 25 years?

19. **EXERCISE** The table shows the number of laps that Jorge swims each week. Jorge's goal is to continue this pace. What algebraic expression can be used to find the total number of laps he will swim after any given number of weeks? How many laps will Jorge swim after 6 weeks?

Week	Number of Laps
1	7
2	14
3	21
4	28

Describe the relationship between the terms in each arithmetic sequence. Then write the next three terms in each sequence.

20. 18, 33, 48, 63, ... 21. 20, 45, 70, 95, ... 22. 38, 61, 84, 107, ...

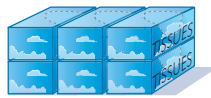
In a *geometric sequence*, each term is found by multiplying the previous term by the same number. Write the next three terms of each geometric sequence.

23. 1, 4, 16, 64, ... 24. 2, 6, 18, 54, ... 25. 4, 12, 36, 108, ...

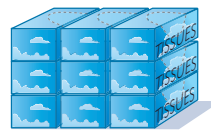
26. **GEOMETRY** Kendra is stacking boxes of tissues for a store display. Each minute, she stacks another layer of boxes. If the pattern continues, how many boxes will be displayed after 45 minutes?



1 Minute



2 Minutes



3 Minutes

NUMBER SENSE Find the 100th number in each sequence.

27. 12, 24, 36, 48, ... 28. 14, 28, 42, 56, ...
 29. 0, 50, 100, 150, ... 30. 0, 75, 150, 225, ...

Academic Standards • ISTEP+
 Extra Practice, pp. 670, 704

31. **RESEARCH** The Fibonacci sequence is one of the most well-known sequences in mathematics. Use the Internet or another source to write a paragraph about the Fibonacci sequence.



H.O.T. Problems

CHALLENGE Not all sequences are arithmetic. But, there is still a pattern. Describe the relationship between the terms in each sequence. Then write the next three terms in the sequence.

32. 1, 2, 4, 7, 11, ...

33. 0, 2, 6, 12, 20, ...

34. **OPEN ENDED** Write five terms of an arithmetic sequence and describe the rule for finding the terms.

35. **SELECT A TOOL** Suppose you want to begin saving \$15 each month. Which of the following tools would you use to determine the amount you will have saved after 2 years? Justify your selection(s). Then use the tool(s) to solve the problem.

paper/pencil

real object

technology

36. **WRITING IN MATH** Janice earns \$6.50 per hour running errands for her neighbor. Explain how the hourly earnings form an arithmetic sequence.

ISTEP+ PRACTICE 7.2.1

37. Which sequence follows the rule $3n - 2$, where n represents the position of a term in the sequence?

A 21, 18, 15, 12, 9, ...

B 3, 6, 9, 12, 15, ...

C 1, 7, 10, 13, 16, ...

D 1, 4, 7, 10, 13, ...

38. Which expression can be used to find the n th term in this sequence?

Position	1	2	3	4	5	n^{th}
Value of Term	2	5	10	17	26	

F $n^2 + 1$

G $2n + 1$

H $n + 1$

J $2n^2 + 2$

Spiral Review

Find each expression mentally. Justify each step. (Lesson 1-8)

39. $(23 + 18) + 7$

40. $5 \cdot (12 \cdot 20)$

Solve each equation mentally. (Lesson 1-7)

41. $f - 26 = 3$

42. $\frac{a}{4} = 8$

43. $30 + y = 50$

44. **SCIENCE** At normal temperatures, sound travels through water at a rate of $5 \cdot 10^3$ feet per second. Write this rate in standard form. (Lesson 1-2)

▶ GET READY for the Next Lesson

PREREQUISITE SKILL Find the value of each expression. (Lesson 1-6)

45. $2x$ if $x = 4$

46. $d - 5$ if $d = 8$

47. $3m - 3$ if $m = 2$

Algebra Lab

Exploring Sequences

MAIN IDEA

Explore patterns in sequences of geometric figures.

IN Academic Standards

7.3.4 Recognize, describe, or extend geometric patterns using tables, graphs, words, or symbols.
P.5.1 Create and use representations to organize, record, and communicate mathematical ideas.
 Also addresses P.5.2.

ACTIVITY

STEP 1 Use toothpicks to build the figures below.



Figure 1

Figure 2

Figure 3

STEP 2 Make a table like the one shown and record the figure number and number of toothpicks used in each figure.

Figure Number	Number of Toothpicks
1	4
2	
3	

STEP 3 Construct the next figure in this pattern. Record your results.

STEP 4 Repeat Step 3 until you have found the next four figures in the pattern.

ANALYZE THE RESULTS

- How many additional toothpicks were used each time to form the next figure in the pattern? Where is this pattern found in the table?
- Based on your answer to Exercise 1, how many toothpicks would be in Figure 0 of this pattern?
- Remove one toothpick from your pattern so that Figure 1 is made up of just three toothpicks as shown. Then create a table showing the number of toothpicks that would be in the first 7 figures by continuing the same pattern as above.
- How many toothpicks would there be in Figure n of this new pattern?
- How could you adapt the expression you wrote in Exercise 4 to find the number of toothpicks in Figure n of the original pattern?
- MAKE A PREDICTION** How many toothpicks would there be in Figure 10 of the original pattern? Explain your reasoning. Then check your answer by constructing the figure.
- Find the number of toothpicks in Figure n of the pattern below, and predict the number of toothpicks in Figure 12. Justify your answer.



Figure 1



Figure 1

Figure 2

Figure 3

1-10

Algebra: Equations and Functions

MAIN IDEA

Make function tables and write equations.

IN Academic Standards

7.2.1 Use variables and appropriate operations to write an expression, equation or inequality that represents a verbal description. Also addresses P.4.1, P.5.1, P.5.2.

New Vocabulary

function
function rule
function table
domain
range

IN Math Online

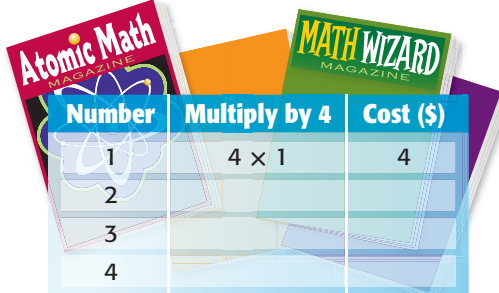
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- Concepts In Motion
- Extra Examples
- Personal Tutor
- Self-Check Quiz

▶ GET READY for the Lesson

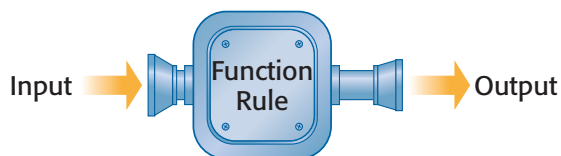
MAGAZINES Suppose you can buy magazines for \$4 each.

1. Copy and complete the table to find the cost of 2, 3, and 4 magazines.
2. Describe the pattern in the table between the cost and the number of magazines.



Number	Multiply by 4	Cost (\$)
1	4×1	4
2		
3		
4		

A relationship that assigns exactly one *output* value for each *input* value is called a **function**. In a function, you start with an input number, perform one or more operations on it, and get an output number. The operation performed on the input is given by the **function rule**.



You can organize the input numbers, output numbers, and the function rule in a **function table**. The set of input values is called the **domain**, and the set of output values is called the **range**.

EXAMPLE Make a Function Table

- 1 MONEY** Javier saves \$20 each month. Make a function table to show his savings after 1, 2, 3, and 4 months. Then identify the domain and range.

The domain is {1, 2, 3, 4}, and the range is {20, 40, 60, 80}.

Input	Function Rule	Output
Number of Months	Multiply by 20	Total Savings (\$)
1	20×1	20
2	20×2	40
3	20×3	60
4	20×4	80

✓ CHECK Your Progress

- a. Suppose a student movie ticket costs \$3. Make a function table that shows the total cost for 1, 2, 3, and 4 tickets. Then identify the domain and range.



Study Tip

Input and Output

When x and y are used in an equation, x usually represents the input, and y usually represents the output.

Functions are often written as equations with two variables—one to represent the input and one to represent the output. Here's an equation for the situation in Example 1.

$$20x = y$$

Function rule: multiply by 20

Input: number of months \rightarrow x y \rightarrow Output: total savings



Real-World EXAMPLES



- 2 ANIMALS** An armadillo sleeps 19 hours each day. Write an equation using two variables to show the relationship between the number of hours h an armadillo sleeps in d days.

Input	Function Rule	Output
Number of Days (d)	Multiply by 19	Number of Hours Slept (h)
1	1×19	19
2	2×19	38
3	3×19	57
d	$d \times 19$	$19d$

Words

Number of hours slept equals number of days times 19 hours each day.

Variable

Let d represent the number of days.
Let h represent the number of hours.

Equation

$$h = 19d$$

- 3** How many hours does an armadillo sleep in 4 days?

$h = 19d$ Write the equation.

$h = 19(4)$ Replace d with 4.

$h = 76$ Multiply.

An armadillo sleeps 76 hours in 4 days.



CHECK Your Progress



BOTANIST A botanist discovers that a certain species of bamboo grows 4 inches each hour.

- Write an equation using two variables to show the relationship between the growth g in inches of this bamboo plant in h hours.
- Use your equation to explain how to find the growth in inches of this species of bamboo after 6 hours.



Real-World Career . . .

How Does a Botanist Use Math? A botanist gathers and studies plant statistics to solve problems and draw conclusions about various plants.

IN Math Online

For more information, go to glencoe.com.



CHECK Your Understanding

Example 1
(p. 63)

Copy and complete each function table. Then identify the domain and range.

1. $y = 3x$

x	$3x$	y
1	$3 \cdot 1$	3
2	$3 \cdot 2$	
3	$3 \cdot 3$	
4		

2. $y = 4x$

x	$4x$	y
0	$4 \cdot 0$	
1	$4 \cdot 1$	
2		
3		

3. **MUSIC** Jonas downloads 8 songs each month onto his digital music player. Make a function table that shows the total number of songs downloaded after 1, 2, 3, and 4 months. Then identify the domain and range.

Examples 2, 3
(p. 64)

SPORTS For Exercises 4 and 5, use the following information.

The top speed reached by a race car is 231 miles per hour.

4. Write an equation using two variables to show the relationship between the number of miles m that a race car can travel in h hours.
5. Use your equation to explain how to find the distance in miles the race car will travel in 3 hours.

Practice and Problem Solving

HOMEWORK HELP

For Exercises	See Examples
6–10	1
11–14	2, 3

Copy and complete each function table. Then identify the domain and range.

6. $y = 2x$

x	$2x$	y
0	$2 \cdot 0$	0
1	$2 \cdot 1$	
2		
3		

7. $y = 6x$

x	$6x$	y
1		
2		
3		
4		

8. $y = 9x$

x	$9x$	y
1		
2		
3		
4		



Make a function table for each situation. Then identify the domain and range.

9. **PIZZA** A pizza shop sells 25 pizzas each hour. Find the number of pizzas sold after 1, 2, 3, and 4 hours.
10. **TYPING** Suppose you can type 60 words per minute. What is the total number of words typed after 5, 10, 15, and 20 minutes?

CELL PHONES For Exercises 11 and 12, use the following information.

A cell phone provider charges a customer \$40 for each month of service.

11. Write an equation using two variables to show the relationship between the total amount charged c , after m months of cell phone service.
12. Use your equation to explain how to find the total cost for 6 months of cell phone service.



INSECTS For Exercises 13 and 14, use the following information.

A cricket will chirp approximately 35 times per minute when the outside temperature is 72°F .

- Write an equation using two variables to show the relationship between the total number of times a cricket will chirp t , after m minutes at this temperature.
- Use your equation to explain how to find the number of times a cricket will have chirped after 15 minutes at this temperature.

Copy and complete each function table. Then identify the domain and range.

15. $y = x - 1$

x	$x - 1$	y
1		
2		
3		
4		

16. $y = x + 5$

x	$x + 5$	y
1		
2		
3		
4		

17. $y = x + 0.25$

x	$x + 0.25$	y
0		
1		
2		
3		

18. $y = x - 1.5$

x	$x - 1.5$	y
2		
3		
4		
5		

MEASUREMENT For Exercises 19 and 20, use the following information.

The formula for the area of a rectangle with length 6 units is $A = 6w$.

- Make a function table that shows the area in square units of a rectangle with a width of 2, 3, 4, and 5 units.
- Study the pattern in your table. Explain how the area of a rectangle with a length of 6 units changes when the width is increased by 1 unit.

ANALYZE TABLES For Exercises 21–23, use the table that shows the approximate velocity of certain planets as they orbit the Sun.

Orbital Velocity Around Sun	
Planet	Velocity (mi/s)
Mercury	30
Earth	19
Jupiter	8
Saturn	6
Neptune	5

- Write an equation to show the relationship between the total number of miles m Jupiter travels in s seconds as it orbits the Sun.
- What equation can be used to show the total number of miles Earth travels?
- Use your equation to explain how to find the number of miles Jupiter and Earth each travel in 1 minute.

Real-World Link
Crickets are among the 800,000 different types of insects in the world.

Academic Standards • ISTEP+

Extra Practice, pp. 671, 704

H.O.T. Problems**CHALLENGE** Write an equation for the function shown in each table.

24.

x	y
1	3
2	4
3	5
4	6

25.

x	y
2	6
4	12
6	18
8	24

26.

x	y
1	3
2	5
3	7
4	9

27. **OPEN ENDED** Write about a real-world situation that can be represented by the equation $y = 3x$.
28. **WRITING IN MATH** Explain the relationship among an *input*, an *output*, and a *function rule*.

ISTEP+ PRACTICE 7.2.1

29. The table shows the number of hand-painted T-shirts Mi-Ling can make after a given number of days.

Number of Days (x)	Total Number of T-Shirts (y)
1	6
2	12
3	18
4	24

Which function rule represents the data?

- A $y = 4x$ C $y = 6x$
 B $y = 5x$ D $y = 12x$

30. Cristina needs to have 50 posters printed to advertise a community book fair. The printing company charges \$3 to print each poster. Which table represents this situation?

F

Posters	Cost (\$)
3	3
6	6
9	9
p	p

H

Posters	Cost (\$)
1	3
2	6
3	9
p	$3 + p$

G

Posters	Cost (\$)
1	3
2	6
3	9
p	$3p$

J

Posters	Cost (\$)
3	1
6	2
9	3
p	$p \div 3$

Spiral Review

31. **ALGEBRA** Write the next three terms of the sequence 27, 36, 45, 54, ...
 (Lesson 1-9)

Use the Distributive Property to rewrite each expression. Then evaluate it. (Lesson 1-8)

32. $5(9 + 7)$ 33. $(12 + 4)4$ 34. $8(7) - 8(2)$ 35. $10(6) - 10(5)$

36. **ALLOWANCE** If Karen receives a weekly allowance of \$8, about how much money in all will she receive in two years? (Lesson 1-1)

Graphing Calculator Lab Functions and Tables

MAIN IDEA

Use technology to represent and compare functions.

IN Academic Standards

7.2.1 Use variables and appropriate operations to write an expression, equation or inequality that represents a verbal description. Also addresses P.3.2, P.4.1, P.5.2, P.7.1.

IN Math Online

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• Other Calculator Keystrokes

You can use a graphing calculator to represent functions.

ACTIVITY

- 1 GROCERIES** A grocery store has 12-ounce bottles of sports drink on sale for \$1.80 each, with no limit on how many you can buy. In addition, you can use a coupon for \$1 off one bottle. Make a table showing the cost for 3, 4, 5, 6, and 7 bottles of this drink.

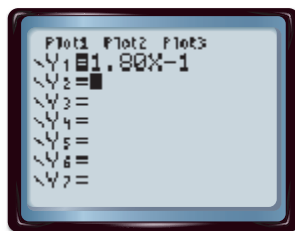
STEP 1 Write an equation to show the relationship between the number of bottles purchased x and their cost y .

Cost is \$1.80 per bottle less \$1.

$$y = 1.80x - 1$$

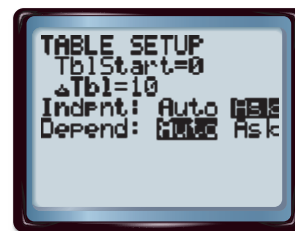
STEP 2

Press $\boxed{Y=}$ on your calculator. Then enter the function into Y_1 by pressing 1.80 $\boxed{X,T,\theta,n}$ $\boxed{-}$ 1 \boxed{ENTER} .



STEP 3

Next, set up a table of x - and y -values. Press $\boxed{2nd}$ $\boxed{[TBLSET]}$ to display the table setup screen. Then press $\boxed{\downarrow}$ $\boxed{\downarrow}$ $\boxed{\rightarrow}$ \boxed{ENTER} to highlight Indpnt: Ask.



STEP 4

Access the table by pressing $\boxed{2nd}$ $\boxed{[TABLE]}$. Then key in each number of bottles, pressing \boxed{ENTER} after each entry.

X	Y1
3	4.4
4	6.2
5	8.0
6	9.8
7	11.6

ANALYZE THE RESULTS

- Analyze the table to determine how many bottles you can buy for \$10. Explain your reasoning.
- MAKE A CONJECTURE** Notice that you can purchase 5 bottles for the whole dollar amount of \$8. How many bottles will you be able to purchase for \$9, the next whole dollar amount? Use the calculator to test your conjecture.

ACTIVITY

- 2 CAMPING** Out-There Campground charges each group a camping fee of \$20 plus \$4.25 per person per night. Roughing-It Campground charges \$6.25 per person per night. Make a table showing the one-night fee for 2, 3, 4, 5, and 6 people to camp at each campground.

STEP 1 Write an equation to show the relationship between the number of people x and the one-night fee y for them to camp at each campground.

Reading Math

The phrase *\$4.25 per person* means *\$4.25 for each person*.

Out-There Campground

Fee is \$20 plus \$4.25 per person.

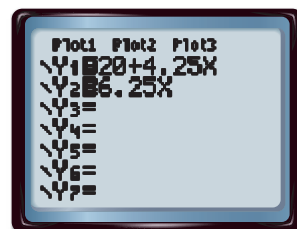
$$y = 20 + 4.25x$$

Roughing-It Campground

Fee is \$6.25 per person.

$$y = 6.25x$$

STEP 2 Enter the function for the Out-There Campground into Y_1 and the function for the Roughing-It Campground into Y_2 .



STEP 3 Next, set up a table of x - and y -values as in Activity 1.

STEP 4 Then access the table and key in each number of people. Notice that the calculator follows the order of operations multiplying each x -value by 4.25 first and then adding 20.

X	Y1	Y2
2	28.5	12.5
3	32.75	18.75
4	37	25
5	41.25	31.25
6	45.5	37.5

ANALYZE THE RESULTS

- For 2, 3, 4, 5, and 6 people, which campground charges the greater total nightly cost to camp?
- MAKE A CONJECTURE** Will the total nightly cost to camp at each campground ever be the same? If so, for what number of people?
- Use the graphing calculator to test your conjecture from Exercise 4. Were you correct? If not, use the graphing calculator to guess and check until you find the correct number of people.
- If all other aspects of these two campgrounds are equal, write a recommendation as to which campground a group of n people should choose based on your cost analysis.

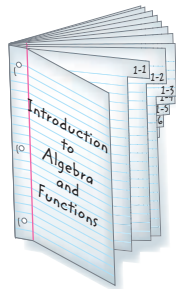
Study Guide and Review

FOLDABLES®

Study Organizer

▶ GET READY to Study

Be sure the following Big Ideas are noted in your Foldable.



BIG Ideas

Squares and Square Roots (Lesson 1-3)

- The square of a number is the product of a number and itself.
- A square root of a number is one of its two equal factors.

Order of Operations (Lesson 1-4)

- Do all operations within grouping symbols first. Evaluate all powers before other operations. Multiply and divide in order from left to right. Add and subtract in order from left to right.

Properties (Lesson 1-8)

- Distributive Property
 $5(2 + 4) = 5 \cdot 2 + 5 \cdot 4$
 $(3 + 2)4 = 3 \cdot 4 + 2 \cdot 4$
- Commutative Property
 $3 + 2 = 2 + 3$
 $7 \cdot 4 = 4 \cdot 7$
- Associative Property
 $6 + (3 + 8) = (6 + 3) + 8$
 $5 \cdot (2 \cdot 3) = (5 \cdot 2) \cdot 3$
- Identity Property
 $4 + 0 = 4$
 $4 \cdot 1 = 4$

Functions (Lesson 1-10)

- A function is a relationship that assigns exactly one *output* value for each *input* value.
- In a function, the function rule gives the operation to perform on the input.

Key Vocabulary

algebra (p. 44)	function rule (p. 63)
algebraic expression (p. 44)	numerical expression (p. 38)
arithmetic sequence (p. 57)	order of operations (p. 38)
base (p. 30)	perfect square (p. 34)
coefficient (p. 45)	powers (p. 30)
defining the variable (p. 50)	radical sign (p. 35)
domain (p. 63)	range (p. 63)
equation (p. 49)	sequence (p. 57)
equivalent expressions (p. 53)	solution (p. 49)
evaluate (p. 31)	square (p. 34)
exponent (p. 30)	square root (p. 35)
factors (p. 30)	term (p. 57)
function (p. 63)	variable (p. 44)

Vocabulary Check

State whether each sentence is *true* or *false*. If *false*, replace the underlined word or number to make a true sentence.

1. Numerical expressions have the same value.
2. Two or more numbers that are multiplied together are called powers.
3. The range of a function is the set of input values.
4. A function assigns exactly two output values for each *input* value.
5. An equation is a sentence that contains an equals sign.
6. A sequence is an ordered list of numbers.
7. The product of a number and itself is the square root of the number.

Lesson-by-Lesson Review

1-1

A Plan for Problem Solving (pp. 25–29)



P.1.1

Use the four-step plan to solve each problem.

- PHONE CALLS** When Tamik calls home from college, she talks ten minutes per call for 3 calls each week. How many minutes does she use in a 15-week semester?
- RUNNING** Darren runs at a rate of 6 feet per second, and Kim runs at a rate of 7 feet per second. If they both start a race at the same time, how far apart are they after one minute?
- WORK** Alan was paid \$9 per hour and earned \$128.25. How many hours did he work?

Example 1 One quart of paint covers 40 square feet of wall space. Brock uses 5 quarts of paint to cover his walls. How many square feet did Brock paint?

Understand Brock uses 5 quarts of paint, each covering 40 square feet.

Plan Multiply 40 by 5.

Solve $40 \cdot 5 = 200$
Brock painted 200 square feet.

Check $200 \div 5 = 40$, so the answer is reasonable.

1-2

Powers and Exponents (pp. 30–33)



7.1.2

Write each power as a product of the same factor.

- 3^4
- 9^6
- 5^1
- 7^5
- Write 5 to the fourth power as a product of the same factor.

Evaluate each expression.

- 3^5
- 7^9
- 2^8
- 18^2
- 10^4
- 100^1
- Write $15 \cdot 15 \cdot 15$ in exponential form.
- PATHS** At the edge of a forest, there are two paths. At the end of each path, there are two additional paths. If at the end of each of those paths there are two more paths, how many paths are there at the end?

Example 2 Write 2^3 as a product of the same factor.

The base is 2. The exponent 3 means that 2 is used as a factor 3 times.

$$2^3 = 2 \cdot 2 \cdot 2$$

Example 3 Evaluate 4^5 .

The base is 4. The exponent 5 means that 4 is used as a factor 5 times.

$$\begin{aligned} 4^5 &= 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \\ &= 1,024 \end{aligned}$$

1-3

Squares and Square Roots (pp. 34–37)

7.1.5

Find the square of each number.

24. 4

25. 13

Find each square root.

26. $\sqrt{81}$

27. $\sqrt{324}$

28. **MEASUREMENT** The area of a certain kind of ceramic tile is 25 square inches. What is the length of one side?

Example 4 Find the square of 15.

$15 \cdot 15 = 225$ Multiply 15 by itself.

Example 5 Find the square root of 441.

$21 \cdot 21 = 441$, so $\sqrt{441} = 21$.

1-4

Order of Operations (pp. 38–41)7.1.7,
7.2.3

Evaluate each expression.

29. $24 - 8 + 3^2$

30. $48 \div 6 + 2 \cdot 5$

31. $9 + 3(7 - 5)^3$

32. $15 + 9 \div 3 - 7$

33. **SEATING** In planning for a ceremony, 36 guests need to be seated with 4 guests per table. An additional 12 guests need to be seated with 3 guests per table. Write an expression to determine how many tables are needed. Then evaluate the expression.

Example 6 Evaluate $24 - (8 \div 4)^4$.

$24 - (8 \div 4)^4 = 24 - 2^4$ Divide 8 by 4.

$= 24 - 16$ Find the value of 2^4 .

$= 8$ Subtract.

1-5

PSI: Guess and Check (pp. 42–43)P.1.3,
P.1.4Solve. Use the *guess and check* strategy.

34. **TRAVEL** Lucinda is driving away from Redding at 50 miles per hour. When she is 100 miles away, Tom leaves Redding, driving at 60 miles per hour in the same direction. After how many hours will Tom pass Lucinda?
35. **FARMING** A farmer sells a bushel of soybeans for \$5 and a bushel of corn for \$3. If he hopes to earn \$164 and plans to sell 40 bushels in all, how many bushels of soybeans does he need to sell?

Example 7 Find two numbers with a product of 30 and a difference of 13.

Make a guess, and check to see if it is correct. Then adjust the guess until it is correct.

5 and 6 $5 \cdot 6 = 30$ and $6 - 5 = 1$
incorrect

3 and 10 $3 \cdot 10 = 30$ and $10 - 3 = 7$
incorrect

2 and 15 $2 \cdot 15 = 30$ and $15 - 2 = 13$
correct

The two numbers are 2 and 15.

1-6

Algebra: Variables and Expressions (pp. 44–47)



7.2.1

Evaluate each expression if $a = 10$, $b = 4$, and $c = 8$.

36. $(a - b)^2$

37. $ab \div c$

38. $3b^2 + c$

39. $\frac{(b + c)^2}{3}$

40. **CLOTHING** The cost of buying h hats and s shirts is given by the expression $\$5.75h + \$8.95s$. Find the cost of purchasing 3 hats and 5 shirts.

Example 8 Evaluate $2m^2 - 5n$ if $m = 4$ and $n = 3$.

$$\begin{aligned} 2m^2 - 5n &= 2(4)^2 - 5(3) && \text{Replace } m \text{ with } 4 \text{ and } n \text{ with } 3. \\ &= 2(16) - 5(3) && \text{Find the value of } 4^2. \\ &= 32 - 15 && \text{Multiply.} \\ &= 17 && \text{Subtract.} \end{aligned}$$

1-7

Algebra: Equations (pp. 49–52)



7.2.2,
P.6.6

Solve each equation mentally.

41. $h + 9 = 17$

42. $31 - y = 8$

43. $\frac{t}{9} = 12$

44. $100 = 20g$

45. **COUNTY FAIRS** Five friends wish to ride the Ferris wheel, which requires 3 tickets per person. The group has a total of 9 tickets. Write and solve an equation to find the number of additional tickets needed for everyone to ride the Ferris wheel.

Example 9 Solve $14 = 5 + x$ mentally.

$$\begin{aligned} 14 &= 5 + x && \text{Write the equation.} \\ 14 &= 5 + 9 && \text{You know that } 5 + 9 = 14. \\ 14 &= 14 && \text{Simplify.} \end{aligned}$$

The solution is 9.

1-8

Algebra: Properties (pp. 53–56)



7.1.7,
7.2.3

Find each expression mentally. Justify each step.

46. $(25 \cdot 15) \cdot 4$

47. $14 + (38 + 16)$

48. $8 \cdot (11 \cdot 5)$

49. **ROSES** Wesley sold roses in his neighborhood for \$2 a rose. He sold 15 roses on Monday and 12 roses on Tuesday. Use the Distributive Property to mentally find the total amount Wesley earned. Explain your reasoning.

Example 10 Find $8 + (17 + 22)$ mentally. Justify each step.

$$\begin{aligned} 8 + (17 + 22) &= 8 + (22 + 17) && \text{Commutative Property of Addition} \\ &= (8 + 22) + 17 && \text{Associative Property of Addition} \\ &= 30 + 17 \text{ or } 47 && \text{Add } 30 \text{ and } 17 \text{ mentally.} \end{aligned}$$

1-9

Algebra: Arithmetic Sequences (pp. 57–61)



7.2.1

Describe the relationship between the terms in each arithmetic sequence. Then find the next three terms in each sequence.

50. $3, 9, 15, 21, 27, \dots$

51. $2.6, 3.4, 4.2, 5, 5.8, \dots$

52. $0, 7, 14, 21, 28, \dots$

MONEY For Exercises 53 and 54, use the following information.

Tanya collected \$4.50 for the first car washed at a band fund-raiser. After the second and third cars were washed, the donations totaled \$9 and \$13.50, respectively.

53. If this donation pattern continues, what algebraic expression can be used to find the amount of money earned for any number of cars washed?
54. How much money will be collected after a total of 8 cars have been washed?

Example 11 At the end of day 1, Sierra read 25 pages of a novel. By the end of days 2 and 3, she read a total of 50 and 75 pages, respectively. If the pattern continues, what expression will give the total number of pages read after any number of days?

Make a table to display the sequence.

Position	Operation	Value of Term
1	$1 \cdot 25$	25
2	$2 \cdot 25$	50
3	$3 \cdot 25$	75
n	$n \cdot 25$	$25n$

Each term is 25 times its position number. So, the expression is $25n$.

1-10

Algebra: Equations and Functions (pp. 63–67)



7.2.1

Copy and complete the function table. Then identify the domain and range.

55. $y = 4x$

x	$4x$	y
5		
6		
7		
8		

56. **NAME TAGS** Charmaine can make 32 name tags per hour. Make a function table that shows the number of name tags she can make in 3, 4, 5, and 6 hours.

Example 12 Create and complete a function table for $y = 3x$. Then identify the domain and range.

Select any four values for the input x .

x	$3x$	y
3	$3(3)$	9
4	$3(4)$	12
5	$3(5)$	15
6	$3(6)$	18

The domain is $\{3, 4, 5, 6\}$.

The range is $\{9, 12, 15, 18\}$.

PART 1 Multiple Choice

Read each question. Then fill in the correct answer on the answer document provided by your teacher or on a sheet of paper.

- A store owner bought some paperback books and then sold them for \$4.50 each. He sold 35 books on Monday and 52 books on Tuesday. What piece of information is needed to find the amount of profit made from sales on Monday and Tuesday?
 - Number of books sold on Wednesday
 - Number of hardback books sold on Monday and Tuesday
 - Total number of paperback books sold
 - How much the owner paid for each of the paperback books
- The table shows the number of milkshakes sold at an ice cream shop each day last week.

Day of Week	Number of Milkshakes
Sunday	31
Monday	9
Tuesday	11
Wednesday	15
Thursday	18
Friday	24
Saturday	28

Which statement does *not* support the data?

- There were almost three times as many milkshakes sold on Sunday as on Tuesday.
- There were half as many milkshakes sold on Monday as on Thursday.
- There were 11 more milkshakes sold on Tuesday than on Saturday.
- The total number of milkshakes sold during the week was 136.

- Which description shows the relationship between the value of a term and n , its position in the sequence?

Position	1	2	3	4	5	n
Value of Term	3	6	9	12	15	

- Add 2 to n .
- Divide n by 3.
- Multiply n by 3.
- Subtract n from 2.

TEST-TAKING TIP

Question 3 Have students eliminate unlikely answer choices. Since the value of each term is greater than its position, eliminate answer choices B and D.

- Andrew spent $\frac{1}{2}$ of his Saturday earnings on a pair of jeans and $\frac{1}{2}$ of the remaining amount on a DVD. After he spent \$7.40 on lunch, he had \$6.10 left. How much did Andrew earn on Saturday?
 - \$13.50
 - \$27
 - \$54
 - \$108
- Lemisha drove an average of 50 miles per hour on Sunday, 55 miles per hour on Monday, and 53 miles per hour on Tuesday. If s represents the number of hours she drove on Sunday, m represents the number of hours she drove on Monday, and t represents the number of hours she drove on Tuesday, which of the following expressions gives the total distance Lemisha traveled?
 - $50s + 53m + 55t$
 - $55s + 50m + 53t$
 - $50s + 55m + 53t$
 - $53s + 55m + 50t$



6. Mrs. Albert drove 850 miles and the average price of gasoline was \$2.50 per gallon. What information is needed to find the amount Mrs. Albert spent on gasoline for the trip?

- F Number of hours the trip took
- G Number of miles per hour traveled
- H Average number of miles the car traveled per gallon of gasoline
- J Average number of miles Mrs. Albert drove per day

7. Mr. Thompson wants to estimate the total amount he spends on insurance and fuel for his car each month. Insurance costs about \$300 per month, and he expects to drive an average of 150 miles per week. What else does he need to estimate his monthly expenses?

- A The cost of fuel and the one-way distance to work
- B The cost of fuel and the number of miles per gallon his car gets
- C The cost of fuel and his weekly pay
- D The gallons of fuel needed per week

8. Jeremy bought 3 hamburgers at \$1.99 each, 2 orders of onion rings at \$0.89 each, and 4 soft drinks at \$1.25 each. He paid 6.75% tax on the whole order. What other information is necessary to find Jeremy's correct change?

- F Total cost of the order
- G Amount he paid in tax
- H Reason for buying the food
- J Amount he gave the cashier

PART 2 Short Response/Grid In

Record your answers on the answer sheet provided by your teacher or on a sheet of paper.

- 9. Emily bought 2.5 pounds of salami for \$1.99 per pound. About how much did she pay?
- 10. How do you correctly evaluate the expression $4 \times (5 + 4) - 27$?
- 11. What value of t makes the following equation true?

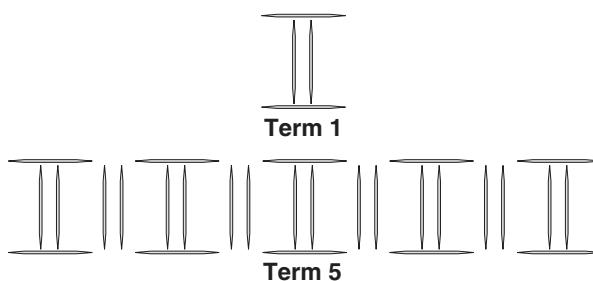
$$t \div 6 = 48$$

- 12. Use the Distributive Property to rewrite $4(3 + 5)$.

PART 3 Extended Response

Record your answers on the answer sheet provided by your teacher or on a sheet of paper. Show your work.

- 13. **GEOMETRY** The first and fifth terms of a toothpick sequence are shown below.



- a. What might the third term look like?
- b. Write a rule that connects the term number and the number of toothpicks in your sequence.

NEED EXTRA HELP?													
If You Missed Question...	1	2	3	4	5	6	7	8	9	10	11	12	13
Go to Lesson...	1-1	1-1	1-9	1-1	1-6	1-1	1-1	1-1	1-1	1-4	1-6	1-8	1-9
IN Academic Standards	P.1.1	P.1.1	7.2.1	P.1.1	7.2.1	P.1.1	P.1.1	P.1.1	P.1.1	7.2.3	7.2.1	7.2.3	7.2.1