

3-3

Solving Multiplication Equations

MAIN IDEA

Solve multiplication equations.

New Vocabulary

formula

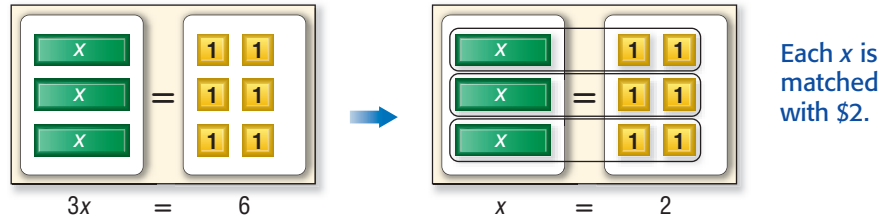
Math Online

glencoe.com

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

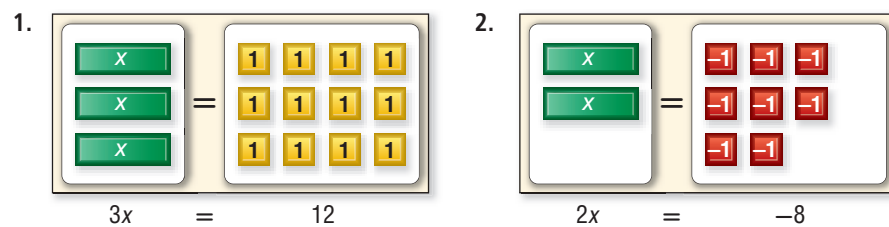
MINI Lab

MONEY Suppose three friends order an appetizer of nachos that costs \$6. They agree to split the cost equally. The figure below illustrates the multiplication equation $3x = 6$, where x represents the amount each friend pays.



Each friend pays \$2. The solution of $3x = 6$ is 2.

Solve each equation using models or a drawing.



- $4x = 20$
- $8 = 2x$
- $3x = -9$
- What operation did you use to find each solution?
- How can you use the coefficient of x to solve $8x = 40$?

Equations like $3x = 6$ are called multiplication equations because the expression $3x$ means 3 times the value of x . So, you can use the Division Property of Equality to solve multiplication equations.

Division Property of Equality

Key Concept

Words If you divide each side of an equation by the same nonzero number, the two sides remain equal.

Symbols If $a = b$ and $c \neq 0$, then $\frac{a}{c} = \frac{b}{c}$.

Examples

Numbers

$$\begin{aligned} 8 &= 8 \\ \frac{8}{2} &= \frac{8}{2} \\ 4 &= 4 \end{aligned}$$

Algebra

$$\begin{aligned} 2x &= -6 \\ \frac{2x}{2} &= \frac{-6}{2} \\ x &= -3 \end{aligned}$$

Review Vocabulary

coefficient the numerical factor for a multiplication expression; Example: the coefficient of x in the expression $4x$ is 4. (Lesson 1-4)

EXAMPLES Solve Multiplication Equations

1 Solve $20 = 4x$. Check your solution.

$$20 = 4x$$

Write the equation.

$$\frac{20}{4} = \frac{4x}{4}$$

Divide each side of the equation by 4.

$$5 = x$$

$$20 \div 4 = 5$$

The solution is 5.

Check the solution.

2 Solve $-8y = 24$. Check your solution.

$$-8y = 24$$

Write the equation.

$$\frac{-8y}{-8} = \frac{24}{-8}$$

Divide each side by -8 .

$$y = -3$$

$$24 \div (-8) = -3$$

The solution is -3 .

Check the solution.

CHECK Your Progress

Solve each equation. Check your solution.

a. $30 = 6x$

b. $-6a = 36$

c. $-9d = -72$

Many real-world situations increase at a constant rate. These can be represented by multiplication equations.

Real-World EXAMPLE

3 **TEXT MESSAGING** It costs \$0.10 to send a text message. You can spend a total of \$5.00. How many text messages can you send?

Words	Total	is equal to	cost of each message	times	number of messages.
Variable	Let m	represent	the number of messages	you can send.	
Equation	5.00	=	0.10	•	m

$$5.00 = 0.10m$$

Write the equation.

$$\frac{5.00}{0.10} = \frac{0.10m}{0.10}$$

Divide each side by 0.10.

$$50 = m$$

$$5.00 \div 0.10 = 50$$

At \$0.10 per message, you can send 50 text messages for \$5.00.

CHECK Your Progress

d. **TRAVEL** Mrs. Acosta's car can travel an average of 24 miles on each gallon of gasoline. Write and solve an equation to find how many gallons of gasoline she will need for a trip of 348 miles.



Real-World Link

Over 60% of teenagers' text messages are sent from their homes—even when a landline is available.

Source: Xerox

A **formula** is an equation that shows the relationship among certain quantities. One of the most common formulas is the equation $d = rt$, which gives the relationship among distance d , rate r , and time t .

Real-World EXAMPLE

Reading Math

Speed Another name for *rate* is *speed*.

- 4 ANIMALS** The tortoise is one of the slowest land animals, reaching an average top speed of about 0.25 mile per hour. At this speed, how long will it take a tortoise to travel 1.5 miles?

You are asked to find the time t it will take to travel a distance d of 1.5 miles at a rate r of 0.25 mile per hour.

METHOD 1 Substitute, then solve.

$d = rt$	Write the equation.
$1.5 = 0.25t$	Replace d with 1.5 and r with 0.25.
$\frac{1.5}{0.25} = \frac{0.25t}{0.25}$	Divide each side by 0.25.
$6 = t$	$1.5 \div 0.25 = 6$

METHOD 2 Solve, then substitute.

$d = rt$	Write the equation.
$\frac{d}{r} = \frac{rt}{r}$	Divide each side by r to solve the equation for t .
$\frac{d}{r} = t$	Simplify.
$\frac{1.5}{0.25} = t$	Replace d with 1.5 and r with 0.25.
$6 = t$	$1.5 \div 0.25 = 6$

It would take a tortoise 6 hours to travel 1.5 miles.

CHOOSE Your Method

- e. **SCIENCE** A sound wave travels a distance of 700 meters in 2.5 seconds. Find the average speed of the sound wave.

CHECK Your Understanding

Examples 1, 2 Solve each equation. Check your solution.

(p. 143)

- | | |
|---------------|----------------|
| 1. $6c = 18$ | 2. $15 = 3z$ |
| 3. $-8x = 24$ | 4. $-9r = -36$ |

Example 3
(p. 143)

5. **WORKING** Antonia earns \$6 per hour helping her grandmother. How many hours does she need to work to earn \$48?

Example 4
(p. 144)

6. **SWIMMING** A shark can swim at an average speed of about 25 miles per hour. At this rate, how long will it take a shark to swim 60 miles?

Practice and Problem Solving

HOMEWORK HELP

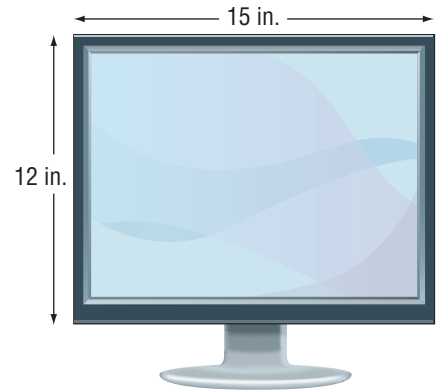
For Exercises	See Examples
7–12	1
13–18	2
19–20	3
21–22	4

Solve each equation. Check your solution.

- | | | |
|-----------------|-----------------|-----------------|
| 7. $7a = 49$ | 8. $9e = 27$ | 9. $2x = -6$ |
| 10. $3y = -21$ | 11. $35 = 5v$ | 12. $72 = 12r$ |
| 13. $-4j = 36$ | 14. $-12y = 60$ | 15. $-4s = -16$ |
| 16. $-6z = -36$ | 17. $48 = -6r$ | 18. $-28 = -7f$ |

For Exercises 19–22, write an equation. Then solve the equation.

19. **MONEY** Brandy wants to buy a digital camera that costs \$300. If she saves \$15 each week, in how many weeks will she have enough money for the camera?
20. **COMPUTERS** The width of a computer monitor is 1.25 times as long as its height. Find the height of the computer monitor at the right.
21. **SPEED** A racecar can travel at a rate of 205 miles per hour. At this rate, how long would it take to travel 615 miles?
22. **INSECTS** A dragonfly, the fastest insect, can fly a distance of 50 feet in about 2 seconds. Find a dragonfly's average speed in feet per second.



Solve each equation. Check your solution.

- | | | |
|-------------------|--------------------|-------------------|
| 23. $0.4x = 9.2$ | 24. $0.9y = 13.5$ | 25. $5.4 = 0.3p$ |
| 26. $9.72 = 1.8a$ | 27. $3.9y = 18.33$ | 28. $2.6b = 2.08$ |

ANALYZE TABLES For Exercises 29 and 30, use the following information.

The table shows women's championship record holders for several track events.

29. Without calculating explain whether Evelyn Ashford or Sanya Richards has the faster average speed.
30. Find the average speed of each athlete in meters per second. Round to the nearest hundredth.

Name	Race (m)	Time (s)
Marion Jones	100	10.72
Evelyn Ashford	200	21.88
Sanya Richards	400	49.27

Source: USA Outdoor Track & Field

31. **HURRICANES** A category 3 hurricane reaches speeds up to 20.88 kilometers per hour. The distance from Cuba to Key West is 145 kilometers. Write and solve a multiplication equation to find how long it would take a category 3 hurricane to travel from Cuba to Key West.
32. **WATER** A case of water bottles costs \$9.48. If there are 12 water bottles in the case, find the cost per bottle. Then find the decrease in cost per bottle if the cost of a case is reduced to \$8.64.

EXTRA PRACTICE

See pages 674, 706.

H.O.T. Problems

33. **FIND THE ERROR** Steve and Becky are solving $-6x = 72$. Who is correct? Explain.



Steve

$$\begin{aligned} -6x &= 72 \\ \frac{-6x}{-6} &= \frac{72}{-6} \\ x &= -12 \end{aligned}$$

$$\begin{aligned} -6x &= 72 \\ \frac{-6x}{6} &= \frac{72}{6} \\ x &= 12 \end{aligned}$$



Becky

34. **CHALLENGE** Solve $3|x| = 12$. Explain your reasoning.

WRITING IN MATH Write a real-world problem that could be represented by each equation.

35. $2x = 16$

36. $3x = 75$

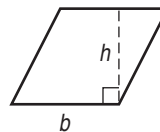
37. $4x = -8$

**TEST PRACTICE**

38. A football player can run 20 yards in 3.4 seconds. Which equation could be used to find y , the number of yards the football player can run in a second?

- A $20y = 3.4$
 B $3.4 - y = 20$
 C $3.4y = 20$
 D $20 + y = 3.4$

39. **SHORT RESPONSE** Use the formula $A = bh$ to find the base in inches of a rhombus with a height of 7 inches and an area of 56 square inches.

**Spiral Review**

ALGEBRA Solve each equation. Check your solution. (Lesson 3-2)

40. $y + 8 = -2$

41. $x - 7 = -2$

42. $20 = z + 23$

43. **ALGEBRA** Write an algebraic expression for the phrase *the product of -3 and y* . (Lesson 3-1)

44. **MONTHS** A lunar month, the time from one new moon to the next, is 29.5 days. How many days longer is our calendar year of 365 days than 12 lunar months? (Lesson 1-1)

GET READY for the Next Lesson

PREREQUISITE SKILL Draw the next two figures in the pattern. (Lesson 2-7)

45.

