

Chapter 1

Resource Masters



Mathematics

Applications and Concepts

Course 2



New York, New York Columbus, Ohio Chicago, Illinois Peoria, Illinois Woodland Hills, California

1-1**Study Guide and Intervention*****A Plan for Problem Solving*****Four-Step Problem-Solving Plan**

When solving problems, it is helpful to have an organized plan to solve the problem. The following four steps can be used to solve any math problem.

1. **Explore** – Get a general understanding of the problem.
2. **Plan** – Make a plan to solve the problem and estimate the answer.
3. **Solve** – Carry out your plan.
4. **Examine** – Check the reasonableness of your answer.

EXAMPLE 1 Use the four-step plan to solve the problem.

RECREATION A canoe rental store along the Illinois River in Oklahoma has 30 canoes that it rents on a daily basis during the summer season. If canoes rent for \$15 per day, how much money can the store collect for canoe rentals during the month of July?

- Explore** You know that they rent 30 canoes per day for \$15 each. You need to determine the total amount of money that can be collected during the month of July.
- Plan** First, find the total amount of money that can be collected each day by finding the product of 30 and 15. Next, multiply the previous result by 31, the number of days in July. You can estimate this result by 30. $30 \times 15 \times 30 = 13,500$
- Solve** Since $30 \times \$15 = \450 , the canoe rental store can collect \$450 in rental fees each day. This means the total amount of money that could be collected during the month of July is $\$450 \times 31$ or \$13,950.
- Examine** Is your answer reasonable? The answer is close to the estimate of \$13,500.

EXERCISES

Use the four-step plan to solve each problem.

1. **MONEY** Colin works for his dad during summer vacation. His dad pays him \$5.20 per hour and he works 20 hours per week. How much will Colin earn during his 8-week summer vacation?
2. **BOOKS** A student assistant in the school library is asked to shelve 33 books. If he puts away 9 books the first hour and then 6 books each hour after that, how long will it take him to shelve all 33 books?
3. **SHOPPING** Alicia bought a \$48 sweater on sale for \$25 and a \$36 purse on sale for \$22. How much did Alicia save?
4. **MAIL** It cost Ramon \$3.73 to mail a package to his grandmother. The post office charged \$2.38 for the first pound and 45 cents for each additional pound. How much did the package weigh?

1-1**Practice: Skills*****A Plan for Problem Solving***

Answer these questions about the four-step problem-solving plan.

1. During which step do you ask if your answer makes sense?
2. During which step do you make a new plan if your first plan doesn't work?
3. During which step do you make a strategy for solving the problem?
4. During which step do you ask yourself, "What do I need to find out?"

Choose one of the following to describe how you would plan to solve each problem. Do not solve the problems.

A. Use only one operation, such as addition or multiplication.

B. Use a combination of operations, such as division and addition.

C. Use a different strategy.

5. **MONEY** Julia opened a savings account with a deposit of \$36. She then deposited \$5 per week for one month. If she then withdrew \$9.50, how much is left in her savings account?
6. In how many different patterns can 3 rose bushes, 2 sunflowers, and 5 tulip plants be planted in a garden?
7. Use the four-step plan to solve Exercise 5.
 - A. Explore
 - B. Plan
 - C. Solve
 - D. Examine

1-1**Practice: Word Problems*****A Plan for Problem Solving***

MAGAZINES For Exercises 1 and 2, use the table that shows the costs of several popular magazines.

Costs of Popular Magazines		
Magazine	Cost of Yearly Subscription	Cost of a Single Copy
<i>Teen World</i>	\$9.98 (12 issues)	\$3.25
<i>Soccer World</i>	\$19.97 (6 issues)	\$4.99
<i>Book Nation</i>	\$19.98 (12 issues)	\$2.99
<i>TV Weekly</i>	\$46.28 (52 issues)	\$1.95

<p>1. How much could you save by buying <i>Teen World</i> with a yearly subscription rather than 12 single copies?</p>	<p>2. Which of the magazines saves you the most money by purchasing a yearly subscription instead of an equivalent number of single copies? How much will you save?</p>
<p>3. BICYCLING Adriana can ride her bicycle 6 miles in one hour. How long will it take her to ride 15 miles?</p>	<p>4. BASKETBALL At Johnson Middle School an average of 500 people attended each of the 15 home basketball games. If admission was \$3 per person, about how much money was collected in all?</p>
<p>5. THEATER A local theater has floor seating, balcony seating, and box seating. If the theater contains 2,500 seats with 425 seats in the balcony and 215 box seats, how many seats are on the floor?</p>	<p>6. POPCORN Janelle plans to buy three boxes of popcorn at the movies for herself and two friends. If each box costs \$1.95, how much change will she receive when she pays with a ten-dollar bill?</p>

1-1**Reading to Learn Mathematics*****A Plan for Problem Solving***

Pre-Activity *Read the introduction at the top of page 6 in your textbook. Write your answers below.*

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?

Reading the Lesson

5. In which step of the four-step plan do you decide which strategy you will use to solve the problem?
6. What does the four-step plan suggest you do if your answer is not correct?
7. Complete the sentence: Once you solve a problem, make sure your solution contains any appropriate _____.

Helping You Remember

8. Think of a way to help you remember the names of each of the steps of the four-step plan in the correct order. For example, try writing a sentence using all of the words.

1-1**Enrichment****Bargain Hunt**

Use the For Sale signs on this page to solve each problem. If information you need is not given, write “cannot be solved.”

1. Kiko works Saturday mornings at the videotape store. She bought ten videotapes on sale and used a \$10 employee discount coupon to help pay for the tapes. How much did she spend in all?
2. Toni bought six handbags at the store that is going out of business. How much did she spend for each handbag?
3. Sid earned \$40 working after school. How much money will he have left if he buys a sweatshirt and four jigsaw puzzles?
4. Suzette bought six jigsaw puzzles and a model airplane kit. How much change did she receive from a \$20 bill?
5. Last week Norrine bought a model airplane kit for \$18.67. How much would she have saved if she had waited until this week to buy the kit?
6. How much would you save if you bought three sweatshirts and two jigsaw puzzles?

2 for \$5

JIGSAW PUZZLES

Regularly \$3.49 each

Save!

Sweatshirts

\$9.99 each

Regularly \$11.99

Videotapes!!!

5 for \$45.95!

This Week Only!

Model Airplane Kits \$3.99

Reg. \$4.99–\$24.99

Going Out of Business

Handbags—3 for \$15

1-2**Study Guide and Intervention*****Powers and Exponents***

$$\begin{array}{c}
 \text{Exponent} \\
 \swarrow \\
 3^4 = 3 \cdot 3 \cdot 3 \cdot 3 = 81 \\
 \uparrow \quad \underbrace{\hspace{2cm}} \\
 \text{Base} \quad \text{common factors}
 \end{array}$$

The **exponent** tells you how many times to use the **base** as a factor.

EXAMPLE 1 Write 6^3 as a product of the same factor.

The base is 6. The exponent 3 means that 6 is used as a factor 3 times.

$$6^3 = 6 \cdot 6 \cdot 6$$

EXAMPLE 2 Evaluate 5^4 .

$$\begin{aligned}
 5^4 &= 5 \cdot 5 \cdot 5 \cdot 5 \\
 &= 625
 \end{aligned}$$

EXAMPLE 3 Write $4 \cdot 4 \cdot 4 \cdot 4 \cdot 4$ in exponential form.

The base is 4. It is used as a factor 5 times, so the exponent is 5.

$$4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 = 4^5$$

EXERCISES

Write each power as a product of the same factor.

1. 7^3

2. 2^7

3. 9^2

4. 15^4

Evaluate each expression.

5. 3^5

6. 7^3

7. 8^4

8. 5^3

Write each product in exponential form.

9. $2 \cdot 2 \cdot 2 \cdot 2$

10. $7 \cdot 7 \cdot 7 \cdot 7 \cdot 7 \cdot 7$

11. $10 \cdot 10 \cdot 10$

12. $9 \cdot 9 \cdot 9 \cdot 9 \cdot 9$

13. $12 \cdot 12 \cdot 12$

14. $5 \cdot 5 \cdot 5 \cdot 5$

15. $6 \cdot 6 \cdot 6 \cdot 6 \cdot 6$

16. $1 \cdot 1 \cdot 1 \cdot 1 \cdot 1 \cdot 1 \cdot 1 \cdot 1$

1-2**Practice: Skills*****Powers and Exponents***

Write each power as a product of the same factor.

1. 11^2

2. 3^4

3. 2^5

4. 9^3

5. 15^3

6. 4^3

7. 1^6

8. 17^4

9. 3^7

10. 8^6

Evaluate each expression.

11. 9^2

12. 8^2

13. 8^3

14. 2^4

15. 2^5

16. 6^3

17. 3^4

18. 3^5

19. 9^3

20. 11^2

21. 4^7

22. 12^3

23. 1^9

24. 10^4

25. 20^4

26. 2^6

Write each product in exponential form.

27. $12 \cdot 12$

28. $10 \cdot 10 \cdot 10$

29. $4 \cdot 4 \cdot 4 \cdot 4 \cdot 4$

30. $9 \cdot 9 \cdot 9 \cdot 9$

31. $15 \cdot 15 \cdot 15 \cdot 15 \cdot 15$

32. $6 \cdot 6 \cdot 6 \cdot 6 \cdot 6 \cdot 6 \cdot 6 \cdot 6$

1-2**Practice: Word Problems*****Powers and Exponents***

<p>1. SPACE SHUTTLE The cost of each flight of the Space Shuttle is about \$10,000,000. Write this amount in exponential form.</p>	<p>2. ANIMALS The African bush elephant is the largest land animal and weighs about 8 tons. Write this amount in exponential form.</p>
<p>3. VOLUME To find the volume of a rectangular box you multiply the length times the width times the height. In a cube all sides are the same length. If the cube has length, width, and height of 6 inches, write the volume as a product. Then write it in exponential form.</p>	<p>4. SCIENCE A certain type of cell doubles every hour. If you start with one cell, at the end of one hour you would have 2 cells, at the end of two hours you have 4 cells, and so on. The expression $2 \times 2 \times 2 \times 2 \times 2$ tells you how many cells you would have after five hours. Write this expression in exponential form; then evaluate it.</p>
<p>5. MATH Write 625 using exponents in as many ways as you can.</p>	<p>6. PREFIXES Many prefixes are used in mathematics and science. The prefix giga in gigameter represents 1,000,000,000 meters. Write this prefix as a power of ten.</p>
<p>7. LIBRARY The school library contains 9^4 books. How many library books are in the school library?</p>	<p>8. HOT DOGS The concession stand at the county fair sold 6^3 hot dogs on the first day. How many hot dogs did they sell?</p>

1-2**Reading to Learn Mathematics*****Powers and Exponents***

Pre-Activity *Read the introduction at the top of page 10 in your textbook. Write your answers below.*

1. How is doubling shown in the table?
2. If the pattern continued, how much storage space would be available by year 6?
3. What is the relationship between the number of 2s and the year?

Reading the Lesson

4. What is the difference between a power and an exponent?
5. Identify the exponent in each expression.
 - a. 5^8
 - b. 8^5
 - c. 8^3
 - d. 8
6. Complete the sentence:
Numbers written with exponents are in _____ form, whereas numbers written without exponents are in _____ form.

Helping You Remember

7. In the expression 6^7 , circle the exponent in red. Then circle the power in another color.

1-2**Enrichment****The Four-Digits Problem**

Use the digits 1, 2, 3, and 4 to write expressions for the numbers 1 through 50. Each digit is used exactly once in each expression. (There might be more than one expression for a given number.)

You can use addition, subtraction, multiplication (not division), exponents, and parentheses in any way you wish. Also, you can use two digits to make one number, as in 34. A few expressions are given to get you started.

1 =

18 =

35 =

2 =

19 =

36 =

3 =

20 =

37 =

4 =

21 =

38 =

5 =

22 =

39 =

6 =

23 =

40 =

7 =

24 =

41 =

8 =

25 =

42 =

9 =

26 =

43 =

10 =

27 =

44 =

11 =

28 =

45 =

12 =

29 =

46 =

13 =

30 =

47 =

14 =

31 =

48 =

15 =

32 =

49 =

16 =

33 =

50 =

17 =

34 =

1-3**Study Guide and Intervention****Order of Operations**

Use the **order of operations** to evaluate numerical expressions.

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

EXAMPLE 1 Evaluate $(10 - 2) - 4 \cdot 2$.

$$\begin{aligned} (10 - 2) - 4 \cdot 2 &= 8 - 4 \cdot 2 && \text{Subtract first since } 10 - 2 \text{ is in parentheses.} \\ &= 8 - 8 && \text{Multiply 4 and 2.} \\ &= 0 && \text{Subtract 8 from 8.} \end{aligned}$$

EXAMPLE 2 Evaluate $8 + (1 + 5)^2 \div 4$.

$$\begin{aligned} 8 + (1 + 5)^2 \div 4 &= 8 + 6^2 \div 4 && \text{First, add 1 and 5 inside the parentheses.} \\ &= 8 + 36 \div 4 && \text{Find the value of } 6^2. \\ &= 8 + 9 && \text{Divide 36 by 4.} \\ &= 17 && \text{Add 8 and 9.} \end{aligned}$$

EXERCISES

Evaluate each expression.

1. $(1 + 7) \times 3$

2. $28 - 4 \cdot 7$

3. $5 + 4 \cdot 3$

4. $(40 \div 5) - 7 + 2$

5. $35 \div 7(2)$

6. 3×10^3

7. $45 \div 5 + 36 \div 4$

8. $42 \div 6 \times 2 - 9$

9. $2 \times 8 - 3^2 + 2$

10. $5 \times 2^2 + 32 \div 8$

11. $3 \times 6 - (9 - 8)^3$

12. 3.5×10^2

1-3**Practice: Skills*****Order of Operations*****Evaluate each expression.**

1. $9 - 3 + 4$

2. $8 + 6 - 5$

3. $12 \div 4 + 5$

4. $25 \times 2 - 7$

5. $36 \div 9(2)$

6. $6 + 3(7 - 2)$

7. $3 \times 6.2 + 5^2$

8. $(1 + 11)^2 \div 3$

9. $12 - (2 + 8)$

10. $15 - 24 \div 4 \cdot 2$

11. $(4 + 2) \cdot (7 + 4)$

12. $(3 \cdot 18) \div (2 \cdot 9)$

13. $24 \div 6 + 4^2$

14. $3 \times 8 - (9 - 7)^3$

15. $9 + (9 - 8 + 3)^4$

16. $3 \times 2^2 + 24 \div 8$

17. $(15 \div 3)^2 + 9 \div 3$

18. $(52 \div 4) + 5^3$

19. 26×10^3

20. 7.2×10^2

21. $5 \times 4^2 - 3 \times 2$

22. $24 \div 6 \div 2$

23. $13 - (6 - 5)^5$

24. $(8 - 3 \times 2) \times 6$

25. $(11 \cdot 4 - 10) \div 2$

26. $10 \div 2 \times (4 - 3)$

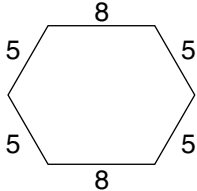
27. 1.82×10^5

28. $35 \div 7 \times 2 - 4$

29. $2^5 + 7(9 - 1)$

30. $12 + 16 \div (3 + 1)$

1-3**Practice: Word Problems****Order of Operations**

<p>1. FOOTBALL The middle school team scored three field goals worth three points each and two touchdowns worth six points each, including extra points. Write a numerical expression to find the team's score. Then evaluate the expression.</p>	<p>2. BOOKS Juan goes to the schoolbook fair where paperback books are \$1.50 and hardback books are \$3.00. Juan buys 5 paperback and 2 hardback books. Write a numerical expression to find how much Juan paid for the books. Then evaluate the expression.</p>
<p>3. GEOMETRY The perimeter of a hexagon is found by adding the lengths of all six sides of the hexagon. For the hexagon below write a numerical expression to find the perimeter. Then evaluate the expression.</p> 	<p>4. MONEY Aisha bought school supplies consisting of 6 spiral notebooks costing \$0.39 each, 2 packages of pencils at \$0.79 each, and a 3-ring binder for \$1.99. Write an expression to find the total amount Aisha spent on school supplies. Then evaluate the expression.</p>
<p>5. REASONING Use the order of operations and the digits 2, 4, 6, and 8 to create an expression with a value of 2.</p>	<p>6. NUMBER SENSE Without parentheses, the expression $8 + 30 \div 2 + 4$ equals 27. Place parentheses in the expression so that it equals 13; then 23.</p>
<p>7. MONEY Tyrone bought 5 postcards at \$0.55 each and a set of postcards for \$1.20. Write an expression to find the total amount Tyrone spent on postcards. Then evaluate the expression.</p>	<p>8. DINING Mr. Firewalks took his family out to eat. They ordered 3 meals costing \$8.99 each, 2 sodas at \$1.50 each, and 1 glass of tea for \$1.25. Write an expression to find the total amount the Firewalks family spent on dinner before taxes and tip. Then evaluate the expression.</p>

1-3**Reading to Learn Mathematics*****Order of Operations***

Pre-Activity *Read the introduction at the top of page 14 in your textbook. Write your answers below.*

1. List the similarities and differences between the two expressions.
2. What was Kaitlyn's first step in simplifying her expression? Percy's first step?
3. **Make a conjecture** about what should be the first step in simplifying $(3 \cdot 5) - 4 + 6$.

Reading the Lesson

4. Why did mathematicians agree on an order of operations?
5. What are three ways to indicate multiplication in a mathematical expression?

Helping You Remember

6. In your own words, describe the order of operations that is used in finding the value of a mathematical expression.

1-3**Enrichment****Nested Expressions**

Sometimes more than one set of parentheses are used to group the quantities in an expression. These expressions are said to have “nested” parentheses. The expression below has “nested” parentheses.

$$(4 + (3 \cdot (2 + 3)) + 8) \div 9$$

Expressions with several sets of grouping symbols are clearer if braces such as { } or brackets such as [] are used. Here is the same example written with brackets and braces.

$$\{4 + [3 \cdot (2 + 3)] + 8\} \div 9$$

To evaluate expressions of this type, work from the inside out.

$$\begin{aligned} \{4 + [3 \cdot (2 + 3)] + 8\} \div 9 &= \{4 + [3 \cdot 5] + 8\} \div 9 \\ &= [4 + 15 + 8] \div 9 \\ &= 27 \div 9 \\ &= 3 \end{aligned}$$

Evaluate each expression.

1. $3 + [(24 \div 8) \cdot 7] - 20$

2. $[(16 - 7 + 5) \div 2] - 7$

3. $[2 \cdot (23 - 6) + 14] \div 6$

4. $50 - [3 \cdot (15 - 5)] + 25$

5. $12 + \{28 - [2 \cdot (11 - 7)] + 3\}$

6. $\{75 + 3 \cdot [(17 - 9) \div 2]\} \cdot 2$

7. $20 + \{3 \cdot [6 + (56 \div 8)]\}$

8. $\{4 + [5 \cdot (12 - 5)] + 15\} \cdot 10$

9. $\{15 \cdot [(38 - 26) \div 4]\} - 15$

10. $\{[34 + (6 \cdot 5)] \div 8\} + 40$

1-4**Study Guide and Intervention****Algebra: Variables and Expressions**

To evaluate an algebraic expression you replace each variable with its numerical value, then use the order of operations to simplify.

EXAMPLE 1 Evaluate $6x - 7$ if $x = 8$.

$$\begin{aligned} 6x - 7 &= 6(8) - 7 && \text{Replace } x \text{ with } 8. \\ &= 48 - 7 && \text{Use the order of operations.} \\ &= 41 && \text{Subtract 7 from 48.} \end{aligned}$$

EXAMPLE 2 Evaluate $5m - 3n$ if $m = 6$ and $n = 5$.

$$\begin{aligned} 5m - 3n &= 5(6) - 3(5) && \text{Replace } m \text{ with } 6 \text{ and } n \text{ with } 5. \\ &= 30 - 15 && \text{Use the order of operations.} \\ &= 15 && \text{Subtract 15 from 30.} \end{aligned}$$

EXAMPLE 3 Evaluate $\frac{ab}{3}$ if $a = 7$ and $b = 6$.

$$\begin{aligned} \frac{ab}{3} &= \frac{(7)(6)}{3} && \text{Replace } a \text{ with } 7 \text{ and } b \text{ with } 6. \\ &= \frac{42}{3} && \text{The fraction bar is like a grouping symbol.} \\ &= 14 && \text{Divide.} \end{aligned}$$

EXAMPLE 4 Evaluate $x^3 + 4$ if $x = 3$.

$$\begin{aligned} x^3 + 4 &= 3^3 + 4 && \text{Replace } x \text{ with } 3. \\ &= 27 + 4 && \text{Use the order of operations.} \\ &= 31 && \text{Add 27 and 4.} \end{aligned}$$

EXERCISES

Evaluate each expression if $a = 4$, $b = 2$, and $c = 7$.

1. $3ac$

2. $5b^3$

3. abc

4. $5 + 6c$

5. $\frac{ab}{8}$

6. $2a - 3b$

7. $\frac{b^4}{4}$

8. $c - a$

9. $20 - bc$

10. $2bc$

11. $ac - 3b$

12. $6a^2$

13. $7c$

14. $6a - b$

15. $ab - c$

1-4**Practice: Skills****Algebra: Variables and Expressions**

Evaluate each expression if $w = 2$, $x = 3$, $y = 5$, and $z = 6$.

1. $2w$

2. $y + 5$

3. $9 - z$

4. $x + w$

5. $3 + 4z$

6. $6y - 5$

7. y^2

8. $y - x$

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

Evaluate each expression if $m = 3$, $n = 7$, and $p = 9$.

10. $m + n$

11. $12 - 3m$

12. $5p$

13. $3.3p$

14. $3.3p + 2$

15. $2p + 3.3$

16. $20 + 2n$

17. $20 - 2n$

18. $\frac{n}{7}$

19. n^2

20. $6m^2$

21. $\frac{p^2}{3}$

22. $1.1 + n$

23. $p - 8.1$

24. $3.6m$

25. $3n - 2m$

26. $3m - n$

27. $2.1n + p$

28. $\frac{m^2}{p}$

29. $\frac{2.5m + 2.5}{5}$

30. $\frac{(n + 2)^2}{3}$

1-4**Practice: Word Problems****Algebra: Variables and Expressions**

<p>1. FIELD TRIP The seventh grade math classes are going on a field trip. The field trip will cost \$7 per student. Write an expression to find the cost of the field trip for s students. What is the total cost if 26 students go on the trip?</p>	<p>2. SOCCER Jason earns \$20 per game as a referee in youth soccer games. Write an expression to find how much money Jason will earn for refereeing any number of games. Let n represent the number of games Jason has refereed. How much will he earn for refereeing 6 games?</p>
<p>3. PROFIT The expressions $c - e$, where c stands for the money collected and e stands for the expenses, is used to find the profit from a basketball concession. If \$500 was collected and expenses were \$150, find the profit for the concession.</p>	<p>4. SAVINGS Kata has a savings account that contains \$230. She decides to deposit \$5 each month from her monthly earnings for baby-sitting after school. Write an expression to find how much money Kata will have in her savings account after x months. Let x represent the number of months. Then find out how much she will have in her account after 1 year.</p>
<p>5. MONEY Mr. Wilson has \$2,500 in his savings account and m dollars in his checking account. Write an expression that describes the total amount that he has in both accounts.</p>	<p>6. ANIMALS Write an expression to represent the total number of legs on h horses and c chickens. How many legs are there in 5 horses and 6 chickens?</p>
<p>7. T-SHIRTS The band wants to order T-shirts. The T-shirts cost \$15 each plus a shipping fee of \$10. Write an expression to find the total cost of c T-shirts.</p>	<p>8. TEMPERATURE The expression $\frac{9}{5}C + 32$, where C stands for temperature in degrees Celsius, is used to convert Celsius to Fahrenheit. If the temperature is 20 degrees Celsius, find the temperature in degrees Fahrenheit.</p>

1-4**Reading to Learn Mathematics****Algebra: Variables and Expressions**

Pre-Activity Complete the Mini Lab at the top of page 18 in your textbook. Write your answers below.

1. Draw the next three figures in the pattern.
2. Find the perimeter of each figure and record your data in the table below. The first three are completed for you.

Number of Triangles	1	2	3	4	5	6
Perimeter	3	4	5			

3. Without drawing the figure, determine the perimeter of a figure made up of 10 triangles. Check by making a drawing.
4. Find a relationship between the number of triangles and the perimeter at each stage of the pattern.

Reading the Lesson

5. Match the description with the appropriate term.

The number 3 in the expression $3y + 2$. _____ **a.** constant

The 7 and the g in the expression $7 - g$. _____ **b.** term

The 4 in the expression $4 + x$. _____ **c.** variable

The entire expression $2v - 1$. _____ **d.** algebraic expression

The z in the expression $z^2 - 21$. _____ **e.** coefficient

Helping You Remember

6. The expression $\frac{1}{3}\pi r \cdot r \cdot h$ represents the volume of a cone where r is the radius of the circular base and h is the height of the figure. Identify the coefficients, variables and constants.

1-4

Enrichment

Albert Einstein’s Famous Theory

When you have solved the puzzle below, the letters in the heavy black boxes will spell the name of an important scientific theory proposed by Albert Einstein. His theory relates mass and energy.

Use these clues to complete the puzzle below.

1. A language of symbols.
2. To evaluate an expression, you _____ the variable with a number.
3. To find a specific numerical value for an algebraic expression.
4. An expression must contain at _____ one operation as well as variables or numbers.
5. The order of _____ helps you to know which operation to do first when evaluating an expression.
6. A symbol that stands for an unknown quantity.
7. The worth of something.
8. You call $2a + 3b$ an algebraic _____.
9. The process of finding the product of two numbers is called _____.
10. In an algebraic expression, you should _____ or divide before you add or subtract.

1-5**Study Guide and Intervention****Algebra: Equations**

- An **equation** is a sentence in mathematics that contains an equals sign.
- The **solution** of an equation is the value that when substituted for the variable makes the equation true.

EXAMPLE 1 Solve $23 + y = 29$ mentally.

$23 + y = 29$ Write the equation.
 $23 + 6 = 29$ You know that $23 + 6$ is 29.
 $29 = 29$ Simplify.
 The solution is 6.

EXAMPLE 2 What value of x is a solution of $x + 8 = 26$?

- A. 16 B. 17 C. 18 D. 19

Substitute each value for x to determine which makes the left side of the equation equivalent to the right side.

Replace x with 16.	Replace x with 17.	Replace x with 18.
$x + 8 = 26$	$x + 8 = 26$	$x + 8 = 26$
$16 + 8 = 26$	$17 + 8 = 26$	$18 + 8 = 26$
$24 \neq 26$ false	$25 \neq 26$ false	$26 = 26$ true

The value of 18 makes the equation true. So, the answer is C.

EXERCISES

Solve each equation mentally.

1. $k + 7 = 15$

2. $g - 8 = 20$

3. $6y = 24$

4. $\frac{a}{3} = 9$

5. $\frac{x}{6} = 9$

6. $8 + r = 24$

7. $12 \cdot 8 = h$

8. $n \div 11 = 8$

9. $48 \div 12 = x$

10. $h - 12 = 24$

11. $19 + y = 28$

12. $9f = 90$

Name the number that is the solution of the given equation.

13. $27 - h = 10$; 7, 17, 27

14. $n \div 11 = 4$; 44, 55, 66

1-5**Practice: Skills****Algebra: Equations**

Solve each equation mentally.

1. $a + 7 = 16$

2. $12 + x = 21$

3. $4d = 60$

4. $15 = \frac{u}{3}$

5. $\frac{b}{7} = 12$

6. $13 \cdot 3 = y$

7. $8 + r = 17$

8. $27 - 12 = m$

9. $h - 22 = 67$

10. $27 + 15 = n$

11. $36 + a = 96$

12. $99 \div d = 3$

13. $6t = 66$

14. $25 = y \div 4$

15. $b - 25 = 120$

16. $n \div 5 = 10$

17. $4y = 48$

18. $5t = 40$

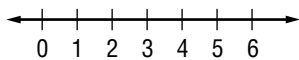
19. $50 \cdot d = 150$

20. $w + 61 = 65$

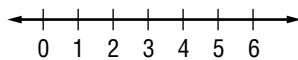
21. $88 \div k = 2$

Graph the solution of each equation on a number line.

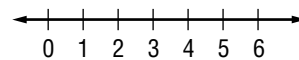
22. $y + 16 = 21$



23. $3f = 18$



24. $13 - x = 10$



Name the number that is the solution of the given equation.

25. $4 + a = 21$; 15, 16, 17

26. $2f = 48$; 20, 22, 24

27. $y - 17 = 30$; 37, 47, 57

28. $48 \div 12 = h$; 3, 4, 5

1-5**Practice: Word Problems****Algebra: Equations**

<p>1. GAS MILEAGE Mr. Moseley's car has a 20-gallon gas tank. It took 14 gallons of gas to fill his tank. Use the equation $14 + g = 20$ to find the number of gallons g that he had before he filled his tank with gas.</p>	<p>2. PAINTING Latisha earned \$5 an hour painting for her dad. If she made \$40 last week, use $5h = 40$ to find how many hours h she painted.</p>
<p>3. LUMBER Mrs. Garcia had a piece of board that was 15 feet long. She cut off 6.5 feet. Use the equation $6.5 + \ell = 15$ to determine how much of the board ℓ she has left.</p>	<p>4. MAGAZINES Mahpee was selling magazine subscriptions. He earned \$5 plus \$0.50 for each subscription he sold. If Mahpee earned \$25, use the equation $25 = 5 + 0.50n$ to find the number of subscriptions n he sold.</p>
<p>5. TIRES The cost of a car tire is \$45 plus \$10 per order regardless of the number of tires purchased. If Mrs. Sato places an order for \$190, use the equation $45t + 10 = 190$ to find the number of tires t she purchased.</p>	<p>6. AREA If the area of a rectangle is 30 square centimeters and the length is 6 centimeters, use the equation $30 = 6w$ to find the width w of the rectangle.</p>
<p>7. SUPPLIES The Jones Middle School had \$4,000 to spend on office supplies. They had already spent \$1,250. Use the equation $1,250 + d = 4,000$ to find how much money d the school had left for other supplies.</p>	<p>8. PENCILS Mi-Leng spent 90 cents on 6 pencils. Use the equation $90 = 6c$ to find the cost c of each pencil.</p>

1-5**Reading to Learn Mathematics****Algebra: Equations**

Pre-Activity *Read the introduction at the top of page 24 in your textbook.
Write your answers below.*

1. How many losses did each team have? Complete the table.

Women's National Basketball Association, 2001		
Team	Wins	Losses
Cleveland	22	
New York	21	
Miami	20	
Charlotte	18	
Orlando	13	
Indiana	10	

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.

Reading the Lesson

4. Complete the sentence: An equation that contains a variable is neither true nor false until the variable is replaced with a _____.
5. Describe what it means to model a problem.
6. What must you do before you write an equation using a variable when modeling a problem?

Helping You Remember

7. Calculating change after buying lunch is a situation that can be modeled with a simple equation. What other daily activities require you to solve an equation? Write down three sample equations.

1-5

Enrichment

Equations as Models

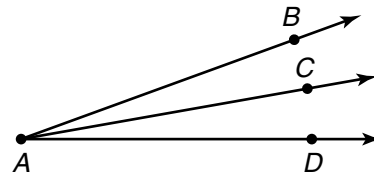
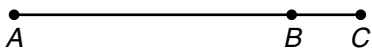
When you write an equation that represents the information in a problem, the equation serves as a model for the problem. One equation can be a model for several different problems.

Each of Exercises 1-8 can be modeled by one of these equations.

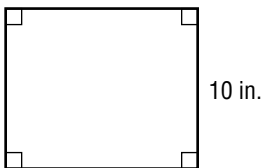
$n + 2 = 10$ $n - 2 = 10$ $2n = 10$ $\frac{n}{2} = 10$

Choose the correct equation. Then solve the problem.

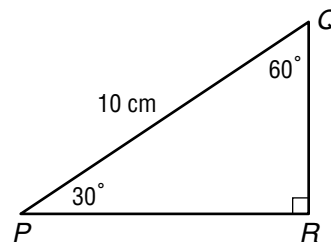
1. Chum earned \$10 for working two hours. How much did he earn per hour?
2. Ana needs \$2 more to buy a \$10 scarf. How much money does she already have?
3. Kathy and her brother won a contest and shared the prize equally. Each received \$10. What was the amount of the prize?
4. Jameel loaned two tapes to a friend. He has ten tapes left. How many tapes did Jameel originally have?
5. In the figure below, the length of \overline{AC} is 10 cm. The length of \overline{BC} is 2 cm. What is the length of \overline{AB} ?
6. Ray \overline{AC} bisects $\angle BAD$. The measure of $\angle BAC$ is 10° . What is the measure of $\angle BAD$?



7. The width of the rectangle below is 2 inches less than the length. What is the length?



8. In the triangle below, the length of \overline{PQ} is twice the length of \overline{QR} . What is the length of \overline{QR} ?



9. **CHALLENGE** On a separate sheet of paper, write a problem that can be modeled by the equation $3a + 5 = 29$.

1-6**Study Guide and Intervention****Algebra: Properties**

Property	Arithmetic	Algebra
Distributive Property	$5(3 + 4) = 5(3) + 5(4)$	$a(b + c) = a(b) + a(c)$
Commutative Property of Addition	$5 + 3 = 3 + 5$	$a + b = b + a$
Commutative Property of Multiplication	$5 \times 3 = 3 \times 5$	$a \times b = b \times a$
Associative Property of Addition	$(2 + 3) + 4 = 2 + (3 + 4)$	$(a + b) + c = a + (b + c)$
Associative Property of Multiplication	$(4 \times 5) \times 6 = 4 \times (5 \times 6)$	$(a \times b) \times c = a \times (b \times c)$
Identity Property of Addition	$5 + 0 = 5$	$a + 0 = a$
Identity Property of Multiplication	$5 \times 1 = 5$	$a \times 1 = a$

EXAMPLE 1 Use the Distributive Property to write $6(4 + 3)$ as an equivalent expression. Then evaluate the expression.

$$\begin{aligned} 6(4 + 3) &= 6 \cdot 4 + 6 \cdot 3 && \text{Apply the Distributive Property.} \\ &= 24 + 18 && \text{Multiply.} \\ &= 42 && \text{Add.} \end{aligned}$$

EXAMPLE 2 Name the property shown by each statement.

$$\begin{aligned} 5 \times 4 &= 4 \times 5 && \text{Commutative Property of Multiplication} \\ 12 + 0 &= 12 && \text{Identity Property of Addition} \\ 7 + (6 + 3) &= (7 + 6) + 3 && \text{Associative Property of Addition} \end{aligned}$$

EXERCISES

Use the Distributive Property to write each expression as an equivalent expression. Then evaluate the expression.

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

Name the property shown by each statement.

4. $9 \times 1 = 9$ 5. $7 \times 3 = 3 \times 7$
6. $(7 + 8) + 2 = 7 + (8 + 2)$ 7. $6(3 + 2) = 6(3) + 6(2)$
8. $15 + 12 = 12 + 15$ 9. $1 \times 20 = 20$
10. $(9 \times 5) \times 2 = 9 \times (5 \times 2)$ 11. $3 = 0 + 3$

1-6**Practice: Skills****Algebra: Properties**

Use the Distributive Property to write each expression as an equivalent expression. Then evaluate the expression.

1. $3(5 + 1)$

2. $(2 + 7)5$

3. $(10 + 2)7$

4. $2(9 - 8)$

5. $4(10 - 2)$

6. $6(13 + 4)$

Name the property shown by each statement.

7. $2 \times (3 \times 7) = (2 \times 3) \times 7$

8. $6 + 3 = 3 + 6$

9. $3(9 - 7) = 3(9) - 3(7)$

10. $18 \times 1 = 18$

11. $7 \times 2 = 2 \times 7$

12. $6 + (1 + 4) = (6 + 1) + 4$

13. $7 + 0 = 7$

14. $0 + 12 = 12$

15. $625 + 281 = 281 + 625$

16. $(12 \times 18) \times 5 = 12 \times (18 \times 5)$

17. $2(8 + 2) = 2(8) + 2(2)$

18. $(15 + 11) + 9 = 15 + (11 + 9)$

19. $(6 + r) + s = 6 + (r + s)$

20. $(4 \times 8) \times a = 4 \times (8 \times a)$

21. $p \times 1 = p$

22. $a + 5 = 5 + a$


23. $y \times 3 = 3 \times y$

24. $b + 0 = b$

25. $(x + y) + z = x + (y + z)$

26. $6(200 + 50) = 6(200) + 6(50)$

1-6**Practice: Word Problems****Algebra: Properties**

<p>1. MUSIC Mr. Escalante and Mrs. Turner plan to take their music classes to a musical revue. Tickets cost \$6 each. Mr. Escalante's class needs 22 tickets, and Mrs. Turner's class needs 26 tickets. Use the Distributive Property to write a sentence to express how to find the total cost of tickets in two ways.</p>	<p>2. SAVINGS Mrs. Perez was looking at her bank account statement. She noticed that her beginning balance was \$500, and she had added nothing to her account. What was the ending balance on her statement? What property did you apply?</p>
<p>3. ADDITION Mr. Brooks was working on addition using dominos with a group of 1st graders. When picking the domino with 3 dots on one end and 5 dots on the other, some students read, "3 plus 5 equal 8" while others read it as "5 plus 3 equals 8." What property were these children using? Explain.</p>	<p>4. AREA Aleta noticed that for the rectangle below she could either multiply 2 times 3 or 3 times 2 to get its area of 6 square inches. What property allows her to do this?</p> <div style="text-align: center;"> <p>3 in.</p>  <p>2 in.</p> </div>
<p>5. NUMBER CUBES Students in Mr. Rivas' class were practicing their multiplication skills by rolling three 6-sided number cubes. Wapi rolled a 2, a 3, and a 5 on his roll. He multiplied the three numbers as follows using the order of operations: $(2 \times 3) \times 5 = 30$. Write another way Wapi could have performed the multiplication without changing the order of the numbers. State the property you used.</p>	<p>6. FACTS Bik was working on memorizing her multiplication facts. She noticed that anytime she multiplied a number by 1, she got the same number she started with. What property allows this to be true?</p>
<p>7. MONEY Mei was trying to figure out the cost of 4 boxes of cereal for \$2.25 each. Write a sentence to show Mei an easy way to do her calculations. What property did you apply to help her?</p>	<p>8. WALKING Jacob walked 3 blocks to Ping's house, then 5 blocks to Jamal's house. Write a sentence to show that the distance from Ping's to Jamal's is the same as the return walk home. Name the property illustrated in your sentence.</p>

1-6**Reading to Learn Mathematics****Algebra: Properties**

Pre-Activity *Read the introduction at the top of page 30 in your textbook. Write your answers below.*

1. Find the total cost for a 5-member family, without tax and tip, if each one orders a fish-bake dinner and cheesecake.
2. Describe the method used to find the total cost.
3. Is there more than one way to find the total cost?

Reading the Lesson

4. Describe what is meant by *equivalent expressions*.
5. The Identity Property says that adding _____ to a number results in the number and multiplying _____ by a number is the number.

Helping You Remember

6. Why are the Distributive Property, Commutative Property, Associative Property, and Identity Property called properties?

Use a dictionary to find the meanings of *distribute* and *commute* that apply to mathematics. Then write an explanation of why the Distributive Property and Commutative Property are named that way.

1-6**Enrichment****The Yoruba**

The Yoruba are an African people who live in southwestern Nigeria and parts of Benin and Togo. No one is sure exactly how long the Yoruba have inhabited this region, but by the year A.D. 1300 they had built many cities surrounded by farms. Through the ages, the Yoruba have made many contributions to the development of art, music, commerce, and mathematics.

At the right, you see the basic numbers of the **Yoruba numeration system**. All other numbers are formed by combining these basic numbers. For example, this is how the Yoruba form the number 36.

$$\begin{aligned} \text{ogun} \times \text{eeji} - \text{eerin} &= 20 \times 2 - 4 \\ &= 40 - 4 \\ &= 36 \end{aligned}$$

So, the Yoruba phrase for 36 is *eerin din logoji*, which means “four less than two twenties.”

Yoruba Names for Numbers

ookan	1
eeji	2
eeta	3
eerin	4
aarun	5
eefa	6
eeje	7
eejo	8
eesan	9
eewaa	10
ogun	20
ogbon	30
igba	200
irinwo	400

Each expression shows how the Yoruba form a certain number. What is the number?

- eeta + ogun
 - ookan + ogun
 - eeji + ogbon
- ogun - eeji
 - ogun - eerin
 - ogbon - aarun
- ogun \times eeji + ookan
 - ogun \times eeta - eeta
 - ogun \times aarun - eerin
- ogun \times eeta - eewaa - aarun
 - ogun \times eerin - eewaa + eeji
 - ogun \times aarun - eewaa - ookan

5. Refer to your answers to Exercise 4 above. How do you think the Yoruba form the number 50? 70? 90?

6. **CHALLENGE** How do you think the Yoruba form the number 2,000?

1-7**Study Guide and Intervention****Sequences**

An **arithmetic sequence** is a list in which each term is found by *adding* the same number to the previous term. 2, 5, 8, 11, 14, ...

$$\begin{array}{ccccccc} & \frown & & \frown & & \frown & & \frown \\ & 2 & , & 5 & , & 8 & , & 11 & , & 14 & , & \dots \\ & & & +3 & & +3 & & +3 & & +3 & & \end{array}$$

A **geometric sequence** is a list in which each term is found by *multiplying* the previous term by the same number. 2, 6, 18, 54, ...

$$\begin{array}{ccccccc} & \frown & & \frown & & \frown \\ & 2 & , & 6 & , & 18 & , & 54 & , & \dots \\ & & & \times 3 & & \times 3 & & \times 3 & & \end{array}$$

EXAMPLE 1 Describe the pattern in the sequence and identify the sequence as *arithmetic, geometric, or neither*. 4, 8, 12, 16, ...

$$\begin{array}{ccccccc} & \frown & & \frown & & \frown \\ & 4 & , & 8 & , & 12 & , & 16 & , & \dots \\ & & & +4 & & +4 & & +4 & & \end{array}$$

Each term is found by adding 4 to the previous term. This sequence is arithmetic.

EXAMPLE 2 Describe the pattern in the sequence and identify the sequence as *arithmetic, geometric, or neither*. 1, 5, 25, 125, ...

$$\begin{array}{ccccccc} & \frown & & \frown & & \frown \\ & 1 & , & 5 & , & 25 & , & 125 & , & \dots \\ & & & \times 5 & & \times 5 & & \times 5 & & \end{array}$$

Each term is found by multiplying the previous term by 5. This sequence is geometric.

EXAMPLE 3 Write the next three terms of the sequence 20, 40, 80, 160,

$$\begin{array}{ccccccc} & \frown & & \frown & & \frown \\ & 20 & , & 40 & , & 80 & , & 160 & , & \dots \\ & & & \times 2 & & \times 2 & & \times 2 & & \end{array}$$

Each term is two times the previous term.

Continue the pattern to find the next three terms.

$$160 \times 2 = 320 \quad 320 \times 2 = 640 \quad 640 \times 2 = 1,280$$

The next three terms are 320, 640, and 1,280.

EXERCISES

Describe the pattern in each sequence and identify the sequence as *arithmetic, geometric, or neither*.

1. 2, 4, 6, 8, ...

2. 6, 12, 24, 48, ...

3. 1, 2, 4, 8, ...

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

5. 1, 1, 2, 3, 5, ...

6. 4, 4, 4, 4, ...

Write the next three terms of each sequence.

7. 3, 6, 9, 12, ...

8. 2, 6, 18, 54, ...

9. 0.2, 0.4, 0.8, 1.6, ...

10. 10, 20, 30, 40, ...

11. 1, 4, 16, 64, ...

12. 4.5, 6.5, 8.5, 10.5, ...

1-7**Practice: Skills****Sequences**

Describe the pattern in each sequence and identify the sequence as *arithmetic*, *geometric*, or *neither*.

1. 3, 6, 12, 24, ...

2. 1, 3, 5, 7, ...

3. 1, 2, 6, 24, ...

4. 0, 7, 14, 21, ...

5. 2, 5, 8, 11, ...

6. 5, 15, 45, 135, ...

7. 0.3, 1.5, 7.5, 37.5, ...

8. 1, 10, 100, 1,000, ...

9. 7, 7, 7, 7, ...

10. 0.5, 2, 8, 32, ...

11. 3, 7, 11, 15, ...

12. 9, 18, 36, 72, ...

13. 11, 22, 44, 88, ...

14. 11, 22, 33, 44, ...

Write the next three terms of each sequence.

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

16. 2, 4, 8, 16, ...

17. 7, 10, 13, 16, ...

18. 3, 15, 75, 375, ...

19. 1, 3, 9, 27, ...

20. 7, 12, 17, 22, ...

21. 5, 7, 9, 11, ...

22. 5, 15, 25, 35, ...

23. 21, 42, 63, 84, ...

24. 6, 24, 96, 384, ...

25. 0.5, 1.0, 1.5, 2.0, ...

26. 1.7, 1.9, 2.1, 2.3, ...

27. 0.5, 1.5, 4.5, 13.5, ...

28. 2, 8, 32, 128, ...

1-7**Practice: Word Problems****Sequences**

<p>1. NUMBERS The multiples of two form a sequence as follows: 2, 4, 6, 8, 10, 12, 14, 16, What type of sequence do you see? What about the multiples of three? Four? Five?</p>	<p>2. OLYMPICS The summer Olympics occur every four years. If the last summer Olympics happened in 2000, when are the next three times that it will occur? What type of sequence do the Olympic years form?</p>
<p>3. BABY-SITTING Tonya charges \$3.50 per hour to baby-sit. The sequence \$3.50, \$7.00, \$10.50, \$14.00, ... represents how much she charges for each subsequent hour. For example, \$10.50 is the third term that represents how much she charges for 3 hours. What are the next three terms in the sequence? How much does she charge for 7 hours of baby-sitting?</p>	<p>4. RECTANGLES Suppose you start with 1 rectangle and then divide it in half. You now have 2 rectangles. You divide each of these in half, and you have 4 rectangles. The sequence for this division is 1, 2, 4, 8, 16, . . . rectangles after each successive division. What type of sequence results?</p>
<p>5. BACTERIA Three bacteria are in a dish. Each hour the number of bacteria multiplies by four. If at the end of the first hour there are 12 bacteria, how many bacteria are there at the end of the next three hours? What type of sequence results?</p>	<p>6. ENROLLMENT The enrollment at Grove Middle School is expected to increase by 40 students each year for the next 5 years. If their current enrollment is 600 students, find their enrollment after each of the next 5 years.</p>
<p>7. SALARY Mrs. Malone's current salary is \$1,500. She expects it to increase \$100 per year. Write the first 6 terms of a sequence that represents her salary. The first term should be her current salary. What does the sixth term represent?</p>	<p>8. FIBONACCI The Fibonacci sequence is named after Leonardo Fibonacci who first explored it. Look at the Fibonacci sequence below and describe its pattern. Is it arithmetic, geometric or neither? 1, 1, 2, 3, 5, 8, 13, 21, 34, ...</p>

1-7**Reading to Learn Mathematics****Sequences**

Pre-Activity Complete the Mini Lab at the top of page 34 in your textbook.
Write your answers below.

1. Draw a six-sided figure and all of its diagonals.
2. How many diagonals does the figure have?
3. Describe the pattern formed by the number of diagonals: 0, 2, 5, 9, ...
4. **Make a prediction** about how many diagonals a 7-sided, an 8-sided, and a 9-sided figure would have.

Reading the Lesson

Complete each sentence.

5. In an arithmetic sequence, each term is found by _____ the same number to the previous term.
6. In a geometric sequence, each term is found by _____ the previous term by the same number.

What is the next term in each of the following sequences?

7. 1, $\overset{\frown}{5}$, $\overset{\frown}{25}$, ...
 $\times 5 \times 5$

8. 7, $\overset{\frown}{10}$, $\overset{\frown}{13}$, ...
 $+ 3 + 3$

Helping You Remember

9. Write down the first four terms of two of your own sequences, an arithmetic sequence and a geometric sequence. Trade with a partner. Describe your partner's sequences. How did you identify the patterns?

1-7

Enrichment

Nested Magic Squares

A magic square is a square arrangement of numbers in which the sum of the numbers in every row, column, and diagonal is the same number. The numbers 1 through 49 can be arranged to make three nested magic squares. First, the large 7-by-7 outer square is magic. Remove its border and you get a 5-by-5 magic square. Finally, remove the border again to get a 3-by-3 magic square.

In the figure below insert the rest of the numbers 1 through 49 to make three nested magic squares.

46	1	2	3	42	41	40
		24	29	22		

1-8**Study Guide and Intervention****Measurement: The Metric System**

The table below is a summary of how to convert measures in the metric system.

	Larger Units → Smaller Units	Smaller Units → Larger Units
Units of Length (meter)	km to m – multiply by 1,000 m to cm – multiply by 100 m to mm – multiply by 1,000 cm to mm – multiply by 10	mm to cm – divide by 10 mm to m – divide by 1,000 cm to m – divide by 100 m to km – divide by 1,000
Units of Mass (kilogram)	kg to g – multiply by 1,000 g to mg – multiply by 1,000	mg to g – divide by 1,000 g to kg – divide by 1,000
Units of Capacity (liter)	kL to L – multiply by 1,000 L to mL – multiply by 1,000	mL to L – divide by 1,000 L to kL – divide by 1,000

EXAMPLE 1 Complete. $62 \text{ cm} = \underline{\hspace{1cm}} \text{ m}$

To convert from centimeters to meters, divide by 100.

$$62 \div 100 = 0.62$$

$$62 \text{ cm} = 0.62 \text{ m}$$

EXAMPLE 2 Complete. $2.6 \text{ kL} = \underline{\hspace{1cm}} \text{ L}$

To convert from kiloliters to liters, multiply by 1,000.

$$2.6 \times 1,000 = 2,600$$

$$2.6 \text{ kL} = 2,600 \text{ L}$$

EXERCISES

Complete.

1. $650 \text{ cm} = \underline{\hspace{1cm}} \text{ m}$

2. $57 \text{ kg} = \underline{\hspace{1cm}} \text{ g}$

3. $751 \text{ mg} = \underline{\hspace{1cm}} \text{ g}$

4. $8.2 \text{ L} = \underline{\hspace{1cm}} \text{ mL}$

5. $52 \text{ L} = \underline{\hspace{1cm}} \text{ kL}$

6. $892 \text{ mm} = \underline{\hspace{1cm}} \text{ m}$

7. $121.4 \text{ kL} = \underline{\hspace{1cm}} \text{ L}$

8. $0.72 \text{ cm} = \underline{\hspace{1cm}} \text{ mm}$

9. $67.3 \text{ g} = \underline{\hspace{1cm}} \text{ kg}$

10. $5.2 \text{ g} = \underline{\hspace{1cm}} \text{ mg}$

11. $0.05 \text{ m} = \underline{\hspace{1cm}} \text{ mm}$

12. $2,500 \text{ mg} = \underline{\hspace{1cm}} \text{ g}$

13. $32 \text{ mm} = \underline{\hspace{1cm}} \text{ cm}$

14. $96 \text{ m} = \underline{\hspace{1cm}} \text{ cm}$

1-8**Practice: Skills****Measurement: The Metric System****Complete.**

1. $660 \text{ m} = \underline{\hspace{1cm}} \text{ km}$

2. $5.7 \text{ m} = \underline{\hspace{1cm}} \text{ cm}$

3. $543 \text{ mL} = \underline{\hspace{1cm}} \text{ L}$

4. $23.7 \text{ g} = \underline{\hspace{1cm}} \text{ mg}$

5. $529 \text{ mg} = \underline{\hspace{1cm}} \text{ g}$

6. $2,640 \text{ mL} = \underline{\hspace{1cm}} \text{ L}$

7. $4.32 \text{ kL} = \underline{\hspace{1cm}} \text{ L}$

8. $75.4 \text{ mg} = \underline{\hspace{1cm}} \text{ g}$

9. $8,300 \text{ mg} = \underline{\hspace{1cm}} \text{ g}$

10. $7.3 \text{ m} = \underline{\hspace{1cm}} \text{ cm}$

11. $250.3 \text{ kL} = \underline{\hspace{1cm}} \text{ L}$

12. $799 \text{ g} = \underline{\hspace{1cm}} \text{ kg}$

13. $8.5 \text{ cm} = \underline{\hspace{1cm}} \text{ mm}$

14. $450 \text{ kg} = \underline{\hspace{1cm}} \text{ g}$

15. $7.3 \text{ L} = \underline{\hspace{1cm}} \text{ mL}$

16. $6,140 \text{ L} = \underline{\hspace{1cm}} \text{ kL}$

17. $3,500 \text{ m} = \underline{\hspace{1cm}} \text{ km}$

18. $89 \text{ km} = \underline{\hspace{1cm}} \text{ m}$

19. $26.8 \text{ mm} = \underline{\hspace{1cm}} \text{ cm}$

20. $750 \text{ m} = \underline{\hspace{1cm}} \text{ km}$

21. $4.8 \text{ m} = \underline{\hspace{1cm}} \text{ cm}$

22. $95 \text{ g} = \underline{\hspace{1cm}} \text{ mg}$

23. $389 \text{ mm} = \underline{\hspace{1cm}} \text{ m}$

24. $56 \text{ L} = \underline{\hspace{1cm}} \text{ kL}$

25. $0.32 \text{ mm} = \underline{\hspace{1cm}} \text{ cm}$

26. $39.1 \text{ g} = \underline{\hspace{1cm}} \text{ kg}$

1-8**Practice: Word Problems*****Measurement: The Metric System***

<p>1. RUNNING Each morning Carlos runs 1.5 kilometers. How many meters did he run?</p>	<p>2. AVIATION A helicopter was flying 800 meters above the ground. How many kilometers above the ground was it flying?</p>
<p>3. SODA A soda can contains 355 milliliters of liquid. How many liters of liquid does it contain?</p>	<p>4. CONSTRUCTION The ceilings of most classrooms are about 2.5 meters above the floor. How many centimeters high is the ceiling?</p>
<p>5. FENCING Gerri's garden is 1,270 centimeters around the edges. How many meters of fencing material does she need to enclose her garden?</p>	<p>6. GARDENING Mr. Chou's lawn sprinkler sprays about 150 liters of water each hour. How many kiloliters of water does it spray?</p>
<p>7. NUTRITION For 11- to 14-year-olds, the Recommended Dietary Allowance (RDA) for protein is about 60 grams daily. How many milligrams do they need daily?</p>	<p>8. MEASUREMENT A measure of one pound is equivalent to about 454 grams. How many kilograms are in one pound? How many milligrams?</p>

1-8**Reading to Learn Mathematics*****Measurement: The Metric System***

Pre-Activity *Complete the Mini Lab at the top of page 38 in your textbook. Write your answers below.*

1. Find three other objects. Use a ruler to find and record the width of all five objects to the nearest millimeter and tenth of a centimeter. Add your measurements to the table.
2. Compare the measurements of each object, and write a rule that describes how to convert from millimeters to centimeters.
3. Use a meterstick to measure the length of your classroom in meters. **Make a conjecture** about which operation you would use to convert this measure to centimeters. Explain.

Reading the Lesson

Complete each sentence.

4. To convert from centimeters to kilometers, first divide by _____ to convert to meters, then divide by _____ to convert to kilometers.
5. To convert from kiloliters to milliliters, first multiply by _____ to convert to liters, then multiply by _____ to convert to milliliters.
6. To convert from _____ to centigrams, multiply by 100.

Helping You Remember

7. Name an everyday object that you can associate with each base metric unit of measure to help you remember what each unit represents.

kilogram:

meter:

liter:

1-8**Enrichment****Using a Measurement Conversion Chart**

You may sometimes want to convert customary measurements to metric measurements. For example, suppose you are reading about horses and want to know how long 5 furlongs are.

Start by finding a conversion table such as the one shown here. (Dictionaries often include such tables.)

1 mil	= 0.001 inch	= 0.0254 millimeter
1 inch	= 1,000 mil	= 2.54 centimeters
12 inches	= 1 foot	= 0.3048 meter
3 feet	= 1 yard	= 0.9144 meter
$5\frac{1}{2}$ yards, or $16\frac{1}{2}$ feet	= 1 rod	= 5.029 meters
40 rods	= 1 furlong	= 201.168 meters
8 furlongs 5,280 feet 1,760 yards	} = 1 (statute) mile	= 1.6093 kilometers
3 miles		

To change from a large unit to a small unit, multiply. To change from a small unit to a large one, divide.

EXAMPLE 1 Change 5 furlongs to meters.

$$5 \times 201.168 = 1,005.84$$

So, 5 furlongs is about 1,000 meters, or 1 kilometer.

Change each measurement to a metric measurement. Round each answer to the nearest tenth.

1. 10 yards

2. 100 leagues

3. 10 inches

4. 100 rods

5. 1,000 mils

6. 10 feet

7. 50 miles

8. 50 furlongs

9. 50 inches

10. 200 feet

11. 200 miles

12. 200 yards

1-9**Study Guide and Intervention****Scientific Notation**

A number is in scientific notation when it is written as the product of a number and a power of ten. The number must be greater than or equal to 1 and less than 10.

- To write a number in standard form, you apply the order of operations. First evaluate the power of ten and then multiply.
- To write a number in scientific notation, move the decimal point to the right of the first nonzero number. Then, find the power of ten by counting the number of places moved.

EXAMPLE 1 Write 6.1×10^3 in standard form.

$$\begin{aligned} 6.1 \times 10^3 &= 6.1 \times 1,000 & 10^3 &= 1,000 \\ &= \underset{\curvearrowright}{6} \underset{\curvearrowright}{.1} \underset{\curvearrowright}{0} \underset{\curvearrowright}{0} & & \text{Move the decimal point 3 places to the right.} \\ &= 6,100 \end{aligned}$$

EXAMPLE 2 Write 62,500 in scientific notation.

$$\begin{aligned} 62,500 &= 6.250 \times 10,000 & & \text{Move the decimal point 4 places to get a number between 1 and 10.} \\ &= 6.25 \times 10^4 \end{aligned}$$

EXERCISES

Write each number in standard form.

1. 7.25×10^2

2. 2.5×10^3

3. 9.95×10^5

4. 8.80×10^4

5. 3.18×10^6

6. 6.12×10^3

Write each number in scientific notation.

7. 325

8. 9,210

9. 200

10. 5,120

11. 561

12. 1,230

13. 21,300

14. 53,000

15. 8,930

1-9**Practice: Skills****Scientific Notation**

Write each number in standard form.

1. 3.1×10^2

2. 2.3×10^3

3. 9.86×10^2

4. 3.25×10^4

5. 6.10×10^5

6. 7.87×10^4

7. 2.2×10^2

8. 4.27×10^3

9. 1.06×10^7

10. 2.11×10^5

11. 4.82×10^4

12. 5.55×10^{10}

Write each number in scientific notation.

13. 230

14. 300

15. 720

16. 2,790

17. 5,000

18. 8,800

19. 37,000

20. 26,300

21. 52,100

22. 120,000

23. 361,000

24. 989,000

25. 5,000,000

26. 82,100,000

27. 51,000,000

Replace each \bullet with $<$, $>$, or $=$ to make a true sentence.

28. $3,000 \bullet 3.0 \times 10^3$

29. $520 \bullet 5.2 \times 10^1$

30. $8,800 \bullet 8.8 \times 10^4$

31. $659,000 \bullet 6.59 \times 10^5$

1-9**Practice: Word Problems****Scientific Notation**

<p>1. ICEBERG The biggest iceberg ever seen that had split off the Ross Ice Shelf in Antarctica happened during the spring of 2000. It was estimated to weigh about 4,000,000,000,000 tons. Write its weight in scientific notation.</p>	<p>2. PLANETS The average distance between Earth and the Sun is 92,960,000 miles. Write this distance in scientific notation.</p>
<p>3. POPULATION The population of Texas was about 20,900,000 in the 2000 U.S. census. Write this number in scientific notation.</p>	<p>4. BASEBALL Willie Mays hit 6.6×10^2 career home runs. Write 6.6×10^2 in standard form.</p>
<p>5. EARTH The mass of Earth is about 6,580,000,000,000,000,000 tons. Write this value in scientific notation.</p>	<p>6. LIGHT The speed of light is about 2.998×10^8 meters per second or about 1.86×10^5 miles per second. Write these values in standard form.</p>
<p>7. WEALTH In 1999, the wealthiest man in the world's assets were estimated at about \$90,000,000,000. Write this value in scientific notation.</p>	<p>8. POPULATION In 2001, the population of the world was about 6,160,000,000. The projected population of the world for the year 2025 is about 7,840,000,000. Write these values in scientific notation.</p>

1-9**Reading to Learn Mathematics****Scientific Notation**

Pre-Activity *Read the introduction at the top of page 43 in your textbook.
Write your answers below.*

1. Complete the table.

	Standard Form	Abbreviated Form
Number of Parking Spaces		13 thousand
Area of Mall (square feet)	4,200,000	

2. Write both numbers as the product of a number and a power of ten.
3. Rewrite both powers of ten using exponents.

Reading the Lesson

Complete each sentence.

4. In scientific notation, the number that is multiplied by a power of 10 must be greater than or equal to 1 and less than _____.
5. To write a number in scientific notation, move the decimal to the _____ of the first nonzero number. Then find the power of _____.

Helping You Remember

6. Explain the difference between standard form and scientific notation. Make a table that shows three examples of each.

1-9**Enrichment****The Speed of Light**

Light travels at approximately 186,000 miles per second. You can use the formula below to find how long it takes light to travel from one place to another.

$$\frac{\text{distance}}{\text{speed of light}} = \text{time}$$

For example, the sun is about 9.3×10^7 miles from Earth. If a gigantic explosion were to occur on the sun, how long would it take to see it from Earth?

$$\frac{93,000,000}{186,000} = 500 \leftarrow \text{Write } 9.3 \times 10^7 \text{ as } 93,000,000.$$

It would take about 500 seconds to see the explosion.

Now you need to change seconds to minutes, since minutes is a more sensible unit for time in this case. To change seconds to minutes, divide.

$$\frac{500}{60} \rightarrow \begin{array}{r} 8 \\ 60 \overline{)500} \\ \underline{480} \\ 20 \end{array}$$

It would take about 8 minutes to see the explosion from Earth.

Compute each amount of time it takes for light to travel to Earth from each place. Then change seconds to a sensible unit.

	Location	Closest Distance to Earth	Time (in seconds)	Time (in a sensible unit)
1.	moon	2.2×10^5 mi		
2.	Halley's Comet	3.11×10^6 mi		
3.	Mars	3.46×10^7 mi		
4.	Venus	2.57×10^7 mi		
5.	Jupiter	3.67×10^8 mi		
6.	Pluto	2.67×10^9 mi		
7.	nearest star	2.48×10^{13} mi		