🔑 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 $a \div c = b \div c, c \neq 0$.

EXAMPLE 1 Solving Equations

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

$$\dfrac{x}{3} = -6 \qquad \text{Write the equation.}$$

$$3 \cdot \dfrac{x}{3} = 3 \cdot (-6) \qquad \text{Multiply each side by 3.}$$

$$x = -18 \qquad \text{Simplify.}$$

So, the solution is $x = -18$.

b. **Solve $18 = -4y$.**

$$18 = -4y \qquad \text{Write the equation.}$$

$$\dfrac{18}{-4} = \dfrac{-4y}{-4} \qquad \text{Divide each side by } -4.$$

$$-4.5 = y \qquad \text{Simplify.}$$

So, the solution is $y = -4.5$.

Check

$18 = -4y$

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

$18 = 18$ ✔

🔴 On Your Own

Solve the equation. Check your solution.

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

2. $-a = -24$

3. $3 = -1.5n$

EXAMPLE 2   **Solving an Equation Using a Reciprocal**

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

$$-\dfrac{4}{5}x = -8 \qquad \text{Write the equation.}$$

$$-\dfrac{5}{4} \cdot \left(-\dfrac{4}{5}x\right) = -\dfrac{5}{4} \cdot (-8) \qquad \text{Multiply each side by } -\dfrac{5}{4}, \text{ the reciprocal of } -\dfrac{4}{5}.$$

$$x = 10 \qquad \text{Simplify.}$$

∴ So, the solution is $x = 10$.

On Your Own

Solve the equation. Check your solution.

4. $-14 = \dfrac{2}{3}x$ **5.** $-\dfrac{8}{5}b = 5$ **6.** $\dfrac{3}{8}h = -9$

EXAMPLE 3   **Real-Life Application**
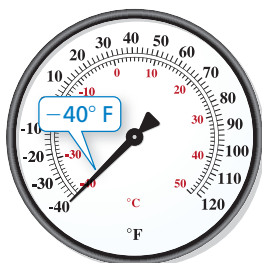
The record low temperature in Arizona is 1.6 times the record low temperature in Rhode Island. What is the record low temperature in Rhode Island?

Record low temperature in Arizona

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 $-40 = 1.6 \times t$

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

$$-\dfrac{40}{1.6} = \dfrac{1.6t}{1.6} \qquad \text{Divide each side by 1.6.}$$

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

∴ The record low temperature in Rhode Island is $-25°$F.

On Your Own

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°F. What is the record low temperature in Alaska?

✓ Vocabulary and Concept Check

1. **WRITING** Explain why multiplication can be used to solve equations involving division.

2. **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.

3. Multiplying by 5   4. Subtracting 12   5. Dividing by -8 6. Adding -6

Practice and Problem Solving

Solve the equation. Check your solution.

① 7. $3h = 15$

8. $-5t = -45$

9. $\dfrac{n}{2} = -7$

10. $\dfrac{k}{-3} = 9$

11. $5m = -10$

12. $8t = -32$

13. $-0.2x = 1.6$

14. $-10 = -\dfrac{b}{4}$

15. $-6p = 48$

16. $-72 = 8d$

17. $\dfrac{n}{1.6} = 5$

18. $-14.4 = -0.6p$

② 19. $\dfrac{3}{4}g = -12$

20. $8 = -\dfrac{2}{5}c$

21. $-\dfrac{4}{9}f = -3$

22. $26 = -\dfrac{8}{5}y$

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

✗ $-4.2x = 21$

$\dfrac{-4.2x}{4.2} = \dfrac{21}{4.2}$

$x = 5$

Write the verbal sentence as an equation. Then solve.

24. A number divided by -9 is -16.

25. A number multiplied by $\dfrac{2}{5}$ is $\dfrac{3}{20}$.

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.

28. **NEWSPAPERS** You make $0.75 for every newspaper you sell. How many newspapers do you have to sell to buy the soccer cleats?

29. **ROCK CLIMBING** A rock climber averages $12\dfrac{3}{5}$ feet per minute.

    How many feet does the rock climber climb in 30 minutes?

Soccer Cleats
$36⁰⁰

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.** $-\dfrac{1}{2}$ **33.** $-1\dfrac{1}{4}$

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

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

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

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

> 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, $\dfrac{3}{4}$ 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 $\dfrac{31}{25}x = -62$ to find the value of x.

x

-62 ft

38. SHOPPING The price of a bike at store A is $\dfrac{5}{6}$ 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 $\dfrac{5}{7}$ of a trip. Your rate of travel is the same throughout the trip. The total trip is 1250 miles. How many more days until you reach your destination?
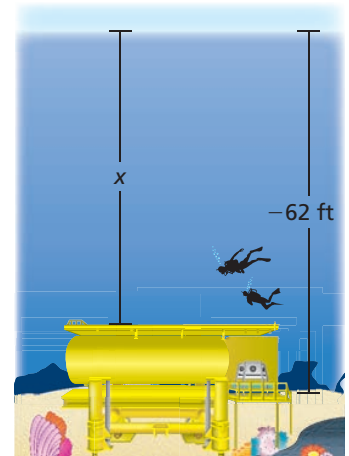
Fair Game Review *What you learned in previous grades & lessons*

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? *(Section 2.1)*

  Ⓐ $\dfrac{1}{4}$ **Ⓑ** $\dfrac{3}{8}$ **Ⓒ** $\dfrac{5}{8}$ **Ⓓ** $\dfrac{3}{4}$