

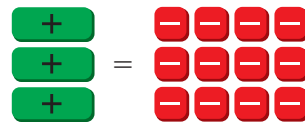
**Essential Question** How can you use multiplication or division to solve equations?

### 1 ACTIVITY: Using Division to Solve Equations

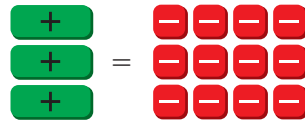
Work with a partner. Use algebra tiles to model and solve the equation.

a.  $3x = -12$

Model the equation  $3x = -12$ .



Your goal is to get one variable tile by itself. Because there are    variable tiles, divide the    tiles into    equal groups. Circle the groups.



Keep one of the groups. This shows the value of  $x$ .



∴ So,  $x =$    .

b.  $2k = -8$

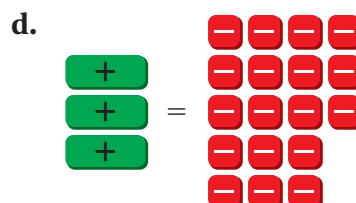
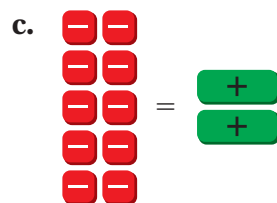
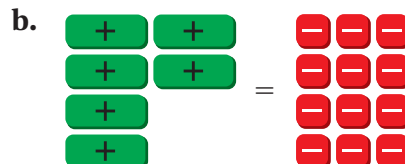
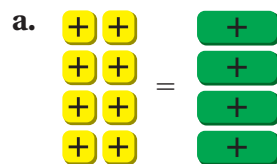
c.  $-15 = 3t$

d.  $-20 = 5m$

e.  $4h = -16$

### 2 ACTIVITY: Writing and Solving Equations

Work with a partner. Write an equation shown by the algebra tiles. Then solve.



COMMON  
CORE

Solving Equations

In this lesson, you will

- solve equations using multiplication or division.
- solve real-life problems.

Learning Standard  
7.EE.4a

### 3 ACTIVITY: Using a Different Method to Find a Solution

#### Math Practice 1

##### Analyze Givens

How can you use the given information to decide which equation represents the situation?

Work with a partner. Choose the equation you can use to solve each problem. Solve the equation. Then explain how to solve the problem without using an equation. How are the two methods related?

- a. For the final part of a race, a handcyclist travels 32 feet each second across a distance of 400 feet. How many seconds does it take for the handcyclist to travel the last 400 feet of the race?

$$32x = 400$$

$$400x = 32$$

$$\frac{x}{32} = 400$$

$$\frac{x}{400} = 32$$



- b. The melting point of the element radon is about  $-96^{\circ}\text{F}$ . The melting point of nitrogen is about 3.6 times the melting point of radon. What is the melting point of nitrogen?

$$3.6x = -96$$

$$x + 96 = 3.6$$

$$\frac{x}{3.6} = -96$$

$$-96x = 3.6$$

- c. This year, a hardware store has a profit of  $-\$6.0$  million. This profit is  $\frac{3}{4}$  of last year's profit. What is last year's profit?

$$\frac{x}{-6} = \frac{3}{4}$$

$$-6x = \frac{3}{4}$$

$$\frac{3}{4} + x = -6$$

$$\frac{3}{4}x = -6$$



### What Is Your Answer?

4. **IN YOUR OWN WORDS** How can you use multiplication or division to solve equations? Give an example of each.

#### Practice

Use what you learned about solving equations to complete Exercises 7–10 on page 106.

**Key Ideas**
**Multiplication Property of Equality**

**Words** Multiplying each side of an equation by the same number produces an equivalent equation.

**Algebra** If  $a = b$ , then  $a \cdot c = b \cdot c$ .

**Division Property of Equality**

**Words** Dividing each side of an equation by the same number produces an equivalent equation.

**Algebra** If  $a = b$ , then  $a \div c = b \div c$ ,  $c \neq 0$ .

**Remember**

Multiplication and division are inverse operations.

**EXAMPLE 1 Solving Equations**

a. Solve  $\frac{x}{3} = -6$ .

$$\frac{x}{3} = -6$$

Write the equation.

Undo the division.

$$3 \cdot \frac{x}{3} = 3 \cdot (-6)$$

Multiplication Property of Equality

$$x = -18$$

Simplify.

∴ The solution is  $x = -18$ .

**Check**

$$\frac{x}{3} = -6$$

$$\frac{-18}{3} = -6$$

$$-6 = -6 \quad \checkmark$$

b. Solve  $18 = -4y$ .

$$18 = -4y$$

Write the equation.

Undo the multiplication.

$$\frac{18}{-4} = \frac{-4y}{-4}$$

Division Property of Equality

$$-4.5 = y$$

Simplify.

∴ The solution is  $y = -4.5$ .

**Check**

$$18 = -4y$$

$$18 \stackrel{?}{=} -4(-4.5)$$

$$18 = 18 \quad \checkmark$$

**On Your Own**

Solve the equation. Check your solution.

1.  $\frac{x}{5} = -2$

2.  $-a = -24$

3.  $3 = -1.5n$

**Now You're Ready**  
Exercises 7–18

## EXAMPLE 2 Solving an Equation Using a Reciprocal

Solve  $-\frac{4}{5}x = -8$ .

$$-\frac{4}{5}x = -8$$

Write the equation.

Multiply each side by  $-\frac{5}{4}$ ,  
the reciprocal of  $-\frac{4}{5}$ .

$$\rightarrow -\frac{5}{4} \cdot \left(-\frac{4}{5}x\right) = -\frac{5}{4} \cdot (-8)$$

Multiplicative Inverse Property

$$x = 10$$

Simplify.

∴ The solution is  $x = 10$ .

### On Your Own

Now You're Ready  
Exercises 19–22

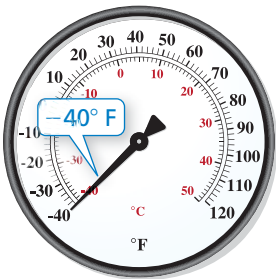
Solve the equation. Check your solution.

4.  $-14 = \frac{2}{3}x$

5.  $-\frac{8}{5}b = 5$

6.  $\frac{3}{8}h = -9$

## EXAMPLE 3 Real-Life Application



Record low temperature  
in Arizona

The record low temperature in Arizona is 1.6 times the record low temperature in Rhode Island. What is the record low temperature in Rhode Island?

**Words** The record low in Arizona is 1.6 times the record low in Rhode Island.

**Variable** Let  $t$  be the record low in Rhode Island.

**Equation**  $-40 = 1.6 \times t$

$$-40 = 1.6t \quad \text{Write equation.}$$

$$-\frac{40}{1.6} = \frac{1.6t}{1.6} \quad \text{Division Property of Equality}$$

$$-25 = t \quad \text{Simplify.}$$

∴ The record low temperature in Rhode Island is  $-25^\circ\text{F}$ .

### On Your Own

Now You're Ready  
Exercises 24–27

7. The record low temperature in Hawaii is  $-0.15$  times the record low temperature in Alaska. The record low temperature in Hawaii is  $12^\circ\text{F}$ . What is the record low temperature in Alaska?

## Vocabulary and Concept Check

- WRITING** Explain why you can use multiplication to solve equations involving division.
- OPEN-ENDED** Turning a light on and then turning the light off are considered to be inverse operations. Describe two other real-life situations that can be thought of as inverse operations.

Describe the inverse operation that will undo the given operation.

- multiplying by 5
- subtracting 12
- dividing by  $-8$
- adding  $-6$

## Practice and Problem Solving

Solve the equation. Check your solution.

7.  $3h = 15$
8.  $-5t = -45$
9.  $\frac{n}{2} = -7$
10.  $\frac{k}{-3} = 9$
11.  $5m = -10$
12.  $8t = -32$
13.  $-0.2x = 1.6$
14.  $-10 = -\frac{b}{4}$
15.  $-6p = 48$
16.  $-72 = 8d$
17.  $\frac{n}{1.6} = 5$
18.  $-14.4 = -0.6p$
19.  $\frac{3}{4}g = -12$
20.  $8 = -\frac{2}{5}c$
21.  $-\frac{4}{9}f = -3$
22.  $26 = -\frac{8}{5}y$

- ERROR ANALYSIS** Describe and correct the error in finding the solution.

**X**

$$\begin{aligned} -4.2x &= 21 \\ \frac{-4.2x}{4.2} &= \frac{21}{4.2} \\ x &= 5 \end{aligned}$$

Write the word sentence as an equation. Then solve.

24. A number divided by  $-9$  is  $-16$ .
25. A number multiplied by  $\frac{2}{5}$  is  $\frac{3}{20}$ .
26. The product of 15 and a number is  $-75$ .
27. The quotient of a number and  $-1.5$  is 21.

In Exercises 28 and 29, write an equation. Then solve.

- NEWSPAPERS** You make  $\$0.75$  for every newspaper you sell. How many newspapers do you have to sell to buy the soccer cleats?
- ROCK CLIMBING** A rock climber averages  $12\frac{3}{5}$  feet per minute. How many feet does the rock climber climb in 30 minutes?



- OPEN-ENDED** (a) Write a multiplication equation that has the given solution.  
 (b) Write a division equation that has the same solution.

30.  $-3$

31.  $-2.2$

32.  $-\frac{1}{2}$

33.  $-1\frac{1}{4}$

34. **REASONING** Which of the methods can you use to solve  $-\frac{2}{3}c = 16$ ?

Multiply each side by  $-\frac{2}{3}$ .

Multiply each side by  $-\frac{3}{2}$ .

Divide each side by  $-\frac{2}{3}$ .

Multiply each side by 3, then divide each side by  $-2$ .

35. **STOCK** A stock has a return of  $-\$1.26$  per day. Write and solve an equation to find the number of days until the total return is  $-\$10.08$ .

36. **ELECTION** In a school election,  $\frac{3}{4}$  of the students vote. There are 1464 ballots. Write and solve an equation to find the number of students.

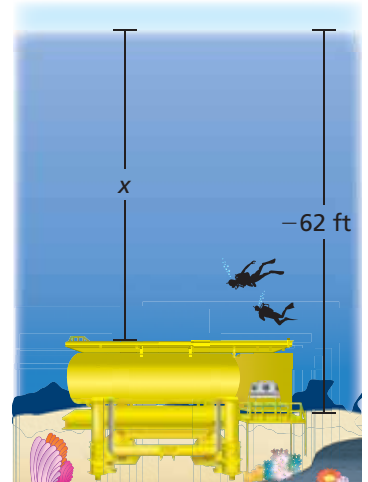
37. **OCEANOGRAPHY** Aquarius is an underwater ocean laboratory located in the Florida Keys National Marine Sanctuary. Solve the equation  $\frac{31}{25}x = -62$  to find the value of  $x$ .

38. **SHOPPING** The price of a bike at Store A is  $\frac{5}{6}$  the price at Store B. The price at Store A is  $\$150.60$ . Write and solve an equation to find how much you save by buying the bike at Store A.

39. **CRITICAL THINKING** Solve  $-2|m| = -10$ .

40. **Number Sense** In four days, your family drives  $\frac{5}{7}$  of a trip.

Your rate of travel is the same throughout the trip. The total trip is 1250 miles. In how many more days will you reach your destination?



## Fair Game Review What you learned in previous grades & lessons

**Subtract.** (Section 1.3)

41.  $5 - 12$

42.  $-7 - 2$

43.  $4 - (-8)$

44.  $-14 - (-5)$

45. **MULTIPLE CHOICE** Of the 120 apartments in a building, 75 have been scheduled to receive new carpet. What fraction of the apartments have not been scheduled to receive new carpet? (Skills Review Handbook)

(A)  $\frac{1}{4}$

(B)  $\frac{3}{8}$

(C)  $\frac{5}{8}$

(D)  $\frac{3}{4}$