

# Chapter 2 Solving Linear Equations

## Prerequisite Skills for the chapter "Solving Linear Equations"

- In the expression  $3x + 7 + 7x$ ,  $3x$  and  $7x$  are like terms.
- The reciprocal of  $\frac{5}{8}$  is  $\frac{8}{5}$ .
- $5x - (6 - x) = 5x - 6 + x = 6x - 6$
- $3(x - 9) - 16 = 3x - 27 - 16 = 3x - 43$
- $23 + 4(x + 2) = 23 + 4x + 8 = 4x + 31$
- $x(7 + x) + 9x^2 = 7x + x^2 + 9x^2 = 10x^2 + 7x$
- $54\% = 0.54$                                       8.  $99\% = 0.99$
- $12.5\% = 0.125$                                       10.  $150\% = 1.5$
- $P = 2l + 2w = 2(16) + 2(7) = 32 + 14 = 46$   
The perimeter is 46 feet.
- $P = 2l + 2w = 2(20) + 2(14) = 40 + 28 = 68$   
The perimeter is 68 centimeters.
- $P = 2l = 2w = 2(11) + 2(4) = 22 + 8 = 30$   
The perimeter is 30 inches.

## Lesson 2.1 Find Square Roots and Compare Real Numbers

### Investigating Algebra Activity for the lesson "Find Square Roots and Compare Real Numbers"

Step 1: Answers will vary.

Step 2:

- None of the students in our group participates in a school sport. If a student is in our group, then the student does not participate in a school sport.
- None of the students in our group is taking an art class. If a student is in our group, then the student is not taking an art class.
- All of the students in our group walk to school. If a student is in our group, then the student walks to school.

Step 3: Answers may vary.

Draw Conclusions

- All of the students in our group listen to rock music. If a student is in our group, then the student listens to rock music.  
None of the students in our group listens to rock music. If a student is in our group, then the student does not listen to rock music.  
Both statements begin with "if a student is in our group" but the conclusion of the statement containing the word "all" is positive, and the conclusion containing the word "none" is negative.
- If a number is a positive number, then the number is an integer. The statement is false. *Sample answer:* A counterexample is 8.4 because it is a positive number but not an integer.
- If a number is a rational number, then it can be written as a fraction. The statement is true.

- If a number is a negative number, then it is not a whole number. The statement is true.
- If a number is a rational number, then it does not have an opposite equal to itself. The statement is false. A counterexample is 0. The opposite of 0 is 0.

### Guided Practice for the lesson "Find Square Roots and Compare Real Numbers"

- $-\sqrt{9} = -3$                                       2.  $\sqrt{25} = 5$
- $\pm\sqrt{64} = \pm 8$                                       4.  $-\sqrt{81} = -9$
- $25 < 32 < 36$   
 $\sqrt{25} < \sqrt{32} < \sqrt{36}$   
 $5 < \sqrt{32} < 6$   
Because 32 is closer to 36 than to 25,  $\sqrt{32}$  is closer to 6 than to 5.
- $100 < 103 < 121$   
 $\sqrt{100} < \sqrt{103} < \sqrt{121}$   
 $10 < \sqrt{103} < 11$   
Because 103 is closer to 100 than 121,  $\sqrt{103}$  is closer to 10 than to 11.
- $-\sqrt{49} < -\sqrt{48} < -\sqrt{36}$   
 $-7 < -\sqrt{48} < -6$   
Because 48 is closer to 49 than to 36,  $-\sqrt{48}$  is closer to  $-7$  than to  $-6$ .
- $-\sqrt{361} < -\sqrt{350} < -\sqrt{324}$   
 $-19 < -\sqrt{350} < -18$   
Because 350 is closer to 361 than to 324,  $-\sqrt{350}$  is closer to  $-19$  than to  $-18$ .

9.

Number	Real number?	Rational number?	Irrational number?
$-\frac{9}{2}$	yes	yes	no
5.2	yes	yes	no
0	yes	yes	no
$\sqrt{7}$	yes	no	yes
4.1	yes	yes	no
$-\sqrt{20}$	yes	no	yes

Number	Integer?	Whole number?
$-\frac{9}{2}$	no	no
5.2	no	no
0	yes	yes
$\sqrt{7}$	no	no
4.1	no	no
$-\sqrt{20}$	no	no



From least to greatest, the numbers are  $-\frac{9}{2}$ ,  $-\sqrt{20}$ ,  $0$ ,  $\sqrt{7}$ ,  $4.1$ , and  $5.2$ .

10. Given: All square roots of perfect squares are rational numbers.

If then form: If a number is a square root of a perfect square, then the number is a rational number. The statement is true.

11. Given: All repeating decimals are irrational numbers.

If then form: If a number is a repeating decimal, then it is an irrational number. The statement is false.

Sample answer:  $0.333 \dots$  is a repeating decimal and can be written as  $\frac{1}{3}$ , so it is a rational number.

12. Given: No integers are irrational numbers.

If then form: If a number is an integer, then it is not an irrational number.

The statement is true.

### Exercises for the lesson "Find Square Roots and Compare Real Numbers"

#### Skill Practice

- The set of all rational and irrational numbers is called the set of *real numbers*.
- If the radicand is a perfect square, the square root will be rational. If not, the square root will be irrational.
- $\sqrt{4} = 2$
- $-\sqrt{49} = -7$
- $-\sqrt{9} = -3$
- $\pm\sqrt{1} = \pm 1$
- $\sqrt{196} = 14$
- $\pm\sqrt{121} = \pm 11$
- $\pm\sqrt{2500} = \pm 50$
- $-\sqrt{225} = -15$
- $\pm\sqrt{169} = \pm 13$
- $-\sqrt{1600} = -40$
- $9 < 10 < 16$   
 $\sqrt{9} < \sqrt{10} < \sqrt{16}$   
 $3 < \sqrt{10} < 4$   
Because 10 is closer to 9 than to 16,  $\sqrt{10}$  is closer to 3 than to 4.
- $-\sqrt{25} < -\sqrt{18} < -\sqrt{16}$   
 $-5 < -\sqrt{18} < -4$   
Because 18 is closer to 16 than to 25,  $-\sqrt{18}$  is closer to  $-4$  than to  $-5$ .
- $-\sqrt{4} < -\sqrt{3} < -\sqrt{1}$   
 $-2 < -\sqrt{3} < -1$   
Because 3 is closer to 4 than to 1,  $-\sqrt{3}$  is closer to  $-2$  than to  $-1$ .
- $144 < 150 < 169$   
 $\sqrt{144} < \sqrt{150} < \sqrt{169}$   
 $12 < \sqrt{150} < 13$

Because 150 is closer to 144 than to 169,  $\sqrt{150}$  is closer to 12 than to 13.

19.  $-\sqrt{100} < -\sqrt{86} < -\sqrt{81}$   
 $-10 < -\sqrt{86} < -9$

Because 86 is closer to 81 than to 100,  $-\sqrt{86}$  is closer to  $-9$  than to  $-10$ .

20.  $36 < 40 < 49$   
 $\sqrt{36} < \sqrt{40} < \sqrt{49}$   
 $6 < \sqrt{40} < 7$

Because 40 is closer to 36 than to 49,  $\sqrt{40}$  is closer to 6 than to 7.

21.  $196 < 200 < 225$   
 $\sqrt{196} < \sqrt{200} < \sqrt{225}$   
 $14 < \sqrt{200} < 15$

Because 200 is closer to 196 than to 225,  $\sqrt{200}$  is closer to 14.

22.  $-\sqrt{81} < -\sqrt{65} < -\sqrt{64}$   
 $-9 < -\sqrt{65} < -8$

Because 65 is closer to 64 than to 81,  $-\sqrt{65}$  is closer to  $-8$  than to  $-9$ .

23. B;  $-\sqrt{680}$

24.

Number	Real number?	Rational number?	Irrational number?
$\sqrt{49}$	yes	yes	no
8	yes	yes	no
$-\sqrt{4}$	yes	yes	no
-3	yes	yes	no

Number	Integer?	Whole number?
$\sqrt{49}$	yes	yes
8	yes	yes
$-\sqrt{4}$	yes	no
-3	yes	no

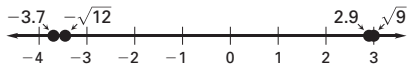


From least to greatest, the numbers are  $-3$ ,  $-\sqrt{4}$ ,  $\sqrt{49}$ , and 8.

25.

Number	Real number?	Rational number?	Irrational number?
$-\sqrt{12}$	yes	no	yes
$-3.7$	yes	yes	no
$\sqrt{9}$	yes	yes	no
$2.9$	yes	yes	no

Number	Integer?	Whole number?
$-\sqrt{12}$	no	no
$-3.7$	no	no
$\sqrt{9}$	yes	yes
$2.9$	no	no

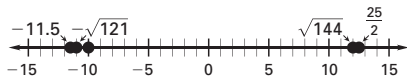


From least to greatest, the numbers are  $-3.7$ ,  $-\sqrt{12}$ ,  $2.9$ , and  $\sqrt{9}$ .

26.

Number	Real number?	Rational number?	Irrational number?
$-11.5$	yes	yes	no
$-\sqrt{121}$	yes	yes	no
$-10$	yes	yes	no
$\frac{25}{2}$	yes	yes	no
$\sqrt{144}$	yes	yes	no

Number	Integer?	Whole number?
$-11.5$	no	no
$-\sqrt{121}$	yes	no
$-10$	yes	no
$\frac{25}{2}$	no	no
$\sqrt{144}$	yes	yes

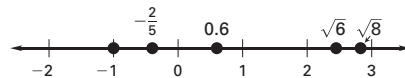


From least to greatest, the numbers are  $-11.5$ ,  $-\sqrt{121}$ ,  $-10$ ,  $\sqrt{144}$ , and  $\frac{25}{2}$ .

27.

Number	Real number?	Rational number?	Irrational number?
$\sqrt{8}$	yes	no	yes
$-\frac{2}{5}$	yes	yes	no
$-1$	yes	yes	no
$0.6$	yes	yes	no
$\sqrt{6}$	yes	no	yes

Number	Integer?	Whole number?
$\sqrt{8}$	no	no
$-\frac{2}{5}$	no	no
$-1$	yes	no
$0.6$	no	no
$\sqrt{6}$	no	no

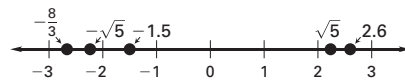


From least to greatest, the numbers are  $-1$ ,  $-\frac{2}{5}$ ,  $0.6$ ,  $\sqrt{6}$ , and  $\sqrt{8}$ .

28.

Number	Real number?	Rational number?	Irrational number?
$-\frac{8}{3}$	yes	yes	no
$-\sqrt{5}$	yes	no	yes
$2.6$	yes	yes	no
$-1.5$	yes	yes	no
$\sqrt{5}$	yes	no	yes

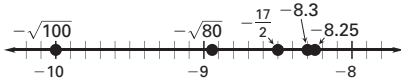
Number	Integer?	Whole number?
$-\frac{8}{3}$	no	no
$-\sqrt{5}$	no	no
$2.6$	no	no
$-1.5$	no	no
$\sqrt{5}$	no	no



From least to greatest, the numbers are  $-\frac{8}{3}$ ,  $-\sqrt{5}$ ,  $-1.5$ ,  $\sqrt{5}$ , and  $2.6$ .

Number	Real number?	Rational number?	Irrational number?
-8.3	yes	yes	no
$-\sqrt{80}$	yes	no	yes
$-\frac{17}{2}$	yes	yes	no
-8.25	yes	yes	no
$-\sqrt{100}$	yes	yes	no

Number	Integer?	Whole number?
-8.3	no	no
$-\sqrt{80}$	no	no
$-\frac{17}{2}$	no	no
-8.25	no	no
$-\sqrt{100}$	yes	no



From least to greatest, then numbers are  $-\sqrt{100}$ ,  $-\sqrt{80}$ ,  $-\frac{17}{2}$ , -8.3, and -8.25.

30. If a number is a whole number, then it is a real number. The statement is true.
31. If a number is a real number, then it is an irrational number. The statement is false.  
*Sample answer:* A counterexample is 5. 5 is a real number but not an irrational number.
32. If a number is a perfect square, then it is not a whole number. The statement is false.  
*Sample answer:* A counterexample is 81. 81 is a perfect square and a whole number.
33. If a number is an irrational number, then the number is not a whole number. The statement is true.
34. When  $x = 9$ ;  $3 + \sqrt{x} = 3 + \sqrt{9} = 3 + 3 = 6$
35. When  $x = 81$ ;  $11 - \sqrt{x} = 11 - \sqrt{81} = 11 - 9 = 2$
36. When  $x = 49$ ;  $4 \cdot \sqrt{x} = 4 \cdot \sqrt{49} = 4 \cdot 7 = 28$
37. When  $x = 36$ ;  $-7 \cdot \sqrt{x} = -7 \cdot \sqrt{36} = -7 \cdot 6 = -42$
38. When  $x = 121$ ;  $-3 \cdot \sqrt{x} - 7 = -3 \cdot \sqrt{121} - 7$   
 $= -3 \cdot 11 - 7$   
 $= -33 - 7$   
 $= -40$
39. When  $x = 100$ ;  $6 \cdot \sqrt{x} + 3 = 6 \cdot \sqrt{100} + 3$   
 $= 6 \cdot 10 + 3$   
 $= 60 + 3$   
 $= 63$

Set	Additive identity?	Additive inverses?
Whole numbers	yes	no (except 0)
Integers	yes	yes
Rational numbers	yes	yes
Real numbers	yes	yes

Set	Multiplicative identity?	Multiplicative inverses?
Whole numbers	yes	no (except 1)
Integers	yes	no (except 1)
Rational numbers	yes	yes (except 0)
Real numbers	yes	yes (except 0)

41. B;  $\sqrt{36} + 17 = 6 + 17 = 24$   
 $87 - \sqrt{36} = 87 - 6 = 81$   
 $5 \cdot \sqrt{36} = 5 \cdot 6 = 30$   
 $8 \cdot \sqrt{36} + 2 = 8 \cdot 6 + 2 = 48 + 2 = 50$   
 $87 - \sqrt{36}$
42. For  $0 < x < 1$ ,  $x < \sqrt{x}$ ; for example, if  $x = \frac{1}{4}$ ,  $\sqrt{x} = \frac{1}{2}$ , and  $\frac{1}{4} < \frac{1}{2}$ . For  $x > 1$ ,  $x > \sqrt{x}$ ; for example, if  $x = 9$ ,  $\sqrt{x} = 3$ , and  $9 > 3$ .
43.  $2 \cdot \sqrt{x}$   
 $(2 \cdot 1)^2 = 4$   
 $(2 \cdot 4)^2 = 64$   
 $(2 \cdot 9)^2 = 324$   
 $(2 \cdot 16)^2 = 1024$   
 $(2 \cdot 25)^2 = 2500$   
 Take each of the first 5 perfect squares and multiply them by 2 and then square that answer, giving you 5 perfect squares for which  $2 \cdot \sqrt{x}$  is a perfect square.
44. For 31 values of  $n$ ,  $\sqrt{n}$  is a rational number. If a number is a whole number, it must be a perfect square in order to have a rational square root. The largest number that, when squared, is less than 1000 is 31.  
 $31^2 = 961$   
 So, there are 31 perfect squares between 1 and 1000.

### Problem Solving

45.  $A = s^2$ ,  $s = \sqrt{A} = \sqrt{3600} = 60$   
 The side length of the painting is 60 inches.

46.  $1600 < 1620 < 1681$

$$\sqrt{1600} < \sqrt{1620} < \sqrt{1681}$$

$$40 < \sqrt{1620} < 41$$

Because 1620 is closer to 1600,  $\sqrt{1620}$  is closer to 40.  
The side length of the section of the field is about 40 yards.

47.  $\sqrt{1225} = 35 \rightarrow$  rational

The side length of the maze in Dallas is 35 feet.

$$\sqrt{576} = 24 \rightarrow$$
 rational

The side length of the maze in San Francisco is 24 feet.

$$\sqrt{2304} = 48 \rightarrow$$
 rational

The side length of the maze in Corona is 48 feet.

$$\sqrt{900} = 30 \rightarrow$$
 rational

The side length of the maze in Waterville is 30 feet.

48.  $A = s^2, s = \sqrt{A} = \sqrt{1450} \approx 38.08$

$$P = 4s$$

$$P = 4(38.08) = 152.32$$

You do not have enough rope to surround the section.  
Each side is a little more than 38 feet. 38 feet times 4 is 152 feet, which is more than 150 feet.

49. Using a calculator,  $\sqrt[3]{10} \approx 2.15443469$ . So, to the nearest tenth of a foot, the approximate edge length of the storage cube is 2.2 ft.

50. a.  $17^\circ\text{C} + 273 = 290\text{K}$

b.  $s = 20.1 \cdot \sqrt{\text{K}} = 20.1 \cdot \sqrt{290} \approx 20.1 \cdot 17.03 \approx 342.3$

The speed of sound in air at  $17^\circ\text{C}$  is about 342 meters per second.

51. a.  $\$500 \cdot \frac{1 \text{ tile}}{\$3.45} \approx 144.93$

The homeowner can buy 144 tiles.

b. The total area of the largest patio the homeowner can build is found by:

$$256(144) = 36,864 \text{ in.}^2$$

If the area of the square equals the length of a side squared, then the square root of the area equals the length of the area equals the length of a side.

$$\sqrt{36,864} = 192 \text{ in.}$$

$$192 \text{ in.} = 16 \text{ ft}$$

The side length is 16 feet.

52. a.

	Area of larger base $\div$ area of smaller base ( $\text{m}^2$ )	Side length of larger base $\div$ side length of smaller base (m)
Menkaure and Khafre	$\frac{46,440}{11,772} \approx 3.9$	$\frac{\sqrt{46,440}}{\sqrt{11,772}} \approx 2.0$
Khafre and Khufu	$\frac{54,056}{46,440} \approx 1.2$	$\frac{\sqrt{54,056}}{\sqrt{46,440}} \approx 1.1$
Menkaure and Khufu	$\frac{54,056}{11,772} \approx 4.6$	$\frac{\sqrt{54,056}}{\sqrt{11,772}} \approx 2.1$

The square root of the first quotient equals the second quotient.

b.  $q = \sqrt{r}$

53.  $A = 6\ell^2$

$$\frac{A}{6} = \ell^2$$

$$\frac{\sqrt{A}}{6} = \sqrt{\ell^2}$$

$$\frac{\sqrt{A}}{6} = \ell$$

## Extension for the Lesson "Find Square Roots and Compare Real Numbers"

### Practice

1. Let  $x$  and  $y$  be two rational numbers. By definition  $x = \frac{a}{b}$  and  $y = \frac{c}{d}$  where  $a, b, c,$  and  $d$  are integers with  $b \neq 0$  and  $d \neq 0$ .

$$xy = \frac{a}{b} \cdot \frac{c}{d}$$

$$xy = \frac{ac}{bd}$$

Because the set of integers is closed under the operation of multiplication, the expressions  $ac$  and  $bd$  are both integers. Therefore, the product  $xy$  is equal to the ratio of two integers. So by definition, this product is a rational number.

2. irrational; integers; rational;  $xy = \frac{c}{d}; \frac{a}{b} \cdot y = \frac{c}{d}; \frac{b}{a} \cdot \frac{a}{b} y = \frac{b}{a} \cdot \frac{c}{d}; \frac{b}{a}; y = \frac{bc}{ad}; \frac{bc}{ad}; xy$ ; the product of a nonzero rational number and an irrational number is irrational.
3. Let  $x$  be a rational number and  $y$  be an irrational number. By definition,  $x = \frac{a}{b}$  where  $a$  and  $b$  are integers with  $b \neq 0$ . Now assume that the sum  $x + y$  is a rational number. Therefore  $x + y$  can be written as the quotient of integers  $c$  and  $d$  with  $d \neq 0$ .

$$x + y = \frac{c}{d}$$

$$\frac{a}{b} + y = \frac{c}{d}$$

$$\frac{a}{b} + y - \frac{a}{b} = \frac{c}{d} - \frac{a}{b}$$

$$y = \frac{bc - ad}{bd}$$

Because the set of integers is closed under the operations of subtraction and multiplication, the expression  $bc - ad$  is an integer. So by definition  $\frac{bc - ad}{bd}$  is a rational number, which means that  $y$  must be rational. But  $y$  is an irrational number, meaning the assumption that  $x + y$  is rational must be false. Therefore,  $x + y$  is an irrational number.

## Lesson 2.2 Solve One-Step Equations

### Investigating Algebra Activity for the lesson "Solve One-Step Equations"

- |                 |                   |                 |
|-----------------|-------------------|-----------------|
| 1. $x + 2 = 6$  | 2. $7 = x + 6$    |                 |
| 3. $x + 3 = 9$  | 4. $x + 2 = 7$    | 5. $x + 8 = 8$  |
| $x = 6$         | $x = 5$           | $x = 0$         |
| 6. $x + 3 = 7$  | 7. $x + 2 = 12$   | 8. $x + 7 = 12$ |
| $x = 4$         | $x = 10$          | $x = 5$         |
| 9. $15 = x + 5$ | 10. $13 = x + 10$ | 11. $4x = 4$    |
| $10 = x$        | $3 = x$           |                 |
| 12. $7 = 3x$    | 13. $2x = 10$     | 14. $3x = 12$   |
|                 | $x = 5$           | $x = 4$         |
| 15. $3x = 18$   | 16. $4x = 16$     | 17. $6 = 2x$    |
| $x = 6$         | $x = 4$           | $3 = x$         |

18.  $12 = 4x$       19.  $20 = 5x$       20.  $21 = 7x$   
 $3 = x$        $4 = x$        $3 = x$

21.  $x + 2 = 5$       Original equation  
 $x + 2 - 2 = 5 - 2$       Subtract 2 from each side.  
 $x = 3$       Simplify. Solution is 3.

22.  $2x = 12,$

$$\frac{2x}{2} = \frac{12}{2},$$

$$x = 6;$$

To solve  $12x = 180$ , divide each side by 12.

$$12x = 180$$

$$\frac{12x}{12} = \frac{180}{12}$$

$$x = 15$$

### Guided Practice for the lesson "Solve One-Step Equations"

- |                      |                     |
|----------------------|---------------------|
| 1. $y + 7 = 10$      | 2. $x - 5 = 3$      |
| $y + 7 - 7 = 10 - 7$ | $x - 5 + 5 = 3 + 5$ |
| $y = 3$              | $x = 8$             |

Check:

$$3 + 7 \stackrel{?}{=} 10$$

$$10 = 10$$

3.  $q - 11 = -5$

$$q - 11 + 11 = -5 + 11$$

$$q = 6$$

Check:

$$6 - 11 \stackrel{?}{=} -5$$

$$-5 = -5$$

5.  $4x = 48$

$$\frac{4x}{4} = \frac{48}{4}$$

$$x = 12$$

Check:

$$4(12) \stackrel{?}{=} 48$$

$$48 = 48$$

7.  $6w = -54$

$$\frac{6w}{6} = \frac{-54}{6}$$

$$w = -9$$

Check:

$$6(-9) \stackrel{?}{=} -54$$

$$-54 = -54$$

2.  $x - 5 = 3$

$$x - 5 + 5 = 3 + 5$$

$$x = 8$$

Check:

$$8 - 5 \stackrel{?}{=} 3$$

$$3 = 3$$

4.  $6 = t - 2$

$$6 + 2 = t - 2 + 2$$

$$8 = t$$

Check:

$$6 \stackrel{?}{=} 8 - 2$$

$$6 = 6$$

6.  $-65 = -5y$

$$\frac{-65}{-5} = \frac{-5y}{-5}$$

$$13 = y$$

Check:

$$-65 \stackrel{?}{=} -5(13)$$

$$-65 = -65$$

8.  $24 = -8n$

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

$$-3 = n$$

Check:

$$24 \stackrel{?}{=} -8(-3)$$

$$24 = 24$$

$$9. \quad \frac{t}{-3} = 9$$

$$-3 \cdot \frac{t}{-3} = -3 \cdot 9$$

$$t = -27$$

Check:

$$\frac{-27}{-3} \stackrel{?}{=} 9$$

$$9 = 9$$

$$11. \quad 13 = \frac{z}{-2}$$

$$-2(13) = -2\left(\frac{z}{-2}\right)$$

$$-26 = z$$

Check:

$$13 \stackrel{?}{=} \frac{-26}{-2}$$

$$13 = 13$$

$$13. \quad \frac{5}{6}w = 10$$

$$\frac{6}{5}\left(\frac{5}{6}w\right) = \frac{6}{5}(10)$$

$$w = 12$$

Check:

$$\frac{5}{6}(12) \stackrel{?}{=} 10$$

$$10 = 10$$

$$15. \quad 9 = -\frac{3}{4}m$$

$$-\frac{4}{3}(9) = -\frac{4}{3}\left(-\frac{3}{4}m\right)$$

$$-12 = m$$

Check:

$$9 \stackrel{?}{=} -\frac{3}{4}(-12)$$

$$9 = 9$$

$$17. \quad d = rt$$

$$100 = 10.1t$$

$$\frac{100}{10.1} = \frac{10.1t}{10.1}$$

$$9.9 = t$$

It would take Crawford 9.9 seconds.

### **Exercises for the lesson "Solve One-Step Equations"**

#### **Skill Practice**

- Two operations that undo each other are called *inverse operations*.
- You would use the division property of equality to solve  $14x = 35$  because dividing each side by 14 would give you an equivalent equation and the value of  $x$ .

$$10. \quad 6 = \frac{c}{7}$$

$$7(6) = 7\left(\frac{c}{7}\right)$$

$$42 = c$$

Check:

$$6 \stackrel{?}{=} \frac{42}{7}$$

$$6 = 6$$

$$12. \quad \frac{a}{5} = -11$$

$$5\left(\frac{a}{5}\right) = 5(-11)$$

$$a = -55$$

Check:

$$\frac{-55}{5} \stackrel{?}{=} -11$$

$$-11 = -11$$

$$14. \quad \frac{2}{3}p = 14$$

$$\frac{3}{2}\left(\frac{2}{3}p\right) = \frac{3}{2}(14)$$

$$p = 21$$

Check:

$$\frac{2}{3}(21) \stackrel{?}{=} 14$$

$$14 = 14$$

$$16. \quad -8 = -\frac{4}{5}v$$

$$-\frac{5}{4}(-8) = -\frac{5}{4}\left(-\frac{4}{5}v\right)$$

$$10 = v$$

Check:

$$-8 \stackrel{?}{=} -\frac{4}{5}(10)$$

$$-8 = -8$$

$$3. \quad x + 5 = 8$$

$$x + 5 - 5 = 8 - 5$$

$$x = 3$$

Check:

$$3 + 5 \stackrel{?}{=} 8$$

$$8 = 8$$

$$5. \quad 11 = f + 6$$

$$11 - 6 = f + 6 - 6$$

$$5 = f$$

Check:

$$11 \stackrel{?}{=} 5 + 6$$

$$11 = 11$$

$$7. \quad 6 = 9 + h$$

$$6 - 9 = 9 - 9 + h$$

$$-3 = h$$

Check:

$$6 \stackrel{?}{=} 9 + (-3)$$

$$6 = 6$$

$$9. \quad y - 4 = 3$$

$$y - 4 + 4 = 3 + 4$$

$$y = 7$$

Check:

$$7 - 4 \stackrel{?}{=} 3$$

$$3 = 3$$

$$11. \quad 14 = k - 3$$

$$14 + 3 = k - 3 + 3$$

$$17 = k$$

Check:

$$14 \stackrel{?}{=} 17 - 3$$

$$14 = 14$$

$$13. \quad -2 = n - 6$$

$$-2 + 6 = n - 6 + 6$$

$$4 = n$$

Check:

$$-2 \stackrel{?}{=} 4 - 6$$

$$-2 = -2$$

$$15. \text{ C; } -8 = d - 13$$

$$-8 + 13 = d - 13 + 13$$

$$5 = d$$

$$16. \text{ A; } 22 + v = -65$$

$$22 + v - 22 = -65 - 22$$

$$v = -87$$

$$4. \quad m + 9 = 2$$

$$m + 9 - 9 = 2 - 9$$

$$m = -7$$

Check:

$$-7 + 9 \stackrel{?}{=} 2$$

$$2 = 2$$

$$6. \quad 13 = 7 + z$$

$$13 - 7 = 7 - 7 + z$$

$$6 = z$$

Check:

$$13 \stackrel{?}{=} 7 + 6$$

$$13 = 13$$

$$8. \quad -3 = 5 + a$$

$$-3 - 5 = 5 - 5 + a$$

$$-8 = a$$

Check:

$$-3 \stackrel{?}{=} 5 + (-8)$$

$$-3 = -3$$

$$10. \quad t - 5 = 7$$

$$t - 5 + 5 = 7 + 5$$

$$t = 12$$

Check:

$$12 - 5 \stackrel{?}{=} 7$$

$$7 = 7$$

$$12. \quad 6 = w - 7$$

$$6 + 7 = w - 7 + 7$$

$$13 = w$$

Check:

$$6 \stackrel{?}{=} 13 - 7$$

$$6 = 6$$

$$14. \quad -11 = b - 9$$

$$-11 + 9 = b - 9 + 9$$

$$-2 = b$$

Check:

$$-11 \stackrel{?}{=} -2 - 9$$

$$-11 = -11$$

17.  $5g = 20$   
 $\frac{5g}{5} = \frac{20}{5}$   
 $g = 4$   
 Check:  
 $5(4) \stackrel{?}{=} 20$   
 $20 = 20$
19.  $48 = 8c$   
 $\frac{48}{8} = \frac{8c}{8}$   
 $6 = c$   
 Check:  
 $48 \stackrel{?}{=} 8(6)$   
 $48 = 48$
21.  $15 = -h$   
 $\frac{15}{-1} = \frac{-h}{-1}$   
 $-15 = h$   
 Check:  
 $15 \stackrel{?}{=} -(-15)$   
 $15 = 15$
23.  $\frac{y}{3} = 5$   
 $3\left(\frac{y}{3}\right) = 3(5)$   
 $y = 15$   
 Check:  
 $\frac{15}{3} \stackrel{?}{=} 5$   
 $5 = 5$
25.  $8 = \frac{x}{6}$   
 $6(8) = 6\left(\frac{x}{6}\right)$   
 $48 = x$   
 Check:  
 $8 \stackrel{?}{=} \frac{48}{6}$   
 $8 = 8$
27.  $-11 = \frac{z}{-2}$   
 $-2(-11) = -2\left(\frac{z}{-2}\right)$   
 $22 = z$   
 Check:  
 $-11 \stackrel{?}{=} \frac{22}{-2}$   
 $-11 = -11$
29. The student multiplied  $x$  by 100 to produce a number with a decimal part identical to the decimal part of  $x$ . When the student subtracted, the result was a whole number.
18.  $-4q = 52$   
 $\frac{-4q}{-4} = \frac{52}{-4}$   
 $q = -13$   
 Check:  
 $-4(-13) \stackrel{?}{=} 52$   
 $52 = 52$
20.  $-108 = 9j$   
 $\frac{-108}{9} = \frac{9j}{9}$   
 $-12 = j$   
 Check:  
 $-108 \stackrel{?}{=} 9(-12)$   
 $-108 = -108$
22.  $187 = -17r$   
 $\frac{187}{-17} = \frac{-17r}{-17}$   
 $-11 = r$   
 Check:  
 $187 \stackrel{?}{=} -17(-11)$   
 $187 = 187$
24.  $\frac{m}{2} = 14$   
 $\frac{2m}{2} = 2(14)$   
 $m = 28$   
 Check:  
 $\frac{28}{2} \stackrel{?}{=} 14$   
 $14 = 14$
26.  $7 = \frac{t}{-7}$   
 $-7(7) = -7\left(\frac{t}{-7}\right)$   
 $-49 = t$   
 Check:  
 $7 \stackrel{?}{=} \frac{-49}{-7}$   
 $7 = 7$
28.  $-3 = \frac{d}{14}$   
 $14(-3) = 14\left(\frac{d}{14}\right)$   
 $-42 = d$   
 Check:  
 $-3 \stackrel{?}{=} \frac{-42}{14}$   
 $-3 = -3$

30. a. Let  $x = 0.\overline{7}$ . Then  $10x = 7.\overline{7}$ .  
 Subtract:  $10x = 7.7777\dots$   
 $-x = -0.7777\dots$   
 $9x = 7$   
 $x = \frac{7}{9}$
- b. Let  $x = 0.\overline{18}$ . Then  $100x = 18.\overline{18}$ .  
 Subtract:  $100x = 18.1818\dots$   
 $-x = -0.1818\dots$   
 $99x = 18$   
 $x = \frac{18}{99}$   
 $= \frac{2}{11}$
31.  $b - 0.4 = 3.1$  Check:  
 $b - 0.4 + 0.4 = 3.1 + 0.4$   $3.5 - 0.4 \stackrel{?}{=} 3.1$   
 $b = 3.5$   $3.1 = 3.1$
32.  $-3.2 + z = -7.4$   
 $-3.2 + z + 3.2 = -7.4 + 3.2$   
 $z = -4.2$   
 Check:  $-3.2 + (-4.2) \stackrel{?}{=} -7.4$   
 $-7.4 = -7.4$
33.  $-5.7 = w - 4.6$  Check:  
 $-5.7 + 4.6 = w - 4.6 + 4.6$   $-5.7 \stackrel{?}{=} -1.1 - 4.6$   
 $-1.1 = w$   $-5.7 = -5.7$
34.  $-6.1 = p + 2.2$  Check:  
 $-6.1 - 2.2 = p + 2.2 - 2.2$   $-6.1 \stackrel{?}{=} -8.3 + 2.2$   
 $-8.3 = p$   $-6.1 = -6.1$
35.  $8.2 = -4g$  36.  $-3.3a = 19.8$   
 $\frac{8.2}{-4} = \frac{-4g}{-4}$   $\frac{-3.3a}{-3.3} = \frac{19.8}{-3.3}$   
 $-2.05 = g$   $a = -6$   
 Check: Check:  
 $8.2 \stackrel{?}{=} -4(-2.05)$   $-3.3(-6) \stackrel{?}{=} 19.8$   
 $8.2 = 8.2$   $19.8 = 19.8$
37.  $\frac{3}{4} = \frac{1}{8} + v$  38.  $\frac{n}{4.6} = -2.5$   
 $\frac{3}{4} - \frac{1}{8} = \frac{1}{8} + v - \frac{1}{8}$   $4.6\left(\frac{n}{4.6}\right) = 4.6(-2.5)$   
 $\frac{5}{8} = v$   $n = -11.5$   
 Check: Check:  
 $\frac{3}{4} \stackrel{?}{=} \frac{1}{8} + \frac{5}{8}$   $\frac{-11.5}{4.6} \stackrel{?}{=} -2.5$   
 $\frac{3}{4} = \frac{3}{4}$   $-2.5 = -2.5$



39.  $-0.12 = \frac{y}{-0.5}$   
 $-0.5(-0.12) = -0.5\left(\frac{y}{-0.5}\right)$   
 $0.06 = y$   
 Check:  
 $-0.12 \stackrel{?}{=} \frac{0.06}{-0.5}$   
 $-0.12 = -0.12$
41.  $\frac{1}{3}c = 32$   
 $\frac{3}{1}\left(\frac{1}{3}c\right) = \frac{3}{1}(32)$   
 $c = 96$   
 Check:  
 $\frac{1}{3}(96) \stackrel{?}{=} 32$   
 $32 = 32$
43.  $\frac{3}{2}k = 18$   
 $\frac{2}{3}\left(\frac{3}{2}k\right) = \frac{2}{3}(18)$   
 $k = 12$   
 Check:  
 $\frac{3}{2}(12) \stackrel{?}{=} 18$   
 $18 = 18$
45.  $-\frac{2}{7}v = 16$   
 $-\frac{7}{2}\left(-\frac{2}{7}v\right) = -\frac{7}{2}(16)$   
 $v = -56$   
 Check:  
 $-\frac{2}{7}(-56) \stackrel{?}{=} 16$   
 $16 = 16$
47.  $\frac{1}{3}y = \frac{1}{5}$   
 $\frac{3}{1}\left(\frac{1}{3}y\right) = \frac{3}{1}\left(\frac{1}{5}\right)$   
 $y = \frac{3}{5}$   
 Check:  
 $\frac{1}{3}\left(\frac{3}{5}\right) \stackrel{?}{=} \frac{1}{5}$   
 $\frac{1}{5} = \frac{1}{5}$
49.  $A = \ell w$   
 $54 = 12x$   
 $\frac{54}{12} = \frac{12x}{12}$   
 $4.5 = x$
40.  $\frac{1}{2}m = 21$   
 $\frac{2}{1}\left(\frac{1}{2}m\right) = \frac{2}{1}(21)$   
 $m = 42$   
 Check:  
 $\frac{1}{2}(42) \stackrel{?}{=} 21$   
 $21 = 21$
42.  $-7 = \frac{1}{5}x$   
 $\frac{5}{1}(-7) = \frac{5}{1}\left(\frac{1}{5}x\right)$   
 $-35 = x$   
 Check:  
 $-7 \stackrel{?}{=} \frac{1}{5}(-35)$   
 $-7 = -7$
44.  $-21 = -\frac{3}{5}t$   
 $-\frac{5}{3}(-21) = -\frac{5}{3}\left(-\frac{3}{5}t\right)$   
 $35 = t$   
 Check:  
 $-21 \stackrel{?}{=} -\frac{3}{5}(35)$   
 $-21 = -21$
46.  $\frac{8}{5}x = \frac{4}{15}$   
 $\frac{5}{8}\left(\frac{8}{5}x\right) = \frac{5}{8}\left(\frac{4}{15}\right)$   
 $x = \frac{1}{6}$   
 Check:  
 $\frac{8}{5}\left(\frac{1}{6}\right) \stackrel{?}{=} \frac{4}{15}$   
 $\frac{4}{15} = \frac{4}{15}$
48.  $-\frac{4}{3} = \frac{2}{3}z$   
 $\frac{3}{2}\left(-\frac{4}{3}\right) = \frac{3}{2}\left(\frac{2}{3}z\right)$   
 $-2 = z$   
 Check:  
 $-\frac{4}{3} \stackrel{?}{=} \frac{2}{3}(-2)$   
 $-\frac{4}{3} = -\frac{4}{3}$

The width is 4.5 inches.

50.  $A = \frac{1}{2}bh$   
 $72 = \frac{1}{2}(16)x$   
 $72 = 8x$   
 $\frac{72}{8} = \frac{8x}{8}$   
 $9 = x$   
 The height is 9 centimeters.
51.  $4a = 6$   
 $\frac{4a}{4} = \frac{6}{4}$   
 $a = \frac{3}{2}$   
 $b = a - 2$   
 $b = \frac{3}{2} - 2$   
 $b = -\frac{1}{2}$
52.  $a - 6.7 = 3.1$   
 $a - 6.7 + 6.7 = 3.1 + 6.7$   
 $a = 9.8$   
 $b = 5a$   
 $b = 5(9.8)$   
 $b = 49$

### Problem Solving

53. Let  $d$  = maximum depth in 1999  
 $d - 9.9 = 1036.7$   
 $d - 9.9 + 9.9 = 1036.7 + 9.9$   
 $d = 1046.6$   
 The maximum depth in 1999 was 1046.6 feet.
54. Let  $t$  = thickness of pendant  
 $20t = 50$   
 $\frac{20t}{20} = \frac{50}{20}$   
 $t = 2.5$   
 Each pendant should be 2.5 millimeters thick.
55.  $A = \ell w$   
 $187 = 17w$   
 $\frac{187}{17} = \frac{17w}{17}$   
 $11 = w$   
 The width of the trampoline is 11 feet.
56. Let  $w$  = weight of occupant  
 $55 + w = 300$   
 $55 + w - 55 = 300 - 55$   
 $w = 245$   
 The maximum weight of a wheelchair occupant is 245 pounds.

57. a. Let  $b$  = all species of birds

$$\frac{4}{7}b = 200$$

- b. Solve the equation part (a).

$$\frac{4}{7}b = 200$$

$$\frac{7}{4}\left(\frac{4}{7}b\right) = \frac{7}{4}(200)$$

$$b = 350 \text{ species of birds}$$

Because  $600 > 350$ , there are more species of plants than birds.

58. Answers will vary.

$$15x = 135$$

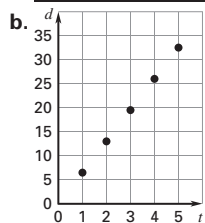
$$\frac{15x}{15} = \frac{135}{15}$$

$$x = 9$$

59. a.  $d = rt$

$$d = 6.5t$$

<b>t (sec)</b>	1	2	3	4	5
<b>d (ft)</b>	6.5	13	19.5	26	32.5



It takes the jellyfish 4 seconds to travel 26 feet.

- c.  $26 = 6.5t$

$$\frac{26}{6.5} = \frac{6.5t}{6.5}$$

$$4 = t$$

60. a. Let  $a$  = area of 1 tatami mat

$$81 = 4.5a$$

$$\frac{81}{4.5} = \frac{4.5a}{4.5}$$

$$18 = a$$

The area of one tatami mat is 18 square feet.

- b.  $A = \ell w$

$$18 = \ell(3)$$

$$\frac{18}{3} = \frac{\ell(3)}{3}$$

$$6 = \ell$$

The length is 6 feet.

61. a. Let  $h$  = number of hits

$$\frac{h}{524} = 0.326$$

$$524\left(\frac{h}{524}\right) = 524(0.326)$$

$$h = 170.824$$

Mueller had about 171 hits.

- b. Let  $w$  = number of hits Wells had

$$w - 44 = 171$$

$$w - 44 + 44 = 171 + 44$$

$$w = 215$$

Vernon Wells had 215 hits.

- c. No, if Wells had the same at bats as Mueller, he would have had a batting average of  $\frac{215}{524} \approx 0.410$ . For Mueller to have a higher batting average, Wells had to have more at bats, not fewer, than Mueller.

62.  $\ell = 1.9w$

$$\frac{\ell}{1.9} = \frac{1.9w}{1.9}$$

$$\frac{\ell}{1.9} = w$$

$$A = \ell w = \ell\left(\frac{\ell}{1.9}\right) = 9.5\left(\frac{9.5}{1.9}\right) = 47.5$$

The area of the flag is 47.5 square feet.

63. Let  $c$  = cost per pound

$$(2.1 - 0.3)c = 4.68$$

$$1.8c = 4.68$$

$$\frac{1.8c}{1.8} = \frac{4.68}{1.8}$$

$$c = 2.6$$

The strawberries cost \$2.60 per pound.

## Lesson 2.3 Solve Two-Step Equations

### Guided Practice for the lesson "Solve Two-Step Equations"

1.  $5x + 9 = 24$

$$5x + 9 - 9 = 24 - 9$$

$$5x = 15$$

$$\frac{5x}{5} = \frac{15}{5}$$

$$x = 3$$

Check:

$$5(3) + 9 \stackrel{?}{=} 24$$

$$15 + 9 \stackrel{?}{=} 24$$

$$24 = 24$$

2.  $4y - 4 = 16$

$$4y - 4 + 4 = 16 + 4$$

$$4y = 20$$

$$y = 5$$

Check:

$$4(5) - 4 \stackrel{?}{=} 16$$

$$20 - 4 \stackrel{?}{=} 16$$

$$16 = 16$$

3.  $-1 = \frac{z}{3} - 7$

$$-1 + 7 = \frac{z}{3} - 7 + 7$$

$$6 = \frac{z}{3}$$

$$6(3) = \frac{z}{3}(3)$$

$$18 = z$$

Check:

$$-1 \stackrel{?}{=} \frac{18}{3} - 7$$

$$-1 \stackrel{?}{=} 6 - 7$$

$$-1 = -1$$

4.  $4w + 2w = 24$

$$6w = 24$$

$$\frac{6w}{6} = \frac{24}{6}$$

$$w = 4$$

Check:

$$4(4) + 2(4) \stackrel{?}{=} 24$$

$$16 + 8 \stackrel{?}{=} 24$$

$$24 = 24$$

5.  $8t - 3t = 35$

$5t = 35$

$\frac{5t}{5} = \frac{35}{5}$

$t = 7$

6.  $-16 = 5d - 9d$

$-16 = -4d$

$4 = d$

7.  $y = -2x + 5$

$11 = -2x + 5$

$11 - 5 = -2x - 5 + 5$

$6 = -2x$

$\frac{6}{-2} = \frac{-2x}{-2}$

$-3 = x$

9.  $P = 2117 + 64d$

$5317 = 2117 + 64d$

$5317 - 2117 = 2117 + 64d - 2117$

$3200 = 64d$

$\frac{3200}{64} = \frac{64d}{64}$

$50 = d$

The diver's depth is 50 feet.

10. Let  $h$  = hours worked

$53 = 8h + 13$

$53 - 13 = 8h + 13 - 13$

$40 = 8h$

$\frac{40}{8} = \frac{8h}{8}$

$5 = h$

Kim worked 5 hours.

### Exercises for the lesson "Solve Two-Step Equations"

#### Skill Practice

- To solve the equation  $2x + 3x = 20$ , you would begin by combining  $2x$  and  $3x$  because they are *like terms*.
- Subtract 7 from each side of the equation to get  $4x = 8$ . Divide each side of the equation by 4 to get  $x = 2$ .

Check:

$8(7) - 3(7) \stackrel{?}{=} 35$

$56 - 21 \stackrel{?}{=} 35$

$35 = 35$

Check:

$-16 \stackrel{?}{=} 5(4) - 9(4)$

$-16 \stackrel{?}{=} 20 - 36$

$-16 = -16$

8.  $y = 4x - 4$

$3 = 4x - 4$

$3 + 4 = 4x - 4 + 4$

$7 = 4x$

$\frac{7}{4} = \frac{4x}{4}$

$1.75 = x$

3.  $3x + 7 = 19$

$3x + 7 - 7 = 19 - 7$

$3x = 12$

$\frac{3x}{3} = \frac{12}{3}$

$x = 4$

Check:

$3(4) + 7 \stackrel{?}{=} 19$

$12 + 7 \stackrel{?}{=} 19$

$19 = 19$

5.  $7d - 1 = 13$

$7d - 1 + 1 = 13 + 1$

$7d = 14$

$\frac{7d}{7} = \frac{14}{7}$

$d = 2$

Check:

$7(2) - 1 \stackrel{?}{=} 13$

$14 - 1 \stackrel{?}{=} 13$

$13 = 13$

7.  $10 = 7 - m$

$10 - 7 = 7 - m - 7$

$3 = -m$

$\frac{3}{-1} = \frac{-m}{-1}$

$-3 = m$

Check:

$10 \stackrel{?}{=} 7 - (-3)$

$10 = 10$

9.  $\frac{a}{3} + 4 = 6$

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

$\frac{a}{3} = 2$

$3\left(\frac{a}{3}\right) = 3(2)$

$a = 6$

Check:

$\frac{6}{3} + 4 \stackrel{?}{=} 6$

$2 + 4 \stackrel{?}{=} 6$

$6 = 6$

4.  $5h + 4 = 19$

$5h + 4 - 4 = 19 - 4$

$5h = 15$

$\frac{5h}{5} = \frac{15}{5}$

$h = 3$

Check:

$5(3) + 4 \stackrel{?}{=} 19$

$15 + 4 \stackrel{?}{=} 19$

$19 = 19$

6.  $2g - 13 = 3$

$2g - 13 + 13 = 3 + 13$

$2g = 16$

$\frac{2g}{2} = \frac{16}{2}$

$g = 8$

Check:

$2(8) - 13 \stackrel{?}{=} 3$

$16 - 13 \stackrel{?}{=} 3$

$3 = 3$

8.  $11 = 12 - q$

$11 - 12 = 12 - q - 12$

$-1 = -q$

$\frac{-1}{-1} = \frac{-q}{-1}$

$1 = q$

Check:

$11 \stackrel{?}{=} 12 - 1$

$11 = 11$

10.  $17 = \frac{w}{5} + 13$

$17 - 13 = \frac{w}{5} + 13 - 13$

$4 = \frac{w}{5}$

$5(4) = 5\left(\frac{w}{5}\right)$

$20 = w$

Check:

$17 \stackrel{?}{=} \frac{20}{5} + 13$

$17 \stackrel{?}{=} 4 + 13$

$17 = 17$

$$11. \quad \frac{b}{2} - 9 = 11$$

$$\frac{b}{2} - 9 + 9 = 11 + 9$$

$$\frac{b}{2} = 20$$

$$2\left(\frac{b}{2}\right) = 2(20)$$

$$b = 40$$

Check:

$$\frac{40}{2} - 9 \stackrel{?}{=} 11$$

$$20 - 9 \stackrel{?}{=} 11$$

$$11 = 11$$

$$13. \quad 7 = \frac{5}{6}c - 8$$

$$7 + 8 = \frac{5}{6}c - 8 + 8$$

$$15 = \frac{5}{6}c$$

$$\frac{6}{5}(15) = \frac{6}{5}\left(\frac{5}{6}c\right)$$

$$18 = c$$

Check:

$$7 \stackrel{?}{=} \frac{5}{6}(18) - 8$$

$$7 \stackrel{?}{=} 15 - 8$$

$$7 = 7$$

$$15. \quad 8y + 3y = 44$$

$$11y = 44$$

$$\frac{11y}{11} = \frac{44}{11}$$

$$y = 4$$

Check:

$$8(4) + 3(4) \stackrel{?}{=} 44$$

$$32 + 12 \stackrel{?}{=} 44$$

$$44 = 44$$

$$17. \quad 11x - 9x = 18$$

$$2x = 18$$

$$\frac{2x}{2} = \frac{18}{2}$$

$$x = 9$$

Check:

$$11(9) - 9(9) \stackrel{?}{=} 18$$

$$99 - 81 \stackrel{?}{=} 18$$

$$18 = 18$$

$$12. \quad -6 = \frac{z}{4} - 3$$

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

$$-3 = \frac{z}{4}$$

$$4(-3) = 4\left(\frac{z}{4}\right)$$

$$-12 = z$$

Check:

$$-6 \stackrel{?}{=} \frac{-12}{4} - 3$$

$$-6 \stackrel{?}{=} -3 - 3$$

$$-6 = -6$$

$$14. \quad 10 = \frac{2}{7}n + 4$$

$$10 - 4 = \frac{2}{7}n + 4 - 4$$

$$6 = \frac{2}{7}n$$

$$\frac{7}{2}(6) = \frac{7}{2}\left(\frac{2}{7}n\right)$$

$$21 = n$$

Check:

$$10 \stackrel{?}{=} \frac{2}{7}(21) + 4$$

$$10 \stackrel{?}{=} 6 + 4$$

$$10 = 10$$

$$16. \quad 2p + 7p = 54$$

$$9p = 54$$

$$\frac{9p}{9} = \frac{54}{9}$$

$$p = 6$$

Check:

$$2(6) + 7(6) \stackrel{?}{=} 54$$

$$12 + 42 \stackrel{?}{=} 54$$

$$54 = 54$$

$$18. \quad 36 = 9x - 3x$$

$$36 = 6x$$

$$\frac{36}{6} = \frac{6x}{6}$$

$$6 = x$$

Check:

$$36 \stackrel{?}{=} 9(6) - 3(6)$$

$$36 \stackrel{?}{=} 54 - 18$$

$$36 = 36$$

$$19. \quad -32 = -5k + 13k$$

$$-32 = 8k$$

$$\frac{-32}{8} = \frac{8k}{8}$$

$$-4 = k$$

Check:

$$-32 \stackrel{?}{=} -5(-4) + 13(-4)$$

$$-32 \stackrel{?}{=} 20 - 52$$

$$-32 = -32$$

$$20. \quad 6 = -7f + 4f$$

$$6 = -3f$$

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

$$-2 = f$$

Check:

$$6 \stackrel{?}{=} -7(-2) + 4(-2)$$

$$6 \stackrel{?}{=} 14 + (-8)$$

$$6 \stackrel{?}{=} 14 - 8$$

$$6 = 6$$

21. D; subtract 6 from each side to isolate the variable.

22. The error is that  $3x$  and  $7$  cannot be combined because they are not like terms.  $7$  should be subtracted from each side giving you  $-3x = 5$ . Then divide each side by  $-3$  giving you  $x = -\frac{5}{3}$ .

23. The first step should be combining  $-2x$  and  $x$  because they are like terms, not dividing by  $-2$ . Combining like terms gives you  $-x = 10$ . Then divide each side by  $-1$  to get  $x = -10$ .

$$24. \quad y = 3x + 7$$

$$-8 = 3x + 7$$

$$-8 - 7 = 3x + 7 - 7$$

$$-15 = 3x$$

$$\frac{-15}{3} = \frac{3x}{3}$$

$$-5 = x$$

$$25. \quad y = 2x + 4$$

$$-10 = 2x + 4$$

$$-10 - 4 = 2x + 4 - 4$$

$$-14 = 2x$$

$$\frac{-14}{2} = \frac{2x}{2}$$

$$-7 = x$$

$$26. \quad y = 10x - 9$$

$$11 = 10x - 9$$

$$11 + 9 = 10x - 9 + 9$$

$$20 = 10x$$

$$\frac{20}{10} = \frac{10x}{10}$$

$$2 = x$$

$$27. \quad 5.6 = 1.1p + 1.2$$

$$5.6 - 1.2 = 1.1p + 1.2 - 1.2$$

$$4.4 = 1.1p$$

$$\frac{4.4}{1.1} = \frac{1.1p}{1.1}$$

$$4 = p$$

Check:

$$5.6 \stackrel{?}{=} 1.1(4) + 1.2$$

$$5.6 \stackrel{?}{=} 4.4 + 1.2$$

$$5.6 = 5.6$$

$$28. \quad 7.2y + 4.7 = 62.3$$

$$7.2y + 4.7 - 4.7 = 62.3 - 4.7$$

$$7.2y = 57.6$$

$$\frac{7.2y}{7.2} = \frac{57.6}{7.2}$$

$$y = 8$$

Check:

$$7.2(8) + 4.7 \stackrel{?}{=} 62.3$$

$$57.6 + 4.7 \stackrel{?}{=} 62.3$$

$$62.3 = 62.3$$

- 29.**  $1.2j - 4.3 = 1.7$  Check:  
 $1.2j - 4.3 + 4.3 = 1.7 + 4.3$   $1.2(5) - 4.3 \stackrel{?}{=} 1.7$   
 $1.2j = 6$   $6 - 4.3 \stackrel{?}{=} 1.7$   
 $\frac{1.2j}{1.2} = \frac{6}{1.2}$   $1.7 = 1.7$   
 $j = 5$
- 30.**  $16 - 2.4d = -8$  Check:  
 $16 - 2.4d - 16 = -8 - 16$   $16 - 2.4(10) \stackrel{?}{=} -8$   
 $-2.4d = -24$   $16 - 24 \stackrel{?}{=} -8$   
 $\frac{-2.4d}{-2.4} = \frac{-24}{-2.4}$   $-8 = -8$   
 $d = 10$
- 31.**  $14.4m - 5.1 = 2.1$  Check:  
 $14.4m - 5.1 + 5.1 = 2.1 + 5.1$   $14.4(0.5) - 5.1 \stackrel{?}{=} 2.1$   
 $14.4m = 7.2$   $7.2 - 5.1 \stackrel{?}{=} 2.1$   
 $\frac{14.4m}{14.4} = \frac{7.2}{14.4}$   $2.1 = 2.1$   
 $m = 0.5$
- 32.**  $-5.3 = 2.2y - 8.6$  Check:  
 $-5.3 + 8.6 = 2.2y - 8.6 + 8.6$   $-5.3 \stackrel{?}{=} 2.2(1.5) - 8.6$   
 $3.3 = 2.2y$   $-5.3 \stackrel{?}{=} 3.3 - 8.6$   
 $\frac{3.3}{2.2} = \frac{2.2y}{2.2}$   $-5.3 = -5.3$   
 $1.5 = y$
- 33.**  $\frac{c}{5.3} + 8.3 = 11.3$  Check:  
 $\frac{c}{5.3} + 8.3 - 8.3 = 11.3 - 8.3$   $\frac{15.9}{5.3} + 8.3 \stackrel{?}{=} 11.3$   
 $\frac{c}{5.3} = 3$   $3 + 8.3 \stackrel{?}{=} 11.3$   
 $5.3\left(\frac{c}{5.3}\right) = 5.3(3)$   $11.3 = 11.3$   
 $c = 15.9$
- 34.**  $3.2 + \frac{x}{2.5} = 4.6$  Check:  
 $3.2 + \frac{x}{2.5} - 3.2 = 4.6 - 3.2$   $3.2 + \frac{3.5}{2.5} \stackrel{?}{=} 4.6$   
 $\frac{x}{2.5} = 1.4$   $3.2 + 1.4 \stackrel{?}{=} 4.6$   
 $2.5\left(\frac{x}{2.5}\right) = 2.5(1.4)$   $4.6 = 4.6$   
 $x = 3.5$
- 35.**  $-1.2 = \frac{z}{4.6} - 2.7$  Check:  
 $-1.2 + 2.7 = \frac{z}{4.6} - 2.7 + 2.7$   $-1.2 \stackrel{?}{=} \frac{6.9}{4.6} - 2.7$   
 $1.5 = \frac{z}{4.6}$   $-1.2 \stackrel{?}{=} 1.5 - 2.7$   
 $4.6(1.5) = 4.6\left(\frac{z}{4.6}\right)$   $-1.2 = -1.2$   
 $6.9 = z$

- 36.**  $3x + 2 = 5$   $3x + 2 = 8$   
 $3x + 2 - 2 = 5 - 2$   $3x + 2 - 2 = 8 - 2$   
 $3x = 3$   $3x = 6$   
 $\frac{3x}{3} = \frac{3}{3}$   $\frac{3x}{3} = \frac{6}{3}$   
 $x = 1$   $x = 2$
- $3x + 2 = 11$   
 $3x + 2 - 2 = 11 - 2$   
 $3x = 9$   
 $\frac{3x}{3} = \frac{9}{3}$   
 $x = 3$

The solution to the equation  $3x + 2 = 14$  is  $x = 4$ . As the right side of the equation increases by 3 and  $x$  is multiplied by 3, each solution increases by 1.

### Problem Solving

- 37.** Let  $n$  = number of classes  
 $24n + 15 = 687$   
 $24n + 15 - 15 = 687 - 15$   
 $24n = 672$   
 $\frac{24n}{24} = \frac{672}{24}$   
 $n = 28$
- The student took 28 classes.
- 38.** Let  $h$  = hours of labor  
 $32h + 76 = 124$   
 $32h + 76 - 76 = 124 - 76$   
 $32h = 48$   
 $\frac{32h}{32} = \frac{48}{32}$   
 $h = 1.5$
- It took 1.5 hours to repair the car.
- 39.** Let  $x$  = number of half-side advertisements  
 $2000 + 800x = 6000$   
 $2000 + 800x - 2000 = 6000 - 2000$   
 $800x = 4000$   
 $\frac{800x}{800} = \frac{4000}{800}$   
 $x = 5$
- The museum can have 5 half-side advertisements.
- 40.** B;  $99 = 7x + 4x$

41. First, figure out how much you would pay per month for a guitar that costs \$542 by letting  $x$  equal the monthly payment and solving the equation.

$$542 = 6x + 50$$

$$542 - 50 = 6x + 50 - 50$$

$$492 = 6x$$

$$\frac{492}{6} = \frac{6x}{6}$$

$$82 = x$$

Because a guitar that costs \$542 would have a monthly payment of \$82 and you can afford to pay up to \$90 per month, you can afford the guitar.

42. a.  $y = 1600x + 2,896,112$

b.  $4,756,505 = 1600x + 2,896,112$

$$4,756,505 - 2,896,112 = 1600x + 2,896,112 - 2,896,112$$

$$1,860,393 = 1600x$$

$$\frac{1,860,393}{1600} = \frac{1600x}{1600}$$

$$1162.75 = x$$

After 1163 days the landfill will reach capacity.

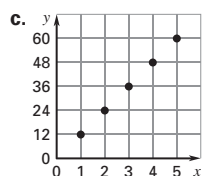
c.  $1600(1200) + 2,900,000 \stackrel{?}{=} 4,756,505$

$$1,920,000 + 2,900,000 \stackrel{?}{=} 4,756,505$$

$$4,820,000 \approx 4,756,505$$

43. a.  $y = 5x + 7x$

Hours	1	2	3	4	5
Marissa's upgrades	5	10	15	20	25
Ryan's upgrades	7	14	21	28	35
Total upgrades	12	24	36	48	60



It would take about 4.5 hours to upgrade all of the computers.

44. The restaurant serves a total of  $400 + 120 = 520$  customers per day. To find after how many days  $x$  the restaurant will have served 2600 customers, solve the equation  $2600 = 520x$ .

$$2600 = 520x$$

$$\frac{2600}{520} = \frac{520x}{520}$$

$$5 = x$$

The restaurant will have served 2600 customers in 5 days.

45. Let  $t =$  time

$$14.6t - 11.3t = 660$$

$$3.3t = 660$$

$$t = 200$$

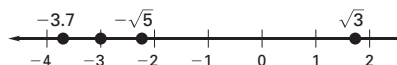
The faster runner will be exactly one lap ahead of the other runner in 200 seconds.

**Quiz for the lessons "Find Square Roots and Compare Real Numbers", "Solve One-Step Equations", and "Solve Two-Step Equations"**

1.

Number	Real number?	Rational number?	Irrational number?
-3	yes	yes	no
$-\sqrt{5}$	yes	no	yes
-3.7	yes	yes	no
$\sqrt{3}$	yes	no	yes

Number	Integer?	Whole number?
-3	yes	no
$-\sqrt{5}$	no	no
-3.7	no	no
$\sqrt{3}$	no	no



From least to greatest, the numbers are  $-3.7$ ,  $-3$ ,  $-\sqrt{5}$ , and  $\sqrt{3}$ .

2. If a number is an irrational number, then it is not a negative number.

The statement is false.

Sample answer: A counterexample is  $-\sqrt{7}$  because  $-\sqrt{7}$  is irrational and a negative number.

3.  $-7b = -56$

$$b = 8$$

Check:

$$-7(8) \stackrel{?}{=} -56$$

$$-56 = -56$$

4.  $\frac{z}{4} = 6$

$$4\left(\frac{z}{4}\right) = 4(6)$$

$$z = 24$$

Check:

$$\frac{24}{4} \stackrel{?}{=} 6$$

$$6 = 6$$

5.  $-\frac{4}{3}t = -12$

$$-\frac{3}{4}\left(-\frac{4}{3}t\right) = -\frac{3}{4}(-12)$$

$$t = 9$$

Check:

$$-\frac{4}{3}(9) \stackrel{?}{=} -12$$

$$-12 = -12$$

6.  $9w - 4 = 14$

$9w = 18$

$w = 2$

Check:

$9(2) - 4 \stackrel{?}{=} 14$

$18 - 4 \stackrel{?}{=} 14$

$14 = 14$

8.  $66 = 4m + 7m$

$66 = 11m$

$6 = m$

Check:

$66 \stackrel{?}{=} 4(6) + 7(6)$

$66 \stackrel{?}{=} 24 + 42$

$66 = 66$

7.  $23 = 1 - d$

$22 = -d$

$-22 = d$

Check:

$23 \stackrel{?}{=} 1 - (-22)$

$23 \stackrel{?}{=} 1 + 22$

$23 = 23$

**Problem Solving Workshop for the lesson "Solve Two-Step Equations"**

1. Method 1: Let  $x$  = team members who are not club members

$775 = 600 + 25x$

$775 - 600 = 600 + 25x - 600$

$175 = 25x$

$\frac{175}{25} = \frac{25x}{25}$

$7 = x$

7 team members are not club members.

Method 2:

Team members not club members	Total amount paid
0	\$600
1	\$625
2	\$650
3	\$675
4	\$700
5	\$725
6	\$750
7	\$775

The table shows that the total amount paid is \$775 when there are 7 team members who aren't club members.

Number of team members	Amount each would pay (\$)
2	300
3	200
4	150
5	120
6	100
7	85.71
8	75

There must be 8 players on your team for you to pay \$75 plus another \$25 for not being a club member.

3. Method 1: Let  $c$  = number of chairs

$370 = 220 + 35c$

$370 - 220 = 220 + 35c - 220$

$150 = 35c$

$\frac{150}{35} = \frac{35c}{35}$

$4.3 = c$

You can buy 4 chairs.

Method 2:

Number of chairs	Total (\$) cost
1	255
2	290
3	325
4	360
5	395

The table shows that you can afford 4 chairs but not 5.

**Quiz for the lessons "Find Square Roots and Compare Real Numbers" and "Solve One-Step Equations"**

1.  $-3$ : real, rational, integer;  $-\sqrt{5}$ : irrational;  $-3.7$ : real, rational;  $\sqrt{3}$ ;  $\sqrt{5}$ : irrational; Order is  $-3.7, -3, -\sqrt{5}, \sqrt{3}$

2. If a number is irrational, then it is not a negative number; false. Sample answer:  $-\sqrt{5}$  is an irrational number and it is negative.

3. Divide each side by  $-7$ ;  $b = 8$

4. Multiply each side by 4;  $z = 24$

5. Multiply each side by  $-\frac{3}{4}$ ;  $t = 9$

6.  $9w - 4 = 14$ ;  $9w = 18$ ;  $w = 2$

7.  $23 = 1 - d$ ;  $22 = -d$ ;  $-22 = d$

8.  $66 = 4m + 11m$ ;  $66 = 11m$ ;  $6 = m$

## Lesson 2.4 Solve Multi-Step Equations

### Guided Practice for the lesson "Solve Multi-Step Equations"

$$1. \begin{aligned} 9d - 2d + 4 &= 32 \\ 7d + 4 &= 32 \\ 7d &= 28 \\ d &= 4 \end{aligned}$$

Check:

$$\begin{aligned} 9(4) - 2(4) + 4 &\stackrel{?}{=} 32 \\ 36 - 8 + 4 &\stackrel{?}{=} 32 \\ 32 &= 32 \end{aligned}$$

$$3. \begin{aligned} 6x - 2(x - 5) &= 46 \\ 6x - 2x + 10 &= 46 \\ 4x + 10 &= 46 \\ 4x &= 36 \\ x &= 9 \end{aligned}$$

$$\begin{aligned} 2. \begin{aligned} 2w + 3(w + 4) &= 27 \\ 2w + 3w + 12 &= 27 \\ 5w + 12 &= 27 \\ 5w &= 15 \\ w &= 3 \end{aligned} \\ \text{Check:} \\ 2(3) + 3(3 + 4) &\stackrel{?}{=} 27 \\ 6 + 3(7) &\stackrel{?}{=} 27 \\ 6 + 21 &\stackrel{?}{=} 27 \\ 27 &= 27 \end{aligned}$$

$$4. \begin{aligned} \frac{3}{4}(z - 6) &= 12 \\ \frac{4}{3} \cdot \frac{3}{4}(z - 6) &= \frac{4}{3}(12) \\ z - 6 &= 16 \\ z &= 22 \end{aligned}$$

$$\begin{aligned} \text{Check:} \\ \frac{3}{4}(22 - 6) &\stackrel{?}{=} 12 \\ \frac{3}{4}(16) &\stackrel{?}{=} 12 \\ 12 &= 12 \end{aligned}$$

$$5. \begin{aligned} \frac{2}{5}(3r + 4) &= 10 \\ \frac{5}{2} \cdot \frac{2}{5}(3r + 4) &= \frac{5}{2}(10) \\ 3r + 4 &= 25 \\ 3r &= 21 \\ r &= 7 \end{aligned}$$

$$\begin{aligned} \text{Check:} \\ \frac{2}{5}(3 \cdot 7 + 4) &\stackrel{?}{=} 10 \\ \frac{2}{5}(21 + 4) &\stackrel{?}{=} 10 \\ \frac{2}{5}(25) &\stackrel{?}{=} 10 \\ 10 &= 10 \end{aligned}$$

$$6. \begin{aligned} -\frac{4}{5}(4a - 1) &= 28 \\ -\frac{5}{4} \left( -\frac{4}{5}(4a - 1) \right) &= -\frac{5}{4}(28) \\ 4a - 1 &= -35 \\ 4a &= -34 \\ a &= -8.5 \end{aligned}$$

$$\begin{aligned} \text{Check:} \\ -\frac{4}{5}[4 \cdot (-8.5) - 1] &\stackrel{?}{=} 28 \\ -\frac{4}{5}(-34 - 1) &\stackrel{?}{=} 28 \\ -\frac{4}{5}(-35) &\stackrel{?}{=} 28 \\ 28 &= 28 \end{aligned}$$

$$7. \begin{aligned} \text{Let } s &\text{ be the number of searchers on each team.} \\ \text{Let } 1 + s &\text{ be the total number of campers on each team.} \\ 21 &= 4 \cdot (1 + s) \\ 21 &= 4 + 4s \\ 21 - 4 &= 4 - 4 + 4s \\ 17 &= 4s \\ \frac{17}{4} &= \frac{4s}{4} \\ 4.25 &= s \end{aligned}$$

Because 5 searchers per team would require a total of  $4(1 + 5) = 24$  campers, 5 searchers will be on one team and 4 searchers on the other teams.

### Exercises for the lesson "Solve Multi-Step Equations"

#### Skill Practice

$$1. \text{ The reciprocal of the fraction } \frac{3}{5} \text{ is } \frac{5}{3}.$$

$$2. \text{ Use the distributive property to multiply } (4y - 7) \text{ by } 3, \text{ giving you } 12y - 21 = 6.$$

Add 21 to each side, giving you  $12y = 27$ . Divide each side by 12 to get  $y = 2.25$ .

$$3. \begin{aligned} p + 2p - 3 &= 6 \\ 3p - 3 &= 6 \\ 3p &= 9 \\ p &= 3 \end{aligned}$$

Check:

$$\begin{aligned} 3 + 2(3) - 3 &\stackrel{?}{=} 6 \\ 3 + 6 - 3 &\stackrel{?}{=} 6 \\ 6 &= 6 \end{aligned}$$

$$4. \begin{aligned} 12v + 14 + 10v &= 80 \\ 22v + 14 &= 80 \\ 22v &= 66 \\ v &= 3 \end{aligned}$$

Check:

$$\begin{aligned} 12(3) + 14 + 10(3) &\stackrel{?}{=} 80 \\ 36 + 14 + 30 &\stackrel{?}{=} 80 \\ 80 &= 80 \end{aligned}$$

$$5. \begin{aligned} 11w - 9 - 7w &= 15 \\ 4w - 9 &= 15 \\ 4w &= 24 \\ w &= 6 \end{aligned}$$

Check:

$$\begin{aligned} 11(6) - 9 - 7(6) &\stackrel{?}{=} 15 \\ 66 - 9 - 42 &\stackrel{?}{=} 15 \\ 15 &= 15 \end{aligned}$$

$$6. \begin{aligned} 5a + 3 - 3a &= -7 \\ 2a - 3 &= -7 \\ 2a &= -10 \\ a &= -5 \end{aligned}$$

Check:

$$\begin{aligned} 5(-5) + 3 - 3(-5) &\stackrel{?}{=} -7 \\ -25 + 3 + 15 &\stackrel{?}{=} -7 \\ -7 &= -7 \end{aligned}$$

$$7. \begin{aligned} 6c - 8 - 2c &= -16 \\ 4c - 8 &= -16 \\ 4c &= -8 \\ c &= -2 \end{aligned}$$

Check:

$$\begin{aligned} 6(-2) - 8 - 2(-2) &\stackrel{?}{=} -16 \\ -12 - 8 + 4 &\stackrel{?}{=} -16 \\ -16 &= -16 \end{aligned}$$

$$8. \begin{aligned} 9 = 7z - 13z - 21 \\ 9 = -6z - 21 \\ 30 = -6z \\ -5 = z \end{aligned}$$

Check:

$$\begin{aligned} 9 &\stackrel{?}{=} 7(-5) - 13(-5) - 21 \\ 9 &\stackrel{?}{=} -35 + 65 - 21 \\ 9 &= 9 \end{aligned}$$

$$9. \begin{aligned} -2 = 3y - 18 - 5y \\ -2 = -2y - 18 \\ 16 = -2y \\ -8 = y \end{aligned}$$

Check:

$$\begin{aligned} -2 &\stackrel{?}{=} 3(-8) - 18 - 5(-8) \\ -2 &\stackrel{?}{=} -24 - 18 + 40 \\ -2 &= -2 \end{aligned}$$

$$10. \begin{aligned} 23 = -4m + 2 + m \\ 23 = -3m + 2 \\ 21 = -3m \\ -7 = m \end{aligned}$$

Check:

$$\begin{aligned} 23 &\stackrel{?}{=} -4(-7) + 2 + (-7) \\ 23 &\stackrel{?}{=} 28 + 2 - 7 \\ 23 &= 23 \end{aligned}$$

$$11. \begin{aligned} 35 = -5 + 2x - 7x \\ 35 = -5 - 5x \\ 40 = -5x \\ -8 = x \end{aligned}$$

Check:

$$\begin{aligned} 35 &\stackrel{?}{=} -5 + 2(-8) - 7(-8) \\ 35 &\stackrel{?}{=} -5 - 16 + 56 \\ 35 &= 35 \end{aligned}$$

$$12. \begin{aligned} 3 + 4(z + 5) &= 31 \\ 3 + 4z + 20 &= 31 \\ 4z + 23 &= 31 \\ 4z &= 8 \\ z &= 2 \end{aligned}$$

Check:

$$\begin{aligned} 3 + 4(2 + 5) &\stackrel{?}{=} 31 \\ 3 + 4(7) &\stackrel{?}{=} 31 \\ 3 + 28 &\stackrel{?}{=} 31 \\ 31 &= 31 \end{aligned}$$



13.  $14 + 2(4g - 3) = 40$

$14 + 8g - 6 = 40$

$8g + 8 = 40$

$8g = 32$

$g = 4$

Check:

$14 + 2(4 \cdot 4 - 3) \stackrel{?}{=} 40$

$14 + 2(16 - 3) \stackrel{?}{=} 40$

$14 + 2(13) \stackrel{?}{=} 40$

$14 + 26 \stackrel{?}{=} 40$

$40 = 40$

15.  $5h + 2(11 - h) = -5$

$5h + 22 - 2h = -5$

$3h + 22 = -5$

$3h = -27$

$h = -9$

Check:

$5(-9) + 2[11 - (-9)] \stackrel{?}{=} -5$

$-45 + 2(20) \stackrel{?}{=} -5$

$-45 + 40 \stackrel{?}{=} -5$

$-5 = -5$

17.  $-3 = 12y - 5(2y - 7)$

$-3 = 12y - 10y + 35$

$-3 = 2y + 35$

$-38 = 2y$

$-19 = y$

Check:

$-3 \stackrel{?}{=} 12(-19) - 5(2(-19) - 7)$

$-3 \stackrel{?}{=} -228 - 5(-38 - 7)$

$-3 \stackrel{?}{=} -228 - 5(-45)$

$-3 \stackrel{?}{=} -228 + 225$

$-3 = -3$

18. C;  $7v - (6 - 2v) = 12$

$7v - 6 + 2v = 12$

$9v - 6 = 12$

$9v = 18$

$v = 2$

19.  $\frac{1}{3}(d + 3) = 5$

$\frac{3}{1} \cdot \frac{1}{3}(d + 3) = \frac{3}{1}(5)$

$d + 3 = 15$

$d = 12$

Check:

$\frac{1}{3}(12 + 3) \stackrel{?}{=} 5$

$\frac{1}{3}(15) \stackrel{?}{=} 5$

$5 = 5$

14.  $5m + 2(m + 1) = 23$

$5m + 2m + 2 = 23$

$7m + 2 = 23$

$7m = 21$

$m = 3$

Check:

$5(3) + 2(3 + 1) \stackrel{?}{=} 23$

$5(3) + 2(4) \stackrel{?}{=} 23$

$15 + 8 \stackrel{?}{=} 23$

$23 = 23$

16.  $27 = 3c - 3(6 - 2c)$

$27 = 3c - 18 + 6c$

$27 = 9c - 18$

$45 = 9c$

$5 = c$

Check:

$27 \stackrel{?}{=} 3(5) - 3(6 - 2 \cdot 5)$

$27 \stackrel{?}{=} 15 - 3(6 - 10)$

$27 \stackrel{?}{=} 15 - 3(-4)$

$27 \stackrel{?}{=} 15 + 12$

$27 = 27$

21.  $\frac{4}{3}(7 - n) = 12$

$\frac{3}{4} \cdot \frac{4}{3}(7 - n) = \frac{3}{4}(12)$

$7 - n = 9$

$-n = 2$

$n = -2$

Check:

$\frac{4}{3}[7 - (-2)] \stackrel{?}{=} 12$

$\frac{4}{3}(9) \stackrel{?}{=} 12$

$12 = 12$

22.  $4 = \frac{2}{9}(4y - 2)$

$\frac{9}{2}(4) = \frac{9}{2} \cdot \frac{2}{9}(4y - 2)$

$18 = 4y - 2$

$20 = 4y$

$5 = y$

Check:

$4 \stackrel{?}{=} \frac{2}{9}(4 \cdot 5 - 2)$

$4 \stackrel{?}{=} \frac{2}{9}(20 - 2)$

$4 \stackrel{?}{=} \frac{2}{9}(18)$

$4 = 4$

23.  $-32 = \frac{8}{7}(3w - 1)$

$\frac{7}{8}(-32) = \frac{7}{8} \cdot \frac{8}{7}(3w - 1)$

$-28 = 3w - 1$

$-27 = 3w$

$-9 = w$

Check:

$-32 \stackrel{?}{=} \frac{8}{7}[3(-9) - 1]$

$-32 \stackrel{?}{=} \frac{8}{7}(-27 - 1)$

$-32 \stackrel{?}{=} \frac{8}{7}(-28)$

$-32 = -32$

24.  $-14 = \frac{2}{5}(9 - 2b)$

$\frac{5}{2}(-14) = \frac{5}{2} \cdot \frac{2}{5}(9 - 2b)$

$-35 = 9 - 2b$

$-44 = -2b$

$22 = b$

Check:

$-14 \stackrel{?}{=} \frac{2}{5}(9 - 2 \cdot 22)$

$-14 \stackrel{?}{=} \frac{2}{5}(9 - 44)$

$-14 \stackrel{?}{=} \frac{2}{5}(-35)$

$-14 = -14$

25. The error was made when using the distributive property.

 $-3$  times  $-6$  is  $18$ , not  $-18$ .

$5x - 3(x - 6) = 2$

$5x - 3x + 18 = 2$

$2x + 18 = 2$

$2x = -16$

$x = -8$

26. The error is that the left side was multiplied by the reciprocal of the fraction  $\frac{1}{2}$ , but the right side was multiplied by  $\frac{1}{2}$ .

$\frac{1}{2}(2x - 10) = 4$

$\frac{2}{1} \cdot \frac{1}{2}(2x - 10) = \frac{2}{1} \cdot 4$

$2x - 10 = 8$

$2x = 18$

$x = 9$

$$\begin{aligned}
 27. \quad & 8.9 + 1.2(3a - 1) = 14.9 \\
 & 8.9 + 3.6a - 1.2 = 14.9 \\
 & 3.6a + 7.7 = 14.9 \\
 & 3.6a = 7.2 \\
 & a = 2
 \end{aligned}$$

Check:

$$\begin{aligned}
 8.9 + 1.2(3 \cdot 2 - 1) &\stackrel{?}{=} 14.9 \\
 8.9 + 1.2(6 - 1) &\stackrel{?}{=} 14.9 \\
 8.9 + 1.2(5) &\stackrel{?}{=} 14.9 \\
 8.9 + 6 &\stackrel{?}{=} 14.9 \\
 14.9 &= 14.9
 \end{aligned}$$

$$\begin{aligned}
 28. \quad & -11.2 + 4(2.1 + q) = -0.8 \\
 & -11.2 + 8.4 + 4q = -0.8 \\
 & -2.8 + 4q = -0.8 \\
 & 4q = 2 \\
 & q = 0.5
 \end{aligned}$$

Check:

$$\begin{aligned}
 -11.2 + 4(2.1 + 0.5) &\stackrel{?}{=} -0.8 \\
 -11.2 + 4(2 \cdot 6) &\stackrel{?}{=} -0.8 \\
 -11.2 + 10.4 &\stackrel{?}{=} -0.8 \\
 -0.8 &= -0.8
 \end{aligned}$$

$$\begin{array}{ll}
 29. \quad 1.3t + 3(t + 8.2) = 37.5 & 30. \quad 1.6 = 7.6 - 5(k + 1.1) \\
 1.3t + 3t + 24.6 = 37.5 & 1.6 = 7.6 - 5k - 5.5 \\
 4.3t + 24.6 = 37.5 & 1.6 = 2.1 - 5k \\
 4.3t = 12.9 & -0.5 = -5k \\
 t = 3 & 0.1 = k
 \end{array}$$

Check:

$$\begin{array}{ll}
 1.3(3) + 3(3 + 8.2) &\stackrel{?}{=} 37.5 & 1.6 &\stackrel{?}{=} 7.6 - 5(0.1 + 1.1) \\
 3.9 + 3(11.2) &\stackrel{?}{=} 37.5 & 1.6 &\stackrel{?}{=} 7.6 - 5(1.2) \\
 3.9 + 33.6 &\stackrel{?}{=} 37.5 & 1.6 &\stackrel{?}{=} 7.6 - 6 \\
 37.5 &= 37.5 & 1.6 &= 1.6
 \end{array}$$

$$\begin{aligned}
 31. \quad & 0.5 = 4.1x - 2(1.3x - 4) \\
 & 0.5 = 4.1x - 2.6x + 8 \\
 & 0.5 = 1.5x + 8 \\
 & -7.5 = 1.5x \\
 & -5 = x
 \end{aligned}$$

Check:

$$\begin{aligned}
 0.5 &\stackrel{?}{=} 4.1(-5) - 2[1.3(-5) - 4] \\
 0.5 &\stackrel{?}{=} -20.5 - 2(-6.5 - 4) \\
 0.5 &\stackrel{?}{=} -20.5 - 2(-10.5) \\
 0.5 &\stackrel{?}{=} -20.5 + 21 \\
 0.5 &= 0.5
 \end{aligned}$$

$$\begin{aligned}
 32. \quad & 8.7 = 3.5m - 2.5(5.4 - 6m) \\
 & 8.7 = 3.5m - 13.5 + 15m \\
 & 8.7 = 18.5m - 13.5 \\
 & 22.2 = 18.5m \\
 & 1.2 = m
 \end{aligned}$$

Check:

$$\begin{aligned}
 8.7 &\stackrel{?}{=} 3.5(1.2) - 2.5(5.4 - 6 \cdot 1.2) \\
 8.7 &\stackrel{?}{=} 4.2 - 2.5(5.4 - 7.2) \\
 8.7 &\stackrel{?}{=} 4.2 - 2.5(-1.8) \\
 8.7 &\stackrel{?}{=} 4.2 + 4.5 \\
 8.7 &= 8.7
 \end{aligned}$$

$$33. \quad \text{First, convert 288 inches to feet: } 288 \text{ inches} \cdot \frac{1 \text{ foot}}{12 \text{ inches}} = 24 \text{ feet.}$$

$$\begin{aligned}
 x + 4 + 4x + 10(x - 1) &= 24 \\
 5x + 4 + 10x - 10 &= 24 \\
 15x - 6 &= 24 \\
 15x &= 30 \\
 x &= 2
 \end{aligned}$$

$$34. \quad \text{First, convert 2600 centimeters to meters:}$$

$$2600 \frac{\text{centimeters}}{\text{centimeters}} \cdot \frac{1 \text{ meter}}{100 \text{ centimeters}} = 26 \text{ meters.}$$

$$\begin{aligned}
 2(x + 3) + 2(2x - 6) &= 26 \\
 2x + 6 + 4x - 12 &= 26 \\
 6x - 6 &= 26 \\
 6x &= 32 \\
 x &= 5\frac{1}{3}
 \end{aligned}$$

$$35. \quad \text{By using the perimeter formula } P = 2l + 2w, \text{ we can solve for the width of the rectangle. Let } w \text{ represent the width and substitute } (3.5 + w) \text{ for the length.}$$

$$\begin{aligned}
 2l + 2w &= P \\
 2(3.5 + w) + 2w &= 31 \\
 7 + 2w + 2w &= 31 \\
 7 + 4w &= 31 \\
 4w &= 24 \\
 w &= 6
 \end{aligned}$$

The width is 6 inches and the length is  $6 + 3.5$ , or 9.5 inches.

$$\begin{array}{ll}
 36. \quad \text{a. } 9(x - 4) = 72 & \text{b. } 8(x + 5) = 60 \\
 x - 4 = 8 & x + 5 = 7.5 \\
 x = 12 & x = 2.5
 \end{array}$$

You should use this method when both sides of the equation can be evenly divided by the number outside the parentheses.

$$\begin{aligned}
 37. \quad & 2n + (2n + 2) + (2n + 4) = 54 \\
 & 6n + 6 = 54 \\
 & 6n = 48 \\
 & n = 8
 \end{aligned}$$

First integer is  $2n = 2 \cdot 8 = 16$ . The integers are 16, 18, and 20.

### Problem Solving

38. Let  $t$  = number of tickets.

$$32.50t + 3.30t + 5.90 = 220.70$$

$$35.80t + 5.90 = 220.70$$

$$35.80t = 214.80$$

$$t = 6$$

There were 6 tickets purchased.

39. Let  $x$  = space between posters.

$$3 + 2 + x + 2 + x + 2 + 3 = 13.5$$

$$2x + 12 = 13.5$$

$$2x = 1.5$$

$$x = 0.75$$

You should leave 0.75 feet between the posters.

40. Let  $t$  = time for front crawl.

$$500 = 45t + 35(12 - t)$$

$$500 = 45t + 420 - 35t$$

$$500 = 10t + 420$$

$$80 = 10t$$

$$8 = t$$

You spent 8 minutes swimming the front crawl.

41. a. Let  $t$  = time Busk crew spent working.

$$137t + 115(t - 0.75) = 8473$$

$$137t + 115t - 86.25 = 8473$$

$$252t - 86.25 = 8473$$

$$252t = 8559.25$$

$$t = 33.97$$

It took about 34 months to complete the tunnel.

- b.  $d = rt$

$$921 = 3r$$

$$307 = r$$

The remainder of the tunnel was completed at a rate of 307 feet per month.

- c. Before the merge, they were working at a rate of  $115 + 137 = 252$  feet per month. After the merge, they were working at a rate of 307 feet per month (see part(b).) The tunnel was being completed more rapidly after the merge.

42. a.  $y = 74.5x + 750$

$$y = 27.50x + 17x + 30x + 750$$

$$2314.50 = 74.5x + 750$$

$$1564.5 = 74.5x$$

$$21 = x$$

The roof has about 21 squares.

b.

Number of squares	Total cost (\$)
5	1122.50
10	1495
15	1867.50
20	2240
25	2612.50

The answer in part (a), 21 squares, makes sense because the total cost is slightly more than the total cost to shingle 20 squares.

43. Let  $q$  be the number of quarters. Then  $q + 8$  is the number of dimes. The equation  $25q + 10(q + 8) = 280$  represents the situation.

$$25q + 10(q + 8) = 280$$

$$25q + 10q + 80 = 280$$

$$35q = 200$$

$$q = 5\frac{5}{7}$$

The number of quarters must be a whole number, so Jan must be mistaken.

### Lesson 2.5 Solve Equations with Variables on Both Sides

#### Guided Practice for the lesson "Solve Equations with Variables on Both Sides"

1.  $24 - 3m = 5m$

Check:

$$24 = 8m$$

$$24 - 3(3) \stackrel{?}{=} 5(3)$$

$$3 = m$$

$$24 - 9 \stackrel{?}{=} 15$$

$$15 = 15$$

2.  $20 + c = 4c - 7$

Check:

$$20 = 3c - 7$$

$$20 + 9 \stackrel{?}{=} 4(9) - 7$$

$$27 = 3c$$

$$29 \stackrel{?}{=} 36 - 7$$

$$9 = c$$

$$29 = 29$$

3.  $9 - 3k = 17 - 2k$

Check:

$$9 = 17 + k$$

$$9 - 3(-8) \stackrel{?}{=} 17 - 2(-8)$$

$$-8 = k$$

$$9 + 24 \stackrel{?}{=} 17 + 16$$

$$33 = 33$$

4.  $5z - 2 = 2(3z - 4)$

Check:

$$5z - 2 = 6z - 8$$

$$5(6) - 2 \stackrel{?}{=} 2(3 \cdot 6 - 4)$$

$$-2 = z - 8$$

$$30 - 2 \stackrel{?}{=} 2(18 - 4)$$

$$6 = z$$

$$28 \stackrel{?}{=} 2(14)$$

$$28 = 28$$

5.  $3 - 4a = 5(a - 3)$

Check:

$$3 - 4a = 5a - 15$$

$$3 - 4(2) \stackrel{?}{=} 5(2 - 3)$$

$$3 = 9a - 15$$

$$3 - 8 \stackrel{?}{=} 5(-1)$$

$$18 = 9a$$

$$-5 = -5$$

$$2 = a$$

6.  $8y - 6 = \frac{2}{3}(6y + 15)$

Check:

$$8y - 6 = 4y + 10$$

$$8(4) - 6 \stackrel{?}{=} \frac{2}{3}(6 \cdot 4 + 15)$$

$$4y - 6 = 10$$

$$32 - 6 \stackrel{?}{=} \frac{2}{3}(24 + 15)$$

$$4y = 16$$

$$26 \stackrel{?}{=} \frac{2}{3}(39)$$

$$y = 4$$

$$26 = 26$$

$$7. \quad 50 + 6x = 2(67 - 4x)$$

$$50 + 6x = 134 - 8x$$

$$50 + 14x = 134$$

$$14x = 84$$

$$x = 6$$

The number of new cars sold will be twice the number of used cars sold in 6 years.

$$8. \quad 9z + 12 = 9(z + 3)$$

$$9z + 12 = 9z + 27$$

$$12 \neq 27$$

The equation has no solution.

$$9. \quad 7w + 1 = 8w + 1$$

$$1 = w + 1$$

$$0 = w$$

$$10. \quad 3(2a + 2) = 2(3a + 3)$$

$$6a + 6 = 6a + 6$$

The statement  $6a + 6 = 6a + 6$  is true for all values of  $a$ . The solution is all real numbers.

### Exercises for the lesson "Solve Equations with Variables on Both Sides"

#### Skill Practice

- An equation that is true for all values of the variable is called an *identity*.
- The equation  $4x + 3 = 4x + 1$  has no solution because 4 times any number plus 3 cannot equal 4 times the same number plus 1.

$$4x + 3 = 4x + 1$$

$$4x - 4x + 3 = 4x - 4x + 1$$

$$3 \neq 1$$

$$3. \quad 8t + 5 = 6t + 1 \qquad 4. \quad k + 1 = 3k - 1$$

$$2t + 5 = 1 \qquad 1 = 2k - 1$$

$$2t = -4 \qquad 2 = 2k$$

$$t = -2 \qquad 1 = k$$

Check:

$$8(-2) + 5 \stackrel{?}{=} 6(-2) + 1$$

$$-16 + 5 \stackrel{?}{=} -12 + 1$$

$$-11 = -11$$

Check:

$$1 + 1 \stackrel{?}{=} 3(1) - 1$$

$$2 \stackrel{?}{=} 3 - 1$$

$$2 = 2$$

$$5. \quad 8c + 5 = 4c - 11 \qquad 6. \quad 8 + 4m = 9m - 7$$

$$4c + 5 = -11 \qquad 8 = 5m - 7$$

$$4c = -16 \qquad 15 = 5m$$

$$c = -4 \qquad 3 = m$$

Check:

$$8(-4) + 5 \stackrel{?}{=} 4(-4) - 11$$

$$-32 + 5 \stackrel{?}{=} -16 - 11$$

$$-27 = -27$$

Check:

$$8 + 4(3) \stackrel{?}{=} 9(3) - 7$$

$$8 + 12 \stackrel{?}{=} 27 - 7$$

$$20 = 20$$

$$7. \quad 10b + 18 = 8b + 4 \qquad \text{Check:}$$

$$2b + 18 = 4 \qquad 10(-7) + 18 \stackrel{?}{=} 8(-7) + 4$$

$$2b = -14 \qquad -70 + 18 \stackrel{?}{=} -56 + 4$$

$$b = -7 \qquad -52 = -52$$

$$8. \quad 19 - 13p = -17p - 5$$

$$19 + 4p = -5$$

$$4p = -24$$

$$p = -6$$

Check:

$$19 - 13(-6) \stackrel{?}{=} -17(-6) - 5$$

$$19 + 78 \stackrel{?}{=} 102 - 5$$

$$97 = 97$$

$$9. \quad 9a = 6(a + 4) \qquad \text{Check:}$$

$$9a = 6a + 24 \qquad 9(8) \stackrel{?}{=} 6(8 + 4)$$

$$3a = 24 \qquad 72 \stackrel{?}{=} 6(12)$$

$$a = 8 \qquad 72 = 72$$

$$10. \quad 5h - 7 = 2(h + 1) \qquad \text{Check:}$$

$$5h - 7 = 2h + 2 \qquad 5(3) - 7 \stackrel{?}{=} 2(3 + 1)$$

$$3h - 7 = 2 \qquad 15 - 7 \stackrel{?}{=} 2(4)$$

$$3h = 9 \qquad 8 = 8$$

$$h = 3$$

$$11. \quad 3(d + 12) = 8 - 4d \qquad \text{Check:}$$

$$3d + 36 = 8 - 4d \qquad 3(-4 + 12) \stackrel{?}{=} 8 - 4(-4)$$

$$7d + 36 = 8 \qquad 3(8) \stackrel{?}{=} 8 + 16$$

$$7d = -28 \qquad 24 = 24$$

$$d = -4$$

$$12. \quad 7(r + 7) = 5r + 59 \qquad \text{Check:}$$

$$7r + 49 = 5r + 59 \qquad 7(5 + 7) \stackrel{?}{=} 5(5) + 59$$

$$2r + 49 = 59 \qquad 7(12) \stackrel{?}{=} 25 + 59$$

$$2r = 10 \qquad 84 = 84$$

$$r = 5$$

$$13. \quad 40 + 14j = 2(-4j - 13)$$

$$40 + 14j = -8j - 26$$

$$40 + 22j = -26$$

$$22j = -66$$

$$j = -3$$

Check:

$$40 + 14(-3) \stackrel{?}{=} 2(-4(-3) - 13)$$

$$40 - 42 \stackrel{?}{=} 2(12 - 13)$$

$$-2 \stackrel{?}{=} 2(-1)$$

$$-2 = -2$$

- 14.**  $5(n + 2) = \frac{3}{5}(5 + 10n)$       Check:  
 $5n + 10 = 3 + 6n$        $5(7 + 2) \stackrel{?}{=} \frac{3}{5}(5 + 10 \cdot 7)$   
 $10 = 3 + n$        $5(9) \stackrel{?}{=} \frac{3}{5}(5 + 70)$   
 $7 = n$        $45 \stackrel{?}{=} \frac{3}{5}(75)$   
 $45 = 45$
- 15.** C;      **16.** D;  
 $8x + 2x = 15x - 10$        $4y + y + 1 = 7(y - 1)$   
 $10x = 15x - 10$        $5y + 1 = 7y - 7$   
 $-5x = -10$        $1 = 2y - 7$   
 $x = 2$        $8 = 2y$   
 $4 = y$
- 17.** First use the distributive property to get  
 $6z - 15 = 2z + 13.$   
Then subtract  $2z$  from each side to get  $4z - 15 = 13.$   
Next add 15 to each side to get  $4z = 28.$  Finally, divide each side by 4 to get  $z = 7.$
- 18.**  $w + 3 = w + 6$       **19.**  $16d = 22 + 5d$   
 $3 \neq 6$        $11d = 22$   
no solution       $d = 2$
- 20.**  $8z = 4(2z + 1)$       **21.**  $12 + 5v = 2v - 9$   
 $8z = 8z + 4$        $12 + 3v = -9$   
 $0 \neq 4$        $3v = -21$   
no solution       $v = -7$
- 22.**  $22x + 70 = 17x - 95$       **23.**  $2 - 15n = 5(-3n + 2)$   
 $5x + 70 = -95$        $2 - 15n = -15n + 10$   
 $5x = -165$        $2 \neq 10$   
 $x = -33$       no solution
- 24.**  $12y + 6 = 6(2y + 1)$   
 $12y + 6 = 12y + 6$   
The equation is an identity, so the solution is all real numbers.
- 25.**  $5(1 + 4m) = 2(3 + 10m)$   
 $5 + 20m = 6 + 20m$   
 $5 \neq 6$   
no solution
- 26.**  $2(3g + 2) = \frac{1}{2}(12g + 8)$   
 $6g + 4 = 6g + 4$   
The equation is an identity, so the solution is all real numbers.
- 27.** The error is that the distributive property was not used correctly on the left side of the equation.  
 $3(x + 5) = 3x + 15$   
 $3x + 15 = 3x + 15$   
The equation is an identity, so the solution is all real numbers.

- 28.** The solution is not only zero. This equation is true for all values of  $y$ , making it an identity.
- 29.** *Sample answer:*  $5x + 4 = 5x$ ; the number  $5x$  cannot be equal to 4 more than itself.
- 30.**  $8w - 8 - 6w = 4w - 7$   
 $2w - 8 = 4w - 7$   
 $-8 = 2w - 7$   
 $-1 = 2w$   
 $-\frac{1}{2} = w$
- 31.**  $3x - 4 = 2x + 8 - 5x$   
 $3x - 4 = 8 - 3x$   
 $6x - 4 = 8$   
 $6x = 12$   
 $x = 2$
- 32.**  $-15c + 7c + 1 = 3 - 8c$   
 $-8c + 1 = 3 - 8c$   
 $-8c + 1 + 8c = 3 - 8c + 8c$   
 $1 \neq 3$   
no solution
- 33.**  $\frac{3}{2} + \frac{3}{4}a = \frac{1}{4}a - \frac{1}{2}$       **34.**  $\frac{5}{8}m - \frac{3}{8} = \frac{1}{2}m + \frac{7}{8}$   
 $\frac{3}{2} + \frac{1}{2}a = -\frac{1}{2}$        $\frac{1}{8}m - \frac{3}{8} = \frac{7}{8}$   
 $\frac{1}{2}a = -2$        $\frac{1}{8}m = \frac{5}{4}$   
 $\frac{2}{1} \cdot \frac{1}{2}a = \frac{2}{1}(-2)$        $\frac{8}{1} \cdot \frac{1}{8}m = \frac{8}{1} \cdot \frac{5}{4}$   
 $a = -4$        $m = 10$
- 35.**  $n - 10 = \frac{5}{6}n - 7 - \frac{1}{3}n$       **36.**  $3.7b + 7 = 8.1b - 19.4$   
 $n - 10 = \frac{1}{2}n - 7$        $7 = 4.4b - 19.4$   
 $\frac{1}{2}n - 10 = -7$        $26.4 = 4.4b$   
 $\frac{1}{2}n = 3$        $6 = b$   
 $\frac{2}{1} \cdot \frac{1}{2}n = \frac{2}{1} \cdot 3$   
 $n = 6$
- 37.**  $6.2h + 5 - 1.4h = 4.8h + 5$   
 $4.8h + 5 = 4.8h + 5$   
The equation is an identity, so the solution is all real numbers.
- 38.**  $0.7z + 1.9 + 0.1z = 5.5 - 0.4z$   
 $0.8z + 1.9 = 5.5 - 0.4z$   
 $1.2z + 1.9 = 5.5$   
 $1.2z = 3.6$   
 $z = 3$

$$\begin{aligned}
 39. \quad 5.4t + 14.6 - 10.1t &= 12.2 - 3.5t - 0.6 \\
 -4.7t + 14.6 &= 12.2 - 3.5t \\
 14.6 &= 12.2 + 1.2t \\
 2.4 &= 1.2t \\
 2 &= t
 \end{aligned}$$

$$\begin{aligned}
 40. \quad \frac{1}{8}(5y + 64) &= \frac{1}{4}(20 + 2y) \\
 \frac{5}{8}y + 8 &= 5 + \frac{1}{2}y \\
 \frac{1}{8}y + 8 &= 5 \\
 \frac{1}{8}y &= -3 \\
 \frac{8}{1} \cdot \frac{1}{8}y &= \frac{8}{1}(-3) \\
 y &= -24
 \end{aligned}$$

$$\begin{aligned}
 41. \quad 14 - \frac{1}{5}(j - 10) &= \frac{2}{5}(25 + j) \\
 14 - \frac{1}{5}j + 2 &= 10 + \frac{2}{5}j \\
 16 - \frac{1}{5}j &= 10 + \frac{2}{5}j \\
 16 &= 10 + \frac{3}{5}j \\
 6 &= \frac{3}{5}j \\
 \frac{5}{3} \cdot 6 &= \frac{5}{3} \cdot \frac{3}{5}j \\
 10 &= j
 \end{aligned}$$

$$\begin{aligned}
 42. \quad 5(1.2k + 6) &= 7.1k + 34.4 \\
 6k + 30 &= 7.1k + 34.4 \\
 30 &= 1.1k + 34.4 \\
 -4.4 &= 1.1k \\
 -4 &= k
 \end{aligned}$$

$$\begin{aligned}
 43. \quad -0.25(4v - 8) &= 0.5(4 - 2v) \\
 -v + 2 &= 2 - v \\
 2 - v &= 2 - v
 \end{aligned}$$

The equation is an identity, so the solution is all real numbers.

$$\begin{aligned}
 44. \quad 6x &= 8x - 10 \\
 -2x &= -10 \\
 x &= 5 \\
 \text{Perimeter} &= 4(6x) = 4(6 \cdot 5) = 120 \text{ units}
 \end{aligned}$$

$$\begin{aligned}
 45. \quad 3x + 6 &= 5x \\
 6 &= 2x \\
 3 &= x \\
 \text{Perimeter} &= 4(5x) = 4(5 \cdot 3) = 60 \text{ units}
 \end{aligned}$$

$$\begin{aligned}
 46. \quad 4x - 2 &= 3x + 7 \\
 x - 2 &= 7 \\
 x &= 9
 \end{aligned}$$

$$\begin{aligned}
 \text{Perimeter} &= 4(4x - 2) \\
 &= 4(4 \cdot 9 - 2) \\
 &= 4(36 - 2) \\
 &= 4(34) \\
 &= 136 \text{ units}
 \end{aligned}$$

$$\begin{aligned}
 47. \quad a(2x + 3) &= 9x + 12 - x \\
 a(2x + 3) &= 8x + 12 \\
 a(2x + 3) &= 4(2x + 3) \\
 a &= 4
 \end{aligned}$$

$$\begin{aligned}
 48. \quad 10x - 35 + 3ax &= 5ax - 7a \\
 5(2x - 7) + 3ax &= 5ax - 7a \\
 5(2x - 7) &= 2ax - 7a \\
 5(2x - 7) &= a(2x - 7) \\
 a &= 5
 \end{aligned}$$

### Problem Solving

$$\begin{aligned}
 49. \quad \text{Let } n &= \text{number of nights.} \\
 35n + 45 &= 40n \\
 45 &= 5n \\
 9 &= n
 \end{aligned}$$

After 9 nights, the total cost is the same for members and nonmembers.

$$\begin{aligned}
 50. \quad \text{Let } m &= \text{number of months.} \\
 42.95m + 60 &= 57.95m \\
 60 &= 15m \\
 4 &= m
 \end{aligned}$$

After 4 months, Dan and Sydney will have paid the same amount.

$$\begin{aligned}
 51. \quad \text{Let } x &= \text{number of years.} \\
 555 + 33x &= 3(230 - 2x) \\
 555 + 33x &= 690 - 6x \\
 555 + 39x &= 690 \\
 39x &= 135 \\
 x &\approx 3.46
 \end{aligned}$$

In about 4 years, there will be 3 times as many students taking Spanish as French.

52. a. Let
- $x$
- = number of visits.

$$360 + 4x = 10x + 6x$$

$$360 + 4x = 16x$$

$$360 = 12x$$

$$30 = x$$

The total cost for a member and a nonmember will be the same after 30 visits.

Number of visits	Cost for Members (\$)	Cost for Non-members (\$)
5	380	80
10	400	160
15	420	240
20	440	320
25	460	400
30	480	480
35	500	560

The total cost for a member and a nonmember will be the same (\$480) after 30 visits.

53. a.
- $23.4t = 24(t - 0.3)$

$$23.4t = 24t - 7.2$$

$$-0.6t = -7.2$$

$$t = 12$$

The sheepdog would catch up to the collie after 12 seconds.

- b.
- $d = rt$

$$2(51) = 23.4t$$

$$102 = 23.4t$$

$$4.4 \approx t$$

It takes the collie about 4.4 seconds to run the last leg.

- c. The sheepdog does not catch up and pass the collie because it takes 12 seconds for the sheepdog to catch up to the collie and it only takes the collie 4.4 seconds to complete the last leg.

- 54.
- $l = w + 12$
- ,
- $P = 7w$

$$P = 2l + 2w$$

$$7w = 2(w + 12) + 2w$$

$$7w = 2w + 24 + 2w$$

$$7w = 4w + 24$$

$$3w = 24$$

$$w = 8$$

$$l = 8 + 12 = 20$$

The width is 8 units, and the length is 20 units.

- 55.
- $l = 3w - 4$
- ,
- $P = 2w + 22$

$$P = 2l + 2w$$

$$2w + 22 = 2(3w - 4) + 2w$$

$$2w + 22 = 6w - 8 + 2w$$

$$2w - 22 = 8w - 8$$

$$22 = 6w - 8$$

$$30 = 6w$$

$$5 = w$$

$$l = 3(5) - 4 = 15 - 4 = 11$$

The width is 5 units, and the length is 11 units.

### Quiz for the lessons "Solve Two-Step Equations" and "Solve Equations with Variables on Both Sides"

1.  $x + 2x - 1 = 38$

Check:

$$3x - 1 = 38$$

$$13 + 2(13) - 1 \stackrel{?}{=} 38$$

$$3x = 39$$

$$13 + 26 - 1 \stackrel{?}{=} 38$$

$$x = 13$$

$$38 = 38$$

2.  $2v + 5v - 8 = 13$

Check:

$$7v - 8 = 13$$

$$2(3) + 5(3) - 8 \stackrel{?}{=} 13$$

$$7v = 21$$

$$6 + 15 - 8 \stackrel{?}{=} 13$$

$$v = 3$$

$$21 - 8 \stackrel{?}{=} 13$$

$$13 = 13$$

3.  $2a - 6(a - 4) = -4$

Check:

$$2a - 6a + 24 = -4$$

$$2(7) - 6(7 - 4) \stackrel{?}{=} -4$$

$$-4a + 24 = -4$$

$$14 - 6(3) \stackrel{?}{=} -4$$

$$-4a = -28$$

$$14 - 18 \stackrel{?}{=} -4$$

$$a = 7$$

$$-4 = -4$$

4.  $\frac{6}{5}(5 - 4g) = -18$

Check:

$$\frac{5}{6} \cdot \frac{6}{5}(5 - 4g) = \frac{5}{6}(-18)$$

$$\frac{6}{5}(5 - 4 \cdot 5) \stackrel{?}{=} -18$$

$$5 - 4g = -15$$

$$\frac{6}{5}(5 - 20) \stackrel{?}{=} -18$$

$$-4g = -20$$

$$\frac{6}{5}(-15) \stackrel{?}{=} -18$$

$$g = 5$$

$$-18 = -18$$

$$5. \quad y - 2 = y + 2 \qquad 6. \quad 2x - 14 = -3x + 6$$

$$y - 2 - y = y + 2 - y \qquad 5x - 14 = 6$$

$$-2 \neq 2 \qquad 5x = 20$$

$$\text{no solution} \qquad x = 4$$

$$7. \quad 10z - 4 = 2(5z - 2)$$

$$10z - 4 = 10z - 4$$

The equation is an identity, so the solution is all real numbers.

$$8. \quad 6m + 5 - 3m = 7(m - 1)$$

$$3m + 5 = 7m - 7$$

$$5 = 4m - 7$$

$$12 = 4m$$

$$3 = m$$

$$9. \quad 2(7 - g) = 9g + 14 - 11g$$

$$14 - 2g = -2g + 14$$

$$-2g + 14 = -2g + 14$$

The equation is an identity, so the solution is all real numbers.

$$10. \quad 13k + 3(k + 11) = 8k - 7$$

$$13k + 3k + 33 = 8k - 7$$

$$16k + 33 = 8k - 7$$

$$8k + 33 = -7$$

$$8k = -40$$

$$k = -5$$

**Spreadsheet Activity for the lesson "Solve Equations with Variables on Both Sides"**

$$1. \quad 15x + 6 = 6x + 24 \qquad 2. \quad 8x - 17 = 5x + 70$$

$$x = 2 \qquad x = 29$$

$$3. \quad 18 - 2(x + 3) = x$$

$$x = 4$$

4. a. Check student's spreadsheet.  
 b. The difference between the left and right sides changes signs between possible answers 3 and 4.  
 c. The solution is 3.5 because the left side and right side both equal 21.7 with that solution.

**Extension for the lesson "Solve Equations with Variables on Both Sides"**

**Guided Practice**

$$1. \quad 5x - 7 = 8 \quad \text{Given}$$

$$5x = 15 \quad \text{Add. Prop. of Eq.}$$

$$x = 3 \quad \text{Div. Prop. of Eq.}$$

$$2. \quad 13 - 2x = x + 25 \quad \text{Given}$$

$$13 = 3x + 25 \quad \text{Add. Prop. of Eq.}$$

$$-12 = 3x \quad \text{Subtr. Prop. of Eq.}$$

$$-4 = x \quad \text{Div. Prop. of Eq.}$$

**Practice**

- Subtraction Property of Equality; Addition Property of Equality; Division Property of Equality
- Distributive Property; Subtraction Property of Equality; Addition Property of Equality
- $5x - 10 = -40$  Given  
 $5x = -30$  Add. Prop. of Eq.  
 $x = -6$  Div. Prop. of Eq.
- $4x + 9 = 16 - 3x$  Given  
 $7x + 9 = 16$  Add. Prop. of Eq.  
 $7x = 7$  Subtr. Prop. of Eq.  
 $x = 1$  Div. Prop. of Eq.
- $5 - x = 17$  Given  
 $-x = 12$  Subtr. Prop. of Eq.  
 $x = -12$  Div. Prop. of Eq.
- $2x - 3 = x - 5$  Given  
 $x - 3 = -5$  Subtr. Prop. of Eq.  
 $x = -2$  Add. Prop. of Eq.
- $19 - 2x = -17$  Given  
 $-2x = -36$  Subtr. Prop. of Eq.  
 $x = 18$  Div. Prop. of Eq.
- $-3x = -5x + 12$  Given  
 $2x = 12$  Add. Prop. of Eq.  
 $x = 6$  Div. Prop. of Eq.
- $5(3x - 20) = -10$  Given  
 $15x - 100 = -10$  Distributive Prop.  
 $15x = 90$  Add. Prop. of Eq.  
 $x = 6$  Div. Prop. of Eq.
- $3(2x + 11) = 9$  Given  
 $6x + 33 = 9$  Distributive Prop.  
 $6x = -24$  Subtr. Prop. of Eq.  
 $x = -4$  Div. Prop. of Eq.
- $2(-x - 5) = 12$  Given  
 $-2x - 10 = 12$  Distributive Prop.  
 $-2x = 22$  Add. Prop. of Eq.  
 $x = -11$  Div. Prop. of Eq.
- $4(5x - 9) = -2(x + 7)$  Given  
 $20x - 36 = -2x - 14$  Distributive Prop.  
 $22x - 36 = -14$  Add. Prop. of Eq.  
 $22x = 22$  Add. Prop. of Eq.  
 $x = 1$  Div. Prop. of Eq.
- $13 - x = -2(x + 3)$  Given  
 $13 - x = -2x - 6$  Distributive Prop.  
 $13 + x = -6$  Add. Prop. of Eq.  
 $x = -19$  Subtr. Prop. of Eq.



$$\begin{aligned}
 14. \quad & 3(7x - 9) - 19x = -15 && \text{Given} \\
 & 21x - 27 - 19x = -15 && \text{Distributive Prop.} \\
 & 2x - 27 = -15 && \text{Simplify.} \\
 & 2x = 12 && \text{Add. Prop. of Eq.} \\
 & x = 6 && \text{Div. Prop. of Eq.}
 \end{aligned}$$

$$\begin{aligned}
 15. \quad & \text{In the initial step, } x \text{ should have been subtracted from} \\
 & \text{each side, not added.} \\
 & 7x = x + 24 && \text{Given} \\
 & 6x = 24 && \text{Subtr. Prop. of Eq.} \\
 & x = 4 && \text{Div. Prop. of Eq.}
 \end{aligned}$$

$$\begin{aligned}
 16. \quad & 6(x + 1) = 30 && \text{Given} \\
 & 6x + 6 = 30 && \text{Distributive Prop.} \\
 & 6x = 24 && \text{Subtr. Prop. of Eq.} \\
 & x = 4 && \text{Div. Prop. of Eq.}
 \end{aligned}$$

**Mixed Review of Problem Solving for the lessons "Find Square Roots and Compare Real Numbers", "Solve One-Step Equations", "Solve Two-Step Equations", "Solve Multi-Step Equations", and "Solve Equations with Variables on Both Sides"**

$$1. \text{ a. } C = 0.25 + 0.07(t - 1)$$

$$\text{b. } 2 = 0.25 + 0.07t - 0.07$$

$$2 = 0.07t + 0.18$$

$$1.82 = 0.07t$$

$$26 = t$$

The duration of the call is 26 minutes.

$$2. \text{ Let } x = \text{weight of cat.}$$

$$162 + x = 175$$

$$x = 13$$

The cat weighs 13 pounds.

$$3. \text{ a. Let } g = \text{number of games.}$$

$$3.75g = 15$$

$$g = 4$$

Paul can bowl 4 games.

$$\text{b. } 3.75g + 1.50 = 15$$

$$3.75g = 13.5$$

$$g = 3.6$$

Brandon can bowl 3 games.

c. If Paul only bowls 3 games, it will cost him  $\$3.75(3) = \$11.75$ . He will have  $\$15 - 11.25 = \$3.75$  left over. So he will have enough to buy the pizza and soda.

$$4. \quad 10(x - 1) + 4x + 14 + 22 = 82$$

$$10x - 10 + 4x + 14 + 22 = 82$$

$$14x + 26 = 82$$

$$14x = 56$$

$$x = 4$$

5. Without a break, the time it would take to make 100 cranes is

$$\frac{100 \text{ cranes}}{40 \text{ cranes/h}} = 2.5 \text{ hours.}$$

If you spent 3 hours total, the time spent not making cranes is  $3 - 2.5 = 0.5$  hour.

6. Let  $v$  = number of visits.

$$22.50v + 90 = 45.00v$$

$$90 = 22.5v$$

$$4 = v$$

The cost of a ticket with the pass, \$22.50, times the number of visits plus the \$90 for the pass must equal the cost of a ticket without the pass, \$45.00, times the same number of visits. So the costs will be the same after 4 visits.

7. Let  $x$  = elevation before eruption.

$$x - 1313 = 8364$$

$$x = 9677$$

The elevation of the volcano before the eruption was 9677 feet. This value minus the decrease in elevation from the 1980 eruption must equal the current elevation of 8364 feet.

8. a. Let  $b$  = number of bulbs.

$$24 = 0.6b$$

$$40 = b$$

Jen purchased 40 bulbs.

$$\text{b. } 30 \text{ ft} \times \frac{12 \text{ in.}}{1 \text{ ft}} = 360 \text{ in.}$$

$$\frac{360}{40} = 9$$

She should place the bulbs 9 inches apart.

c. Let  $b$  = number of bulbs.

$$6b = 360$$

$$b = 60$$

To plant the bulbs 6 inches apart, she should need a total of 60 bulbs. Because she already has 40 bulbs, she would need  $60 - 40 = 20$  more bulbs.

9. Sample answer:

$$4x + 15 = 47$$

$$4x = 32$$

$$x = 8$$

## Lesson 2.6 Write Ratios and Proportions

### Guided Practice for the lesson "Write Ratios and Proportions"

$$1. \quad \frac{44}{52} = \frac{11}{13}$$

$$2. \quad \frac{44}{44 + 52} = \frac{44}{96} = \frac{11}{24}$$

$$3. \quad \frac{w}{35} = \frac{4}{7}$$

Check:

$$35 \cdot \frac{w}{35} = 35 \cdot \frac{4}{7}$$

$$\frac{20}{35} \stackrel{?}{=} \frac{4}{7}$$

$$w = \frac{140}{7}$$

$$\frac{4}{7} = \frac{4}{7}$$

$$w = 20$$

4.  $\frac{9}{2} = \frac{m}{12}$  Check:

$12 \cdot \frac{9}{2} = 12 \cdot \frac{m}{12}$   $\frac{9}{2} \stackrel{?}{=} \frac{54}{12}$

$\frac{108}{2} = m$   $\frac{9}{2} = \frac{9}{2}$

$54 = m$

5.  $\frac{z}{54} = \frac{5}{9}$  Check:

$54 \cdot \frac{z}{54} = 54 \cdot \frac{5}{9}$   $\frac{30}{54} \stackrel{?}{=} \frac{5}{9}$

$z = \frac{270}{9}$   $\frac{5}{9} = \frac{5}{9}$

$z = 30$

6.  $\frac{5}{125} = \frac{x}{1029}$

$1029 \cdot \frac{5}{125} = 1029 \cdot \frac{x}{1029}$

$\frac{5145}{125} = x$

$41.16 = x$

The elevator travels from the lobby to the observation level in 41.16 seconds.

7.  $\frac{2}{5} = \frac{x}{25}$

$25 \cdot \frac{2}{5} = 25 \cdot \frac{x}{25}$

$\frac{50}{5} = x$

$10 = x$

It is likely that 10 blue moons will occur in the next 25 years.

**Exercises for the lesson "Write Ratios and Proportions"**

**Skill Practice**

1. A proportion is an equation that states that two ratios are equal.

2. Sample Answer:  $\frac{3}{8}$ , 3:8, 3 to 8

3. no; 14 to 18 = 7 to 9

4. yes 5. yes

6. no; 28 to 32 = 7 to 8

7.  $\frac{2}{5} = \frac{x}{3}$  Check:

$3 \cdot \frac{2}{5} = 3 \cdot \frac{x}{3}$   $\frac{2}{5} \stackrel{?}{=} \frac{6}{3}$

$\frac{6}{5} = x$   $\frac{2}{5} \stackrel{?}{=} \frac{6}{15}$

$\frac{2}{5} = \frac{2}{5}$

8.  $\frac{4}{1} = \frac{z}{16}$  Check:

$16 \cdot \frac{4}{1} = 16 \cdot \frac{z}{16}$   $\frac{4}{1} \stackrel{?}{=} \frac{64}{16}$

$64 = z$   $4 = 4$

9.  $\frac{c}{8} = \frac{11}{4}$  Check:

$8 \cdot \frac{c}{8} = 8 \cdot \frac{11}{4}$   $\frac{22}{8} \stackrel{?}{=} \frac{11}{4}$

$c = \frac{88}{4}$   $\frac{11}{4} = \frac{11}{4}$

$c = 22$

10.  $\frac{36}{12} = \frac{x}{2}$  Check:

$2 \cdot \frac{36}{12} = 2 \cdot \frac{x}{2}$   $\frac{36}{12} \stackrel{?}{=} \frac{6}{2}$

$\frac{72}{12} = x$   $\frac{6}{2} = \frac{6}{2}$

$6 = x$

11.  $\frac{16}{7} = \frac{m}{21}$  Check:

$21 \cdot \frac{16}{7} = 21 \cdot \frac{m}{21}$   $\frac{16}{7} \stackrel{?}{=} \frac{48}{21}$

$\frac{336}{7} = m$   $\frac{16}{7} = \frac{16}{7}$

$48 = m$

12.  $\frac{k}{9} = \frac{10}{18}$  Check:

$9 \cdot \frac{k}{9} = 9 \cdot \frac{10}{18}$   $\frac{5}{9} \stackrel{?}{=} \frac{10}{18}$

$k = \frac{90}{18}$   $\frac{5}{9} = \frac{5}{9}$

$k = 5$

13.  $\frac{5}{8} = \frac{t}{24}$  Check:

$24 \cdot \frac{5}{8} = 24 \cdot \frac{t}{24}$   $\frac{5}{8} \stackrel{?}{=} \frac{15}{24}$

$\frac{120}{8} = t$   $\frac{5}{8} = \frac{5}{8}$

$15 = t$

14.  $\frac{d}{5} = \frac{80}{100}$  Check:

$5 \cdot \frac{d}{5} = 5 \cdot \frac{80}{100}$   $\frac{4}{5} \stackrel{?}{=} \frac{80}{100}$

$d = \frac{400}{100}$   $\frac{4}{5} = \frac{4}{5}$

$d = 4$

15.  $\frac{v}{20} = \frac{8}{4}$  Check:

$20 \cdot \frac{v}{20} = 20 \cdot \frac{8}{4}$   $\frac{40}{20} \stackrel{?}{=} \frac{8}{4}$

$v = \frac{160}{4}$   $\frac{8}{4} = \frac{8}{4}$

$v = 40$

16.  $\frac{r}{60} = \frac{40}{50}$  Check:

$$60 \cdot \frac{r}{60} = 60 \cdot \frac{40}{50}$$

$$r = \frac{2400}{50}$$

$$r = 48$$

$$17. \quad \frac{16}{48} = \frac{n}{36}$$

$$36 \cdot \frac{16}{48} = 36 \cdot \frac{n}{36}$$

$$\frac{576}{48} = n$$

$$12 = n$$

$$18. \quad \frac{49}{98} = \frac{s}{112}$$

$$112 \cdot \frac{49}{98} = 112 \cdot \frac{s}{112}$$

$$\frac{5488}{98} = s$$

$$56 = s$$

19. C;

$$\frac{8}{5} = \frac{x}{20}$$

$$20 \cdot \frac{8}{5} = 20 \cdot \frac{x}{20}$$

$$\frac{160}{5} = x$$

$$32 = x$$

21. Both sides of the equation need to be multiplied by 6, not  $\frac{1}{6}$ .

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

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

$$\frac{18}{4} = x$$

$$\frac{9}{2} = x$$

22. To keep both sides of the equation equal, you must multiply both sides by the same number. The right side should be multiplied by 10, not 20.

$$\frac{m}{10} = \frac{50}{20}$$

$$10 \cdot \frac{m}{10} = 10 \cdot \frac{50}{20}$$

$$m = \frac{500}{20}$$

$$m = 25$$

$$23. \quad \frac{3}{8} = \frac{x}{32}$$

$$32 \cdot \frac{3}{8} = 32 \cdot \frac{x}{32}$$

$$\frac{96}{8} = x$$

$$12 = x$$

$$\frac{48}{60} \stackrel{?}{=} \frac{40}{50}$$

$$\frac{4}{5} = \frac{4}{5}$$

Check:

$$\frac{16}{48} \stackrel{?}{=} \frac{12}{36}$$

$$\frac{1}{3} = \frac{1}{3}$$

Check:

$$\frac{49}{98} \stackrel{?}{=} \frac{56}{112}$$

$$\frac{1}{2} = \frac{1}{2}$$

20. B;

$$\frac{z}{15} = \frac{28}{35}$$

$$15 \cdot \frac{z}{15} = 15 \cdot \frac{28}{35}$$

$$z = \frac{420}{35}$$

$$z = 12$$

$$25. \quad \frac{x}{4} = \frac{8}{16}$$

$$4 \cdot \frac{x}{4} = 4 \cdot \frac{8}{16}$$

$$x = \frac{32}{16}$$

$$x = 2$$

$$27. \quad \frac{b}{10} = \frac{7}{2}$$

$$10 \cdot \frac{b}{10} = 10 \cdot \frac{7}{2}$$

$$b = \frac{70}{2}$$

$$b = 35$$

$$29. \quad \frac{12}{18} = \frac{d}{27}$$

$$27 \cdot \frac{12}{18} = 27 \cdot \frac{d}{27}$$

$$\frac{324}{18} = d$$

$$18 = d$$

$$31. \quad \frac{b}{0.5} = \frac{9}{2.5}$$

$$0.5 \left( \frac{b}{0.5} \right) = 0.5 \left( \frac{9}{2.5} \right)$$

$$b = \frac{4.5}{2.5}$$

$$b = 1.8$$

$$32. \quad \frac{1.1}{1.2} = \frac{n}{3.6}$$

$$3.6 \left( \frac{1.1}{1.2} \right) = 3.6 \left( \frac{n}{3.6} \right)$$

$$\frac{3.96}{1.2} = n$$

$$3.3 = n$$

$$33. \quad \frac{2.1}{7.7} = \frac{v}{8.8}$$

$$8.8 \left( \frac{2.1}{7.7} \right) = 8.8 \left( \frac{v}{8.8} \right)$$

$$\frac{18.48}{7.7} = v$$

$$2.4 = v$$

$$34. \quad \frac{36}{54} = \frac{2x}{6}$$

$$6 \left( \frac{36}{54} \right) = 6 \left( \frac{2x}{6} \right)$$

$$\frac{216}{54} = 2x$$

$$4 = 2x$$

$$2 = x$$

$$26. \quad \frac{y}{20} = \frac{9}{5}$$

$$20 \cdot \frac{y}{20} = 20 \cdot \frac{9}{5}$$

$$y = \frac{180}{5}$$

$$y = 36$$

$$28. \quad \frac{4}{12} = \frac{n}{3}$$

$$3 \cdot \frac{4}{12} = 3 \cdot \frac{n}{3}$$

$$\frac{12}{12} = n$$

$$1 = n$$

$$30. \quad \frac{t}{21} = \frac{40}{28}$$

$$21 \cdot \frac{t}{21} = 21 \cdot \frac{40}{28}$$

$$t = \frac{840}{28}$$

$$t = 30$$

Check:

$$\frac{1.8}{0.5} \stackrel{?}{=} \frac{9}{2.5}$$

$$3.6 = 3.6$$

Check:

$$\frac{1.1}{1.2} \stackrel{?}{=} \frac{3.3}{3.6}$$

$$0.917 = 0.917$$

Check:

$$\frac{2.1}{7.7} \stackrel{?}{=} \frac{2.4}{8.8}$$

$$0.273 = 0.273$$

Check:

$$\frac{36}{54} \stackrel{?}{=} \frac{2(2)}{6}$$

$$\frac{36}{54} \stackrel{?}{=} \frac{4}{6}$$

$$\frac{2}{3} = \frac{2}{3}$$

$$35. \quad \frac{3a}{4} = \frac{36}{12}$$

$$4\left(\frac{3a}{4}\right) = 4\left(\frac{36}{12}\right)$$

$$3a = \frac{144}{12}$$

$$3a = 12$$

$$a = 4$$

Check:

$$\frac{3(4)}{4} \stackrel{?}{=} \frac{36}{12}$$

$$\frac{12}{4} \stackrel{?}{=} \frac{36}{12}$$

$$3 = 3$$

$$36. \quad \frac{10h}{108} = \frac{5}{9}$$

$$108\left(\frac{10h}{108}\right) = 108\left(\frac{5}{9}\right)$$

$$10h = \frac{540}{9}$$

$$10h = 60$$

$$h = 6$$

Check:

$$\frac{10(6)}{108} \stackrel{?}{=} \frac{5}{9}$$

$$\frac{60}{108} \stackrel{?}{=} \frac{5}{9}$$

$$\frac{5}{9} = \frac{5}{9}$$

$$37. \quad \frac{6r}{10} = \frac{36}{15}$$

$$10\left(\frac{6r}{10}\right) = 10\left(\frac{36}{15}\right)$$

$$6r = \frac{360}{15}$$

$$6r = 24$$

$$r = 4$$

Check:

$$\frac{6(4)}{10} \stackrel{?}{=} \frac{36}{15}$$

$$\frac{24}{10} \stackrel{?}{=} \frac{36}{15}$$

$$2.4 = 2.4$$

$$38. \quad \frac{12}{42} = \frac{4w}{56}$$

$$56\left(\frac{12}{42}\right) = 56\left(\frac{4w}{56}\right)$$

$$\frac{672}{42} = 4w$$

$$16 = 4w$$

$$4 = w$$

Check:

$$\frac{12}{42} \stackrel{?}{=} \frac{4(4)}{56}$$

$$\frac{12}{42} \stackrel{?}{=} \frac{16}{56}$$

$$\frac{2}{7} = \frac{2}{7}$$

$$39. \quad \frac{m+3}{8} = \frac{40}{64}$$

$$8\left(\frac{m+3}{8}\right) = 8\left(\frac{40}{64}\right)$$

$$m+3 = \frac{320}{64}$$

$$m+3 = 5$$

$$m = 2$$

Check:

$$\frac{2+3}{8} \stackrel{?}{=} \frac{40}{64}$$

$$\frac{5}{8} \stackrel{?}{=} \frac{40}{64}$$

$$\frac{5}{8} = \frac{5}{8}$$

$$40. \quad \frac{5}{13} = \frac{k-4}{39}$$

$$39\left(\frac{5}{13}\right) = 39\left(\frac{k-4}{39}\right)$$

$$\frac{195}{13} = k-4$$

$$15 = k-4$$

$$19 = k$$

Check:

$$\frac{5}{13} \stackrel{?}{=} \frac{19-4}{39}$$

$$\frac{5}{13} \stackrel{?}{=} \frac{15}{39}$$

$$\frac{5}{13} = \frac{5}{13}$$

$$41. \quad \frac{7}{112} = \frac{c-3}{8}$$

$$8\left(\frac{7}{112}\right) = 8\left(\frac{c-3}{8}\right)$$

$$\frac{56}{112} = c-3$$

$$0.5 = c-3$$

$$3.5 = c$$

Check:

$$\frac{7}{112} \stackrel{?}{=} \frac{3.5-3}{8}$$

$$0.0625 \stackrel{?}{=} \frac{0.5}{8}$$

$$0.0625 = 0.0625$$

$$42. \quad \frac{6+n}{60} = \frac{15}{90}$$

$$60\left(\frac{6+n}{60}\right) = 60\left(\frac{15}{90}\right)$$

$$6+n = \frac{900}{90}$$

$$6+n = 10$$

$$n = 4$$

Check:

$$\frac{6+4}{60} \stackrel{?}{=} \frac{15}{90}$$

$$\frac{10}{60} \stackrel{?}{=} \frac{15}{90}$$

$$\frac{1}{6} = \frac{1}{6}$$

$$43. \text{ Yes. Sample answer: } \frac{3}{6} = \frac{4}{8}$$

Both  $\frac{3}{6}$  and  $\frac{4}{8}$  simplify to  $\frac{1}{2}$ , therefore they form a proportion.

44. Yes; multiply both sides of the equation by  $b$  to get

$$b \cdot \frac{a}{b} = b \cdot \frac{c}{d}$$

$$a = \frac{bc}{d}$$

Then divide both sides by  $c$  to get

$$\frac{a}{c} = \frac{bc}{dc}$$

$$\frac{a}{c} = \frac{b}{d}$$

### Problem Solving

$$45. \quad \frac{\text{number from Kentucky}}{\text{total}} = \frac{6}{435} = \frac{2}{145}$$

$$46. \quad 30 - 16 = 14 \text{ girls}$$

$$\frac{\text{girls}}{\text{boys}} = \frac{14}{16} = \frac{7}{8}$$

$$47. \quad \frac{\text{small pizzas}}{\text{large pizzas}} = \frac{96}{240} = \frac{2}{5}$$

$$48. \quad \frac{\text{medium pizzas}}{\text{large pizzas}} = \frac{144}{240} = \frac{3}{5}$$

$$49. \quad \frac{\text{large pizzas}}{\text{all pizzas}} = \frac{240}{96 + 144 + 240} = \frac{240}{480} = \frac{1}{2}$$

$$50. \quad \frac{7}{10} = \frac{x}{30}$$

$$30\left(\frac{7}{10}\right) = 30\left(\frac{x}{30}\right)$$

$$\frac{210}{10} = x$$

$$21 = x$$

The students can read 21 pages in 30 minutes.

$$51. \quad \frac{10}{4} = \frac{x}{18}$$

$$18\left(\frac{10}{4}\right) = 18\left(\frac{x}{18}\right)$$

$$\frac{180}{4} = x$$

$$45 = x$$

The team will score 45 goals in the remaining games.

$$52. \text{ a. } \frac{1.85}{1} = \frac{x}{38}$$

$$38\left(\frac{1.85}{1}\right) = 38\left(\frac{x}{38}\right)$$

$$70.3 = x$$

The length is 70.3 feet.

Width (ft)	Length (ft)
20	37
25	46.25
30	55.5
35	64.75
40	74

The answer in part (a) is reasonable because the table shows that when the width is between 35 and 40 feet, the length is between 64.75 and 74 feet. The answer of 70.3 feet is in this range.

$$53. \text{ a. } \frac{\text{snowboarders}}{\text{all}} = \frac{10}{10 + 13} = \frac{10}{23}$$

$$\text{b. } \frac{10}{23} = \frac{x}{253}$$

$$253\left(\frac{10}{23}\right) = 253\left(\frac{x}{253}\right)$$

$$\frac{2530}{23} = x$$

$$110 = x$$

There were 110 lift tickets sold to snowboarders.

$$\text{c. } \frac{\text{rented}}{\text{all}} = \frac{4}{4 + 7} = \frac{4}{11}$$

$$\frac{4}{11} = \frac{x}{110}$$

$$110\left(\frac{4}{11}\right) = 110\left(\frac{x}{110}\right)$$

$$\frac{440}{11} = x$$

$$40 = x$$

There were 40 snowboarders who rented snowboards.

$$54. \text{ a. } \frac{10}{3} = \frac{x}{11}$$

$$\text{b. } \frac{5}{2} = \frac{x}{14}$$

$$\text{c. } \frac{10}{3} = \frac{x}{11}$$

$$11\left(\frac{10}{3}\right) = 11\left(\frac{x}{11}\right)$$

$$\frac{110}{3} = x$$

$$36.67 = x$$

You will have to wait 36.67 minutes.

$$\frac{5}{4} = \frac{x}{14}$$

$$14\left(\frac{5}{4}\right) = 14\left(\frac{x}{14}\right)$$

$$\frac{70}{2} = x$$

$$35 = x$$

Your friend will have to wait 35 minutes. By solving both proportions, we see that your friend has a shorter wait and will be able to purchase tickets first.

55. Let  $x$  = distance slower car travels.

$$\frac{x}{30} = \frac{x + 15}{50}$$

$$50\left(\frac{x}{30}\right) = 50\left(\frac{x + 15}{50}\right)$$

$$\frac{50x}{30} = x + 15$$

$$30\left(\frac{50x}{30}\right) = 30(x + 15)$$

$$50x = 30x + 450$$

$$20x = 450$$

$$x = 22.5$$

$$22.5 + 15 = 37.5$$

The slower car travels 22.5 miles, and the faster car travels 37.5 miles.

## Lesson 2.7 Solve Proportions Using Cross Products

### Guided Practice for the lesson "Solve Proportions Using Cross Products"

$$1. \quad \frac{4}{a} = \frac{24}{30}$$

$$4(30) = 24a$$

$$120 = 24a$$

$$5 = a$$

Check:

$$\frac{4}{5} \stackrel{?}{=} \frac{24}{30}$$

$$4(30) \stackrel{?}{=} 5(24)$$

$$120 = 120$$

$$2. \quad \frac{3}{x} = \frac{2}{x-6}$$

$$3(x-6) = 2x$$

$$3x - 18 = 2x$$

$$-18 = -x$$

$$18 = x$$

$$3. \quad \frac{m}{5} = \frac{m-6}{4}$$

$$4m = 5(m-6)$$

$$4m = 5m - 30$$

$$-m = -30$$

$$m = 30$$

$$4. \quad \frac{8}{100} = \frac{x}{260}$$

$$8(260) = 100x$$

$$2080 = 100x$$

$$20.8 = x$$

The seal should be fed 20.8 pounds of food per day.

5. distance on map = 2.5 cm

$$\frac{1}{85} = \frac{2.5}{d}$$

$$1(d) = 85(2.5)$$

$$d = 212.5$$

The actual distance between Columbus and Cleveland is about 212.5 kilometers.

$$6. \quad \frac{1}{600} = \frac{1.6}{x}$$

$$x = 600(1.6)$$

$$x = 960 \text{ ft}$$

The actual length of the *Queen Elizabeth II* is about 960 feet.

### Exercises for the lesson "Solve Proportions Using Cross Products"

#### Skill Practice

1. In a proportion, a *cross product* is the product of the numerator of one ratio and the denominator of the other ratio.

2. Measure the distance in centimeters in the drawing and then substitute the value in the proportion

$$\frac{1}{3} = \frac{\text{distance in drawing}}{\text{actual distance}}$$

$$3. \quad \frac{2}{3} = \frac{4}{x}$$

$$2x = 3(4)$$

$$2x = 12$$

$$x = 6$$

Check:

$$\frac{3}{18} \stackrel{?}{=} \frac{2}{18-6}$$

$$3(18-6) \stackrel{?}{=} 2(18)$$

$$3(12) \stackrel{?}{=} 2(18)$$

$$36 = 36$$

Check:

$$\frac{30}{5} \stackrel{?}{=} \frac{30-6}{4}$$

$$4(30) \stackrel{?}{=} 5(30-6)$$

$$120 \stackrel{?}{=} 5(24)$$

$$120 = 120$$

$$4. \quad \frac{3}{y} = \frac{15}{35}$$

$$15y = 3(35)$$

$$15y = 105$$

$$y = 7$$

$$5. \quad \frac{13}{6} = \frac{52}{z}$$

$$13z = 6(52)$$

$$13z = 312$$

$$z = 24$$

$$6. \quad \frac{10}{45} = \frac{v}{27}$$

$$10(27) = 45v$$

$$270 = 45v$$

$$6 = v$$

$$7. \quad \frac{5m}{6} = \frac{10}{12}$$

$$12(5m) = 6(10)$$

$$60m = 60$$

$$m = 1$$

$$8. \quad \frac{3k}{27} = \frac{2}{3}$$

$$3(3k) = 2(27)$$

$$9k = 54$$

$$k = 6$$

$$9. \quad -\frac{49}{7} = \frac{a+7}{6}$$

$$-49(6) = 7(a+7)$$

$$-294 = 7a + 49$$

$$-343 = 7a$$

$$-49 = a$$

$$10. \quad \frac{6}{t+4} = \frac{42}{77}$$

$$6(77) = 42(t+4)$$

$$462 = 42t + 168$$

$$294 = 42t$$

$$7 = t$$

Check:

$$\frac{3}{7} \stackrel{?}{=} \frac{15}{35}$$

$$3(35) \stackrel{?}{=} 7(15)$$

$$105 = 105$$

Check:

$$\frac{13}{6} \stackrel{?}{=} \frac{52}{24}$$

$$13(24) \stackrel{?}{=} 6(52)$$

$$312 = 312$$

Check:

$$\frac{10}{45} \stackrel{?}{=} \frac{6}{27}$$

$$10(27) \stackrel{?}{=} 45(6)$$

$$270 = 270$$

Check:

$$\frac{5(1)}{6} \stackrel{?}{=} \frac{10}{12}$$

$$5(1)(12) \stackrel{?}{=} 6(10)$$

$$60 = 60$$

Check:

$$\frac{3(6)}{27} \stackrel{?}{=} \frac{2}{3}$$

$$\frac{18}{27} \stackrel{?}{=} \frac{2}{3}$$

$$54 = 54$$

Check:

$$\frac{-49}{7} \stackrel{?}{=} \frac{-49+7}{6}$$

$$\frac{-49}{7} \stackrel{?}{=} \frac{-42}{6}$$

$$-7 = -7$$

Check:

$$\frac{6}{7+4} \stackrel{?}{=} \frac{42}{77}$$

$$6(77) \stackrel{?}{=} 42(7+4)$$

$$462 \stackrel{?}{=} 42(11)$$

$$462 = 462$$

$$11. \quad \frac{8}{12} = \frac{r}{r+1}$$

$$8(r+1) = 12r$$

$$8r + 8 = 12r$$

$$8 = 4r$$

$$2 = r$$

$$12. \quad \frac{n}{n-12} = \frac{9}{5}$$

$$5n = 9(n-12)$$

$$5n = 9n - 108$$

$$-4n = -108$$

$$n = 27$$

$$13. \quad \frac{11}{w} = \frac{33}{w+24}$$

$$11(w+24) = 33w$$

$$11w + 264 = 33w$$

$$264 = 22w$$

$$12 = w$$

$$14. \quad \frac{18}{d+13} = \frac{6}{d-13}$$

$$18(d-13) = 6(d+13)$$

$$18d - 234 = 6d + 78$$

$$12d - 234 = 78$$

$$12d = 312$$

$$d = 26$$

15. B;

$$\frac{15}{-2h} = \frac{5}{12}$$

$$15(12) = -2h(5)$$

$$180 = -10h$$

$$-18 = h$$

Check:

$$\frac{8}{12} \stackrel{?}{=} \frac{2}{2+1}$$

$$8(2+1) \stackrel{?}{=} 12(2)$$

$$8(3) \stackrel{?}{=} 12(2)$$

$$24 = 24$$

Check:

$$\frac{27}{27-12} \stackrel{?}{=} \frac{9}{5}$$

$$27(5) \stackrel{?}{=} 9(27-12)$$

$$135 \stackrel{?}{=} 9(15)$$

$$135 = 135$$

Check:

$$\frac{11}{12} \stackrel{?}{=} \frac{33}{12+24}$$

$$11(12+24) \stackrel{?}{=} 12(33)$$

$$11(36) \stackrel{?}{=} 12(33)$$

$$396 = 396$$

Check:

$$\frac{18}{26+13} \stackrel{?}{=} \frac{6}{26-13}$$

$$6(26+13) \stackrel{?}{=} 18(26-13)$$

$$6(39) \stackrel{?}{=} 18(13)$$

$$234 = 234$$

16. D;

$$\frac{7}{s-14} = \frac{21}{s+18}$$

$$7(s+18) = 21(s-14)$$

$$7s + 126 = 21s - 294$$

$$126 = 14s - 294$$

$$420 = 14s$$

$$30 = s$$

17. The cross products property states that the product of the numerator of one ratio and the denominator of the other can be used to solve a proportion, not the numerator of one and the numerator of the other.

$$\frac{4}{3} = \frac{16}{x}$$

$$4x = 3(16)$$

$$4x = 48$$

$$x = 12$$

18. The error occurred in cross multiplying 14 and  $b+2$ . Distribute the 14 to both  $b$  and 2.

$$\frac{18}{14} = \frac{b+2}{b}$$

$$18b = 14(b+2)$$

$$18b = 14b + 28$$

$$4b = 28$$

$$b = 7$$

$$19. \quad \frac{7}{3} = \frac{2x+5}{x}$$

$$7x = 3(2x+5)$$

$$7x = 6x + 15$$

$$x = 15$$

Check:

$$\frac{7}{3} \stackrel{?}{=} \frac{2 \cdot 15 + 5}{15}$$

$$\frac{7}{3} \stackrel{?}{=} \frac{30 + 5}{15}$$

$$\frac{7}{3} \stackrel{?}{=} \frac{35}{15}$$

$$\frac{7}{3} = \frac{7}{3}$$

$$20. \quad \frac{a}{9a-2} = \frac{1}{8}$$

$$8a = 1(9a-2)$$

$$8a = 9a - 2$$

$$-a = -2$$

$$a = 2$$

$$21. \quad \frac{24}{5+z} = \frac{4}{z-1}$$

$$24(z-1) = 4(5z+4)$$

$$24z - 24 = 20z + 16$$

$$4z - 24 = 16$$

$$4z = 40$$

$$z = 10$$

$$22. \quad \frac{c-8}{-2} = \frac{11-4c}{11}$$

$$11(c-8) = -2(11-4c)$$

$$11c - 88 = -22 + 8c$$

$$3c - 88 = -22$$

$$3c = 66$$

$$c = 22$$

$$23. \quad \frac{k-8}{7+k} = \frac{-1}{5}$$

$$5(k-8) = -1(7+k)$$

$$5k - 40 = -7 - k$$

$$6k - 40 = -7$$

$$6k = 33$$

$$k = 5.5$$

Check:

$$\frac{2}{9(2)-2} \stackrel{?}{=} \frac{1}{8}$$

$$2(8) \stackrel{?}{=} (9 \cdot 2 - 2)$$

$$16 \stackrel{?}{=} 18 - 2$$

$$16 = 16$$

Check:

$$\frac{24}{5(10)+4} \stackrel{?}{=} \frac{4}{10-1}$$

$$\frac{24}{54} \stackrel{?}{=} \frac{4}{9}$$

$$24(9) \stackrel{?}{=} 54(4)$$

$$216 = 216$$

Check:

$$\frac{22-8}{-2} \stackrel{?}{=} \frac{11-4(22)}{11}$$

$$\frac{14}{-2} \stackrel{?}{=} \frac{-77}{11}$$

$$14(11) \stackrel{?}{=} -2(-77)$$

$$154 = 154$$

Check:

$$\frac{5.5-8}{7+5.5} \stackrel{?}{=} \frac{-1}{5}$$

$$\frac{-2.5}{12.5} \stackrel{?}{=} \frac{-1}{5}$$

$$-2.5(5) \stackrel{?}{=} 12.5(-1)$$

$$-12.5 = -12.5$$

$$24. \quad \frac{2}{-3} = \frac{4v + 4}{2v + 14}$$

$$2(2v + 14) = -3(4v + 4)$$

$$4v + 28 = -12v - 12$$

$$16v + 28 = -12$$

$$16v = -40$$

$$v = -2.5$$

$$25. \quad \frac{m + 1}{4} = \frac{3m + 6}{7}$$

$$7(m + 1) = 4(3m + 6)$$

$$7m + 7 = 12m + 24$$

$$7 = 5m + 24$$

$$-17 = 5m$$

$$-3.4 = m$$

$$26. \quad \frac{6}{4 + 2w} = \frac{-2}{w - 10}$$

$$6(w - 10) = -2(4 + 2w)$$

$$6w - 60 = -8 - 4w$$

$$10w - 60 = -8$$

$$10w = 52$$

$$w = 5.2$$

$$27. \quad \frac{n + 0.3}{n - 3.2} = \frac{9}{2}$$

$$9(n - 3.2) = 2(n + 0.3)$$

$$9n - 28.8 = 2n + 0.6$$

$$7n - 28.8 = 0.6$$

$$7n = 29.4$$

$$n = 4.2$$

$$28. \quad \frac{-3}{11} = \frac{5 - h}{h + 1.4}$$

$$-3(h + 1.4) = 11(5 - h)$$

$$-3h - 4.2 = 55 - 11h$$

$$8h - 4.2 = 55$$

$$8h = 59.2$$

$$h = 7.4$$

$$29. \quad \frac{4}{b - 3.9} = \frac{2}{b + 1}$$

$$4(b + 1) = 2(b - 3.9)$$

$$4b + 4 = 2b - 7.8$$

$$2b + 4 = -7.8$$

$$2b = -11.8$$

$$b = -5.9$$

Check:

$$\frac{2}{-3} \stackrel{?}{=} \frac{4(-2.5) + 4}{2(-2.5) + 14}$$

$$\frac{2}{-3} \stackrel{?}{=} \frac{-6}{9}$$

$$2(9) \stackrel{?}{=} -3(-6)$$

$$18 = 18$$

Check:

$$\frac{-3.4 + 1}{4} \stackrel{?}{=} \frac{3(-3.4) + 6}{7}$$

$$\frac{-2.4}{4} \stackrel{?}{=} \frac{-4.2}{7}$$

$$-2.4(7) \stackrel{?}{=} 4(-4.2)$$

$$-16.8 = -16.8$$

Check:

$$\frac{6}{4 + 2(5.2)} \stackrel{?}{=} \frac{-2}{5.2 - 10}$$

$$\frac{6}{14.4} \stackrel{?}{=} \frac{-2}{-4.8}$$

$$6(-4.8) \stackrel{?}{=} 14.4(-2)$$

$$-28.8 = -28.8$$

Check:

$$\frac{4.2 + 0.3}{4.2 - 3.2} \stackrel{?}{=} \frac{9}{2}$$

$$\frac{4.5}{1} \stackrel{?}{=} \frac{9}{2}$$

$$4.5(2) \stackrel{?}{=} 1(9)$$

$$9 = 9$$

Check:

$$\frac{-3}{11} \stackrel{?}{=} \frac{5 - 7.4}{7.4 + 1.4}$$

$$\frac{-3}{11} \stackrel{?}{=} \frac{-2.4}{8.8}$$

$$-3(8.8) \stackrel{?}{=} 11(-2.4)$$

$$-26.4 = -26.4$$

Check:

$$\frac{4}{-5.9 - 3.9} \stackrel{?}{=} \frac{2}{-5.9 + 1}$$

$$\frac{4}{-9.8} \stackrel{?}{=} \frac{2}{-4.9}$$

$$4(-4.9) \stackrel{?}{=} -9.8(2)$$

$$-19.6 = -19.6$$

$$30. \quad \frac{16.5 + 3t}{3} = \frac{0.9 - t}{-5}$$

$$-5(16.5 + 3t) = 3(0.9 - t)$$

$$-82.5 - 15t = 2.7 - 3t$$

$$-82.5 = 2.7 + 12t$$

$$-85.2 = 12t$$

$$-7.1 = t$$

Check:

$$\frac{16.5 + 3(-7.1)}{3} \stackrel{?}{=} \frac{0.9 - (-7.1)}{-5}$$

$$\frac{-4.8}{3} \stackrel{?}{=} \frac{8}{-5}$$

$$-4.8(-5) \stackrel{?}{=} 3(8)$$

$$24 = 24$$

$$31. \quad \frac{a}{b} = \frac{c}{d} \quad \text{Given}$$

$$bd \cdot \frac{a}{b} = bd \cdot \frac{c}{d} \quad \text{Multiplication property of equality}$$

$$\frac{bd \cdot a}{b} = \frac{bd \cdot c}{d} \quad \text{Multiply.}$$

$$ab = cb \quad \text{Simplify.}$$

32. The value of  $h$  decreases as  $k$  increases because when we cross multiply we get  $hk = 5(14)$ . If  $k$  increases, it would have to be multiplied by a smaller number to remain equal to 5 times 14.

$$33. \quad \frac{\text{biscuits}}{\text{cups flour}} \rightarrow \frac{12}{2} = \frac{30}{x}$$

$$12x = 2(30)$$

$$12x = 60$$

$$x = 5$$

There are 5 cups of flour needed to make 30 biscuits.

$$34. \quad \frac{\text{time (min)}}{\text{photos}} \rightarrow \frac{7.2}{8} = \frac{x}{20}$$

$$8x = 20(7.2)$$

$$8x = 144$$

$$x = 18$$

It will take 18 minutes to upload 20 photographs.

$$35. \quad \frac{\text{cm}}{\text{km}} \rightarrow \frac{1}{15} = \frac{6}{x}$$

$$1(x) = 15(6)$$

$$x = 90$$

The actual distance is 90 kilometers.



$$36. \frac{\text{cm}}{\text{km}} \rightarrow \frac{1}{15} = \frac{3.2}{x}$$

$$1(x) = 15(3.2)$$

$$x = 48$$

The actual distance is 48 kilometers.

$$37. \frac{\text{cm}}{\text{km}} \rightarrow \frac{1}{15} = \frac{0.5}{x}$$

$$1(x) = 15(0.5)$$

$$x = 7.5$$

The actual distance is 7.5 kilometers.

$$38. \frac{\text{cm}}{\text{km}} \rightarrow \frac{1}{15} = \frac{4.7}{x}$$

$$1(x) = 15(4.7)$$

$$x = 70.5$$

The actual distance is 70.5 kilometers.

$$39. \frac{\text{model (m)}}{\text{actual (m)}} \rightarrow \frac{1}{25} = \frac{x}{443.2}$$

$$1(443.2) = 25x$$

$$443.2 = 25x$$

$$17.728 = x$$

The height of the model is 17.728 meters.

$$40. \text{ a. } \frac{\text{shell (in.)}}{\text{burst (ft)}} \rightarrow \frac{2}{90} = \frac{4.75}{x}$$

$$2x = 90(4.75)$$

$$2x = 427.5$$

$$x = 213.75$$

The burst diameter is 213.75 feet.

b.

Shell (in.)	Burst (ft)
2	90
3	135
4	180
5	225
6	270

The answer to part (a) makes sense because the shell was between 4 and 5 inches, so the burst should be between 180 and 225 feet.

$$41. \frac{\text{length}}{\text{width}} \rightarrow \frac{3}{2} = \frac{6}{x}$$

$$3x = 2(6)$$

$$3x = 12$$

$$x = 4 \text{ in.}$$

$$\frac{\text{drawing (in.)}}{\text{actual (yd)}} \rightarrow \frac{1}{20} = \frac{4}{w}$$

$$1(w) = 20(4)$$

$$w = 80$$

The actual width of the field is 80 yards. By solving the proportion  $\frac{3}{2} = \frac{6}{x}$ , you find the width of the field in the drawing. That result can be put into another proportion to

solve for the actual width of the field.

$$42. \text{ a. } \frac{\text{moles}}{\text{grams}} \rightarrow \frac{1}{1.008} = \frac{x}{4.58}$$

$$1(4.58) = 1.008x$$

$$4.58 = 1.008x$$

$$4.5 = x$$

There are 4.5 moles of hydrogen.

$$\text{ b. } \frac{\text{moles}}{\text{grams}} \rightarrow \frac{1}{15.999} = \frac{x}{54.5}$$

$$1(54.5) = 15.999x$$

$$54.5 = 15.999x$$

$$3.4 = x$$

There are 3.4 moles of oxygen.

c. The ratio of moles of hydrogen to moles of oxygen is  $\frac{4.5}{3.4} \approx \frac{1.32}{1}$ .

It is nearly equal to the ratio of moles of hydrogen to moles of carbon  $\frac{4}{3} \approx \frac{1.33}{1}$ .

43. *Sample answer:* I would assign 11 seats to the freshmen, 8 seats to the sophomores, 7 seats to the juniors, and 4 seats to the seniors. The actual numbers obtained from the proportions are 10.464, 8.4, 6.816, and 4.32. If I round each of those numbers in the traditional way, the sum is only 29. I rounded 10.464 up to 11 to get a total of 30 seats. I chose 10.464 because of the three numbers with decimal parts less than 0.5, its decimal part is the greatest.

## Lesson 2.8 Rewrite Equations and Formulas

### Guided Practice for the lesson "Rewrite Equations and Formulas"

$$1. a - bx = c$$

$$-bx = c - a$$

$$x = \frac{c - a}{-b}$$

$$x = \frac{a - c}{b}$$

$$x = \frac{a - c}{b}$$

$$= \frac{12 - (-3)}{5}$$

$$= \frac{15}{5}$$

$$= 3$$

$$2. ax = bx + c$$

$$ax - bx = c$$

$$x(a - b) = c$$

$$x = \frac{c}{a - b}$$

$$x = \frac{c}{a - b}$$

$$= \frac{20}{11 - 6}$$

$$= \frac{20}{5}$$

$$= 4$$

$$3. 5x - 4y = 20$$

$$4y = 20 - 5x$$

$$y = \frac{20 - 5x}{4}$$

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

4. a.  $P = 2l + 2w$

$$P - 2l = 2w$$

$$\frac{P - 2l}{2} = w$$

b.  $\frac{19.2 - 2(7.2)}{2} = w$

$$\frac{19.2 - 14.4}{2} = w$$

$$\frac{4.8}{2} = w$$

$$2.4 = w$$

The width is 2.4 feet.

5.  $F = \frac{9}{5}c + 32$

$$= \frac{9}{5}(22) + 32$$

$$= 39.6 + 32$$

$$= 71.6^\circ\text{F}$$

The high for Saturday is  $71.6^\circ\text{F}$ .

$$F = \frac{9}{5}c + 32 = \frac{9}{5}(16) + 32 = 28.8 + 32 = 60.8^\circ\text{F}$$

The high for Sunday is  $60.8^\circ\text{F}$ .

### Exercises for the lesson "Rewrite Equations and Formulas"

#### Skill Practice

1. When you write the equation  $3x + 2 = 8$  as  $ax + b = c$ , the equation  $ax + b = c$  is called a *literal equation* because the coefficients and constants have been replaced by letters.

2. Divide each side by  $pr$  to get  $\frac{I}{pr} = t$ .

3.  $ax = bx - c$

$$ax - bx = -c$$

$$x(a - b) = -c$$

$$x = \frac{-c}{a - b}$$

$$x = \frac{c}{b - a};$$

$$x = \frac{c}{b - a}$$

$$= \frac{10}{3 - 8}$$

$$= -2$$

5.  $c = \frac{x + a}{b}$

$$cb = x + a$$

$$cb - a = x;$$

$$x = cb - a = 2(7) - 5 = 9$$

4.  $a(x + b) = c$

$$ax + ab = c$$

$$ax = c - ab$$

$$x = \frac{c - ab}{a};$$

$$x = \frac{c - ab}{a}$$

$$= \frac{9 - 2(1)}{2}$$

$$= \frac{7}{2}$$

$$= 3.5$$

6.  $\frac{x}{a} = \frac{b}{c}$

$$x = a \cdot \frac{b}{c};$$

$$x = \frac{ab}{c}$$

$$= \frac{8(4.5)}{12}$$

$$= \frac{36}{12}$$

$$= 3$$

8.  $ax + b = cx - d$

$$b = cx - d - ax$$

$$b + d = cx - ax$$

$$b + d = x(c - a)$$

$$\frac{b + d}{c - a} = x;$$

$$x = \frac{b + d}{c - a} = \frac{9 + 1}{7 - 2} = 2$$

9. The error was that  $b$  needed to be subtracted from both sides, not added.

$$ax + b = 0$$

$$ax = -b$$

$$x = \frac{-b}{a}$$

10. The error was that both sides should have been divided by  $(a - b)$ , not multiplied.

$$c = ax - bx$$

$$c = (a - b)x$$

$$\frac{c}{a - b} = x$$

11.  $2x + y = 7$

$$y = 7 - 2x$$

12.  $5x + 4y = 10$

$$4y = 10 - 5x$$

$$y = \frac{10 - 5x}{4}$$

$$y = \frac{5}{2} - \frac{5}{4}x$$

14.  $18x - 2y = 26$

$$-2y = 26 - 18x$$

$$y = \frac{26 - 18x}{-2}$$

$$y = -13 + 9x$$

16.  $8x - 8y = 5$

$$8y = 5 - 8x$$

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

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

7.  $\frac{x}{a} + b = c$

$$\frac{x}{a} = c - b$$

$$x = a(c - b);$$

$$x = a(c - b)$$

$$= 4(13 - 6)$$

$$= 28$$

13.  $12 = 9x + 3y$

$$12 - 9x = 3y$$

$$\frac{12 - 9x}{3} = y$$

$$4 - 3x = y$$

15.  $14 = 7y - 6x$

$$14 + 6x = 7y$$

$$\frac{14 + 6x}{7} = y$$

$$2 + \frac{6}{7}x = y$$

17.  $30 = 9x - 5y$

$$30 - 9x = -5y$$

$$\frac{30 - 9x}{-5} = y$$

$$\frac{9}{5}x - 6 = y$$

18.  $3 + 6x = 11 - 4y$   
 $3 + 6x - 11 = -4y$   
 $6x - 8 = -4y$   
 $\frac{6x - 8}{-4} = y$   
 $2 - \frac{3}{2}x = y$
19.  $2 + 6y = 3x + 4$   
 $6y = 3x + 4 - 2$   
 $6y = 3x + 2$   
 $y = \frac{3x + 2}{6}$   
 $y = \frac{1}{2}x + \frac{1}{3}$
20.  $V = \ell wh$   
 $\frac{V}{\ell} = wh$   
 $\frac{V}{\ell h} = w$
21.  $S = 2B + Ph$   
 $S - 2B = Ph$   
 $\frac{S - 2B}{P} = h$
22.  $\ell = 24f$   
 $\frac{\ell}{24} = f$
23. C;  $A = \frac{1}{2}(b_1 + b_2)h$   
 $2A = (b_1 + b_2)h$   
 $\frac{2A}{h} = b_1 + b_2$   
 $\frac{2A}{h} - b_2 = b_1$
24.  $4.2x - 2y = 16.8$   
 $-2y = 16.8 - 4.2x$   
 $y = \frac{16.8 - 4.2x}{-2}$   
 $y = 2.1x - 8.4$
25.  $9 - 0.5y = 2.5x$   
 $-0.5y = 2.5x - 9$   
 $y = \frac{2.5x - 9}{-0.5}$   
 $y = -5x + 18$
26.  $8x - 5x + 21 = 36 - 6y$   
 $3x + 21 = 36 - 6y$   
 $3x - 15 = -6y$   
 $\frac{3x - 15}{-6} = y$   
 $-\frac{1}{2}x + \frac{5}{2} = y$
27.  $S = \pi r \ell + \pi r^2$   
 $S - \pi r^2 = \pi r \ell$   
 $\frac{S - \pi r^2}{\pi r} = \ell$   
 $\frac{S}{\pi r} - r = \ell;$   
 $\ell = \frac{S}{\pi r} - r = \frac{283}{(3.14)(5)} - 5 \approx 18.03 - 5 = 13.03 \text{ cm}$
28.  $A = 4\pi pw$   
 $\frac{A}{4\pi w} = p;$   
 $p = \frac{A}{4\pi w} = \frac{905}{4(3.14)(9)} \approx 8.01 \text{ ft}$
29. Answers will vary.
30.  $x = \frac{a + b + c}{ab}$   
 $xab = a + b + c$   
 $xab - a = b + c$   
 $a(xb - 1) = b + c$

$$a = \frac{b + c}{xb - 1}$$

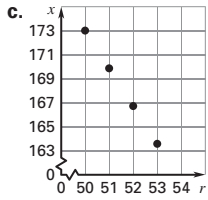
31.  $y = x\left(\frac{ab}{a - b}\right)$   
 $\frac{y}{x} = \frac{ab}{a - b}$   
 $y(a - b) = xab$   
 $ya - yb = xab$   
 $-yb = xab - ya$   
 $-yb = a(xb - y)$   
 $\frac{-yb}{xb - y} = a$   
 $\frac{yb}{y - xb} = a$

**Problem Solving**

32. a.  $d = 4n - 2$   
 $d + 2 = 4n$   
 $\frac{d + 2}{4} = n$
- b.  $d = 5: n = \frac{d + 2}{4} = \frac{5 + 2}{4} = \frac{7}{4} = 1.75 \text{ in.}$   
 $d = 12: n = \frac{d + 2}{4} = \frac{12 + 2}{4} = \frac{14}{4} = 3.5 \text{ in.}$   
 $d = 16: n = \frac{d + 2}{4} = \frac{16 + 2}{4} = \frac{18}{4} = 4.5 \text{ in.}$   
 $d = 20: n = \frac{d + 2}{4} = \frac{20 + 2}{4} = \frac{22}{4} = 5.5 \text{ in.}$
33. a.  $C = 12x + 25$   
 $C - 25 = 12x$   
 $\frac{C - 25}{12} = x$
- b.  $C = 145: x = \frac{C - 25}{12} = \frac{145 - 25}{12} = 10 \text{ nights}$   
 $C = 181: x = \frac{C - 25}{12} = \frac{181 - 25}{12} = 13 \text{ nights}$   
 $C = 205: x = \frac{C - 25}{12} = \frac{205 - 25}{12} = 15 \text{ nights}$
34. a.  $P = 2\pi r + 2x$   
 $P - 2\pi r = 2x$   
 $\frac{P - 2\pi r}{2} = x$

b.

$r$ (ft)	$x$ (ft)
50	$\frac{660 - 2(3.14)(50)}{2} = 173$
51	$\frac{660 - 2(3.14)(51)}{2} \approx 170$
52	$\frac{660 - 2(3.14)(52)}{2} \approx 167$
53	$\frac{660 - 2(3.14)(53)}{2} \approx 164$



As the radius increases by 1, the value of  $x$  decreases by 3. So, when  $r = 54$ ,  $x = 164 - 3 = 161$  ft.

35. The percent equation is  $a = p\% \cdot b$ . Because you want to calculate the percent tip, you should solve the equation for  $p\%$ . Divide each side of the equation by  $b$  to get  $\frac{a}{b} = p\%$ . So the amount of the tip,  $a$ , divided by the amount of the bill,  $b$ , gives you the percent tip.

36. a.  $C = 2\pi r$

$$\frac{C}{2\pi} = r$$

b.  $C = 7: r = \frac{C}{2\pi} = \frac{7}{2(3.14)} \approx 1.1$  ft

$C = 8: r = \frac{C}{2\pi} = \frac{8}{2(3.14)} \approx 1.3$  ft

$C = 9: r = \frac{C}{2\pi} = \frac{9}{2(3.14)} \approx 1.4$  ft

- c. The formula for area of a circle is  $A = \pi r^2$ . Solve the circumference formula for  $r$  and substitute  $\frac{C}{2\pi}$  for  $r$  in the area formula.

$$A = \pi \left( \frac{C}{2\pi} \right)^2$$

37.  $20g = 55t$

$$g = \frac{55t}{20}$$

$$g = \frac{11t}{4}$$

**Quiz for the lessons "Write Ratios and Proportions," "Solve Proportions Using Cross Products" and "Solve Percent Problems"**

1.  $\frac{24}{20} = \frac{x}{5}$

$$5 \cdot \frac{24}{20} = 5 \cdot \frac{x}{5}$$

$$\frac{120}{20} = x$$

$$6 = x$$

Check:

$$\frac{24}{20} \stackrel{?}{=} \frac{6}{5}$$

$$\frac{6}{5} = \frac{6}{5}$$

2.  $\frac{6}{-7} = \frac{3z}{42}$

$$42 \cdot \frac{6}{-7} = 42 \cdot \frac{3z}{42}$$

$$\frac{252}{-7} = 3z$$

$$-36 = 3z$$

$$-12 = z$$

Check:

$$\frac{6}{-7} \stackrel{?}{=} \frac{3(-12)}{42}$$

$$\frac{6}{-7} \stackrel{?}{=} \frac{-36}{42}$$

$$\frac{-6}{7} = \frac{-6}{7}$$

3.  $\frac{14}{12} = \frac{w + 11}{18}$

$$18 \cdot \frac{14}{12} = 18 \cdot \frac{w + 11}{18}$$

$$\frac{252}{12} = w + 11$$

$$21 = w + 11$$

$$10 = w$$

Check:

$$\frac{14}{12} \stackrel{?}{=} \frac{10 + 11}{18}$$

$$\frac{14}{12} \stackrel{?}{=} \frac{21}{18}$$

$$\frac{7}{6} = \frac{7}{6}$$

5.  $\frac{10}{17} = \frac{k}{2k - 3}$

$$10(2k - 3) = 17k$$

$$20k - 30 = 17k$$

$$-30 = -3k$$

$$10 = k$$

Check:

$$\frac{10}{17} \stackrel{?}{=} \frac{10}{2(10) - 3}$$

$$\frac{10}{17} \stackrel{?}{=} \frac{10}{20 - 3}$$

$$\frac{10}{17} = \frac{10}{17}$$

4.  $\frac{18}{5a} = \frac{3}{-5}$

$$18(-5) = 3(5a)$$

$$-90 = 15a$$

$$-6 = a$$

Check:

$$\frac{18}{5(-6)} \stackrel{?}{=} \frac{3}{-5}$$

$$\frac{18}{-30} \stackrel{?}{=} \frac{3}{-5}$$

$$18(-5) \stackrel{?}{=} -30(3)$$

$$-90 = -90$$

6.  $\frac{h - 1}{3} = \frac{2h + 1}{9}$

$$3(2h + 1) = 9(h - 1)$$

$$6h + 3 = 9h - 9$$

$$3 = 3h - 9$$

$$12 = 3h$$

$$4 = h$$

Check:

$$\frac{4 - 1}{3} \stackrel{?}{=} \frac{2(4) + 1}{9}$$

$$\frac{3}{3} \stackrel{?}{=} \frac{8 + 1}{9}$$

$$\frac{3}{3} \stackrel{?}{=} \frac{9}{9}$$

$$1 = 1$$

7.  $5x - 3y = 9$

$$-3y = 9 - 5x$$

$$y = \frac{9 - 5x}{-3}$$

$$y = \frac{5}{3}x - 3$$

8.  $3x + 2y + 5x = 12$

$$8x + 2y = 12$$

$$2y = 12 - 8x$$

$$y = \frac{12 - 8x}{2}$$

$$y = 6 - 4x$$

9.  $4(2x - y) = 6$

$$8x - 4y = 6$$

$$-4y = 6 - 8x$$

$$y = \frac{6 - 8x}{-4}$$

$$y = 2x - \frac{3}{2}$$

10.  $V = \pi r^2 h$

$$\frac{V}{\pi r^2} = h$$

**Mixed Review of Problem Solving for the lessons "Write Ratios and Proportions," "Solve Proportions Using Cross Products," "Solve Percent Problems," and "Rewrite Equations and Formulas"**

1. a.  $\frac{7}{31} = \frac{x}{1209}$

b.  $31x = 7(1209)$

$31x = 8463$

$x = 273$

273 students would choose baseball as their favorite sport.

2. a.  $\frac{5}{4+5} = \frac{5}{9}$

b.  $\frac{5}{9} = \frac{x}{216}$

$9x = 5(216)$

$9x = 1080$

$x = 120$

There are 120 female students in the freshman class.

3.  $\frac{7}{154} = \frac{x}{770}$

$154x = 5390$

$x = 35$

You will use 35 gallons of gasoline to travel 770 miles. At \$2 per gallon for gasoline,  $\$2(35) = \$70$ . So, you should budget \$70 for gasoline.

4. By solving the surface area-to-volume quotient formula for  $r$ , you get

$r = \frac{3}{Q}$

You can then substitute this equivalent of  $r$  into the formula for diameter giving you,

$d = 2\left(\frac{3}{Q}\right)$  or  $d = \frac{6}{Q}$ .

5. a.  $a = p\% \cdot b$

$84 = 60\% \cdot b$

$84 = 0.6b$

$140 = b$

He had 140 free throw attempts.

6. a.  $a = 6\% \cdot 208,000$

$a = 0.06 \cdot 208,000$

$a = 12,480$

The agent should expect \$12,480 in commission.

b.  $a = 6\% \cdot 205,000$

$a = 0.06 \cdot 205,000$

$a = 12,300$

The agent receives \$12,300.

c.  $a = 10\% \cdot 12,300$

$a = 0.1 \cdot 12,300$

$a = 1230$

The assistant receives \$1230. To find what percent of \$205,000 this amount is, use the percent equation again.

$1230 = p\% \cdot 205,000$

$0.006 = p\%$

$0.6\% = p\%$

The assistant receives 0.6% of the selling price.

7.  $A = \frac{1}{2}d_1d_2$

Multiply each side of the equation by 2 (the reciprocal of  $\frac{1}{2}$ ).

$2A = d_1d_2$

Divide each side of the equation by  $d_2$  to solve for  $d_1$ .

$\frac{2A}{d_2} = d_1$

8. Answers will vary.

**Chapter Review for the chapter "Solving Linear Equations"**

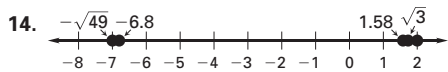
- A *scale drawing* is a two-dimensional drawing of an object in which the dimensions of the drawing are in proportion to the dimensions of the object.
- When you perform the same inverse operation on each side of an equation, you produce an *equivalent* equation.
- When you combine like terms, you get  $10x = 10x$ . So, the equation is true for all real numbers, making it an identity.
- In the proportion  $\frac{7}{8} = \frac{28}{32}$ ,  $7 \cdot 32$  and  $8 \cdot 28$  are *cross products*.
- $6x - 2y = 16$   
Subtract  $6x$  from each side of the equation.  
 $-2y = 16 - 6x$   
Divide each side by  $-2$ .  
 $y = \frac{16 - 6x}{-2}$   
Simplify.  
 $y = 3x - 8$
- $\sqrt{121} = 11$
- $-\sqrt{36} = -6$
- $\pm\sqrt{81} = \pm 9$
- $\pm\sqrt{225} = \pm 15$
- $81 < 97 < 100$   
 $\sqrt{81} < \sqrt{97} < \sqrt{100}$   
 $9 < \sqrt{97} < 10$   
Because 97 is closer to 100 than to 81,  $\sqrt{97}$  is closer to 10 than to 9.
- $-\sqrt{49} < -\sqrt{48} < -\sqrt{36}$   
 $-7 < -\sqrt{48} < -6$   
Because 48 is closer to 49 than to 36,  $-\sqrt{48}$  is closer to  $-7$  than to  $-6$ .

12.  $-\sqrt{144} < -\sqrt{142} < -\sqrt{121}$   
 $-12 < -\sqrt{142} < -11$

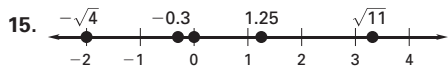
Because 142 is closer to 144 than to 121,  $-\sqrt{142}$  is closer to  $-12$  than to  $-11$ .

13.  $289 < 300 < 324$   
 $\sqrt{289} < \sqrt{300} < \sqrt{324}$   
 $17 < \sqrt{300} < 18$

Because 300 is closer to 289 than to 324,  $\sqrt{300}$  is closer to 17 than to 18.



From least to greatest, the numbers are  $-\sqrt{49}$ ,  $-6.8$ ,  $1.58$ ,  $\sqrt{3}$ , and 2.



From least to greatest, the numbers are  $-\sqrt{4}$ ,  $-0.3$ ,  $0$ ,  $1.25$ , and  $\sqrt{11}$ .

16.  $x - 4 = 3$                       17.  $-8 + a = 5$   
 $x - 4 + 4 = 3 + 4$                        $-8 + a + 8 = 5 + 8$   
 $x = 7$      $a = 13$

Check:                                      Check:  
 $7 - 4 \stackrel{?}{=} 3$                                        $-8 + 13 \stackrel{?}{=} 5$   
 $3 = 3$      $5 = 5$

18.  $4m = -84$                       19.  $-5z = 75$   
 $\frac{4m}{4} = \frac{-84}{4}$                                        $\frac{-5z}{-5} = \frac{75}{-5}$   
 $m = -21$      $z = -15$

Check:                                      Check:  
 $4(-21) \stackrel{?}{=} -84$                                        $-5(-15) \stackrel{?}{=} 75$   
 $-84 = -84$      $75 = 75$

20.  $11 = \frac{r}{6}$                                       21.  $-27 = \frac{3}{4}w$   
 $6 \cdot 11 = 6 \cdot \frac{r}{6}$                                        $\frac{4}{3}(-27) = \frac{4}{3}(\frac{3}{4}w)$   
 $66 = r$      $-36 = w$

Check:                                      Check:  
 $11 \stackrel{?}{=} \frac{66}{6}$      $-27 \stackrel{?}{=} \frac{3}{4}(-36)$   
 $11 = 11$      $-27 = -27$

22.  $A = \ell w$   
 $211,200 = 660w$   
 $\frac{211,200}{660} = \frac{660w}{660}$

$320 = w$   
 The width is 320 feet.

23.  $9b + 5 = 23$   
 $9b = 18$   
 $b = 2$

Check:  
 $9(2) + 5 \stackrel{?}{=} 23$   
 $18 + 5 \stackrel{?}{=} 23$   
 $23 = 23$

25.  $\frac{n}{3} - 4 = 2$   
 $\frac{n}{3} = 6$

$3 \cdot \frac{n}{3} = 3 \cdot 6$   
 $n = 18$

Check:

$\frac{18}{3} - 4 \stackrel{?}{=} 2$   
 $6 - 4 \stackrel{?}{=} 2$   
 $2 = 2$

27.  $3t + 9t = 60$   
 $12t = 60$   
 $t = 5$

Check:

$3(5) + 9(5) \stackrel{?}{=} 60$   
 $15 + 45 \stackrel{?}{=} 60$   
 $60 = 60$

29.  $3w + 4w - 2 = 12$   
 $7w - 2 = 12$   
 $7w = 14$   
 $w = 2$

Check:

$3(2) + 4(2) - 2 \stackrel{?}{=} 12$   
 $6 + 8 - 2 \stackrel{?}{=} 12$   
 $12 = 12$

31.  $c + 2c - 5 - 5c = 7$   
 $-2c - 5 = 7$   
 $-2c = 12$   
 $c = -6$

Check:

$-6 + 2(-6) - 5 - 5(-6) \stackrel{?}{=} 7$   
 $-6 - 12 - 5 + 30 \stackrel{?}{=} 7$   
 $7 = 7$

32.  $4y - (y - 4) = -20$   
 $4y - y + 4 = -20$   
 $3y + 4 = -20$   
 $3y = -24$   
 $y = -8$

24.  $11 = 5y - 4$   
 $15 = 5y$   
 $3 = y$

Check:

$11 \stackrel{?}{=} 5(3) - 4$   
 $11 \stackrel{?}{=} 15 - 4$   
 $11 = 11$

26.  $\frac{3}{2}v + 2 = 20$   
 $\frac{3}{2}v = 18$

$\frac{2}{3} \cdot \frac{3}{2}v = \frac{2}{3} \cdot 18$   
 $v = 12$

Check:

$\frac{3}{2}(12) + 2 \stackrel{?}{=} 20$   
 $18 + 2 \stackrel{?}{=} 20$   
 $20 = 20$

28.  $-110 = -4c - 6c$   
 $-110 = -10c$   
 $11 = c$

Check:

$-110 \stackrel{?}{=} -4(11) - 6(11)$   
 $-110 \stackrel{?}{=} -44 - 66$   
 $-110 \stackrel{?}{=} -110$

30.  $z + 5 - 4z = 8$   
 $5 - 3z = 8$   
 $-3z = 3$   
 $z = -1$

Check:

$-1 + 5 - 4(-1) \stackrel{?}{=} 8$   
 $4 + 4 \stackrel{?}{=} 8$   
 $8 = 8$

$$\begin{aligned}
 33. \quad & 8a - 3(2a + 5) = 13 \\
 & 8a - 6a - 15 = 13 \\
 & 2a - 15 = 13 \\
 & 2a = 28 \\
 & a = 14
 \end{aligned}$$

$$\begin{aligned}
 \text{Check:} \\
 & 8(14) - 3(2 \cdot 14 + 5) \stackrel{?}{=} 13 \\
 & 112 - 3(28 + 5) \stackrel{?}{=} 13 \\
 & 112 - 3(33) \stackrel{?}{=} 13 \\
 & 112 - 99 \stackrel{?}{=} 13 \\
 & 13 = 13
 \end{aligned}$$

$$\begin{aligned}
 34. \quad & 16h - 4(5h - 7) = 4 \\
 & 16h - 20h + 28 = 4 \\
 & -4h + 28 = 4 \\
 & -4h = -24 \\
 & h = 6
 \end{aligned}$$

$$\begin{aligned}
 \text{Check:} \\
 & 16(6) - 4(5 \cdot 6 - 7) \stackrel{?}{=} 4 \\
 & 96 - 4(30 - 7) \stackrel{?}{=} 4 \\
 & 96 - 4(23) \stackrel{?}{=} 4 \\
 & 96 - 92 \stackrel{?}{=} 4 \\
 & 4 = 4
 \end{aligned}$$

$$35. \quad \frac{3}{2}(b + 1) = 3$$

$$\frac{2}{3} \cdot \frac{3}{2}(b + 1) = \frac{2}{3} \cdot 3$$

$$b + 1 = 2$$

$$b = 1$$

Check:

$$\frac{3}{2}(1 + 1) \stackrel{?}{=} 3$$

$$\frac{3}{2}(2) \stackrel{?}{=} 3$$

$$3 = 3$$

$$36. \quad \frac{4}{3}(2x - 1) = -12$$

$$\frac{3}{4} \cdot \frac{4}{3}(2x - 1) = \frac{3}{4}(-12)$$

$$2x - 1 = -9$$

$$2x = -8$$

$$x = -4$$

Check:

$$\frac{4}{3}[2(-4) - 1] \stackrel{?}{=} -12$$

$$\frac{4}{3}(-8 - 1) \stackrel{?}{=} -12$$

$$\frac{4}{3}(-9) \stackrel{?}{=} -12$$

$$-12 = -12$$

$$37. \quad \frac{6}{5}(8k + 2) = -36$$

$$\frac{5}{6} \cdot \frac{6}{5}(8k + 2) = \frac{5}{6}(-36)$$

$$8k + 2 = -30$$

$$8k = -32$$

$$k = -4$$

Check:

$$\frac{6}{5}[8(-4) + 2] \stackrel{?}{=} -36$$

$$\frac{6}{5}(-32 + 2) \stackrel{?}{=} -36$$

$$\frac{6}{5}(-30) \stackrel{?}{=} -36$$

$$-36 = -36$$

$$38. \quad -3z - 1 = 8 - 3z$$

$$-1 \neq 8$$

no solution

$$39. \quad 16 - 2m = 5m + 9$$

$$16 = 7m + 9$$

$$7 = 7m$$

$$1 = m$$

$$40. \quad 2.9w + 5 = 4.7w - 7.6$$

$$5 = 1.8w - 7.6$$

$$12.6 = 1.8w$$

$$7 = w$$

$$41. \quad 2y + 11.4 = 2.6 - 0.2y$$

$$2.2y + 11.4 = 2.6$$

$$2.2y = -8.8$$

$$y = -4$$

$$42. \quad 4(x - 3) = -2(6 - 2x)$$

$$4x - 12 = -12 + 4x$$

$$4x - 12 = 4x - 12$$

The equation is an identity, so the solution is all real numbers.

$$43. \quad 6(2a + 10) = 5(a + 5)$$

$$12a + 60 = 5a + 25$$

$$7a + 60 = 25$$

$$7a = -35$$

$$a = -5$$

$$44. \quad \frac{1}{12}(48 + 24b) = 2(17 - 4b)$$

$$4 + 2b = 34 - 8b$$

$$4 + 10b = 34$$

$$10b = 30$$

$$b = 3$$

$$45. \quad 1.5(n + 20) = 0.5(3n + 60)$$

$$1.5n + 30 = 1.5n + 30$$

The equation is an identity, so the solution is all real numbers.

$$46. \quad \text{a. } 8x - 3 = 6x + 5$$

$$2x - 3 = 5$$

$$2x = 8$$

$$x = 4$$

$$\text{b. } P = 4s = 4(6x + 5)$$

$$4(6 \cdot 4 + 5) = 4(24 + 5) = 4(29) = 116$$

The perimeter is 116 units.

$$47. \quad \frac{56}{16} = \frac{x}{2}$$

$$2 \cdot \frac{56}{16} = 2 \cdot \frac{x}{2}$$

$$7 = x$$

Check:

$$\frac{56}{16} \stackrel{?}{=} \frac{7}{2}$$

$$\frac{7}{2} = \frac{7}{2}$$

$$48. \quad \frac{y}{9} = \frac{25}{15}$$

$$9 \cdot \frac{y}{9} = 9 \cdot \frac{25}{15}$$

$$y = 15$$

Check:

$$\frac{15}{9} \stackrel{?}{=} \frac{25}{15}$$

$$\frac{5}{3} = \frac{5}{3}$$

$$49. \quad \frac{2}{7} = \frac{m}{91}$$

$$91 \cdot \frac{2}{7} = 91 \cdot \frac{m}{91}$$

$$26 = m$$

Check:

$$\frac{2}{7} \stackrel{?}{=} \frac{26}{91}$$

$$\frac{2}{7} = \frac{2}{7}$$

$$50. \quad \frac{5z}{3} = \frac{105}{6}$$

$$3 \cdot \frac{5z}{3} = 3 \cdot \frac{105}{6}$$

$$5z = 52.5$$

$$z = 10.5$$

Check:

$$\frac{5(10.5)}{3} \stackrel{?}{=} \frac{105}{6}$$

$$\frac{52.5}{3} \stackrel{?}{=} \frac{105}{6}$$

$$17.5 = 17.5$$

$$51. \quad \frac{9}{4} = \frac{3a}{20}$$

$$20 \cdot \frac{9}{4} = 20 \cdot \frac{3a}{20}$$

$$45 = 3a$$

$$15 = a$$

Check:

$$\frac{9}{4} \stackrel{?}{=} \frac{3 \cdot 15}{20}$$

$$\frac{9}{4} \stackrel{?}{=} \frac{45}{20}$$

$$2.25 = 2.25$$

$$53. \quad \frac{1}{560} = \frac{x}{1400}$$

$$1400 \cdot \frac{1}{560} = 1400 \cdot \frac{x}{1400}$$

$$2.5 = x$$

2.5 gallons of paint are needed to cover 1400 square feet.

$$54. \quad \frac{5}{7} = \frac{20}{r}$$

$$5r = 7(20)$$

$$5r = 140$$

$$r = 28$$

Check:

$$\frac{5}{7} \stackrel{?}{=} \frac{20}{28}$$

$$5(28) \stackrel{?}{=} 7(20)$$

$$140 = 140$$

$$56. \quad \frac{126}{56} = \frac{9}{4b}$$

$$126(4b) = 56(9)$$

$$504b = 504$$

$$b = 1$$

$$57. \quad \frac{10}{3m} = \frac{-5}{6}$$

$$-5(3m) = 10(6)$$

$$-15m = 60$$

$$m = -4$$

$$58. \quad \frac{n+8}{5n-2} = \frac{3}{8}$$

$$8(n+8) = 3(5n-2)$$

$$8n+64 = 15n-6$$

$$64 = 7n-6$$

$$70 = 7n$$

$$10 = n$$

$$52. \quad \frac{c+2}{45} = \frac{8}{5}$$

$$45 \cdot \frac{c+2}{45} = 45 \cdot \frac{8}{5}$$

$$c+2 = 72$$

$$c = 70$$

Check:

$$\frac{70+2}{45} \stackrel{?}{=} \frac{8}{5}$$

$$\frac{72}{45} \stackrel{?}{=} \frac{8}{5}$$

$$1.6 = 1.6$$

$$55. \quad \frac{6}{z} = \frac{12}{5}$$

$$12z = 6(5)$$

$$12z = 30$$

$$z = 2.5$$

Check:

$$\frac{6}{2.5} \stackrel{?}{=} \frac{12}{5}$$

$$12(2.5) \stackrel{?}{=} 6(5)$$

$$30 = 30$$

Check:

$$\frac{126}{56} \stackrel{?}{=} \frac{9}{4 \cdot 1}$$

$$2.25 = 2.25$$

Check:

$$\frac{10}{3(-4)} \stackrel{?}{=} \frac{-5}{6}$$

$$\frac{10}{-12} \stackrel{?}{=} \frac{-5}{6}$$

$$\frac{-5}{6} = \frac{-5}{6}$$

Check:

$$\frac{10+8}{5 \cdot 10-2} \stackrel{?}{=} \frac{3}{8}$$

$$\frac{18}{48} \stackrel{?}{=} \frac{3}{8}$$

$$\frac{3}{8} = \frac{3}{8}$$

$$59. \quad \frac{5-c}{3} = \frac{2c+2}{-4}$$

$$-4(5-c) = 3(2c+2)$$

$$-20+4c = 6c+6$$

$$-20 = 2c+6$$

$$-26 = 2c$$

$$-13 = c$$

$$60. \quad \frac{1}{12} = \frac{6.8}{x}$$

$$1(x) = 12(6.8)$$

$$x = 81.6$$

The actual distance between the cities is about 81.6 kilometers.

$$61. \quad x+7y=0$$

$$7y = -x$$

$$y = \frac{-x}{7}$$

$$63. \quad 4y-x=20-y$$

$$5y-x=20$$

$$5y = x+20$$

$$y = \frac{x+20}{5}$$

$$y = \frac{x}{5} + 4$$

$$64. \quad a. \quad V = \ell wh$$

$$\frac{V}{\ell w} = h$$

$$b. \quad h = \frac{V}{\ell w} = \frac{5850}{(30)(13)} = \frac{5850}{390} = 15$$

The height is 15 inches.

Check:

$$\frac{5-(-13)}{3} \stackrel{?}{=} \frac{2(-13)+2}{-4}$$

$$\frac{18}{3} \stackrel{?}{=} \frac{-26+2}{-4}$$

$$6 \stackrel{?}{=} \frac{-24}{-4}$$

$$6 = 6$$

$$62. \quad 3x = 2y - 18$$

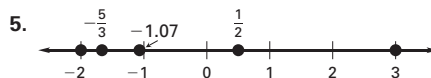
$$3x + 18 = 2y$$

$$\frac{3x+18}{2} = y$$

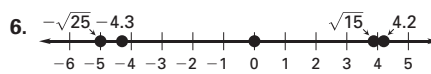
$$\frac{3}{2}x + 9 = y$$

### Chapter Test for the chapter "Solving Linear Equations"

- $-\frac{1}{4}$  is a real number and a rational number.
- $\sqrt{90}$  is a real number and an irrational number.
- $-\sqrt{144}$  is a real number, a rational number, and an integer.
- 8.95 is a real number and a rational number.



From least to greatest, the numbers are  $-2$ ,  $-\frac{5}{3}$ ,  $-1.07$ ,  $\frac{1}{2}$ , and  $3$ .



From least to greatest, the numbers are  $-\sqrt{25}$ ,  $-4.3$ ,  $0$ ,  $\sqrt{15}$ , and  $4.2$ .



7.  $5 + r = -19$

$r = -24$

Check:

$5 + (-24) \stackrel{?}{=} -19$

$-19 = -19$

9.  $-11x = -77$

$x = 7$

Check:

$-11(7) \stackrel{?}{=} -77$

$-77 = -77$

10.  $\frac{a}{9} = 6$

$9 \cdot \frac{a}{9} = 9 \cdot 6$

$a = 54$

Check:

$\frac{54}{9} \stackrel{?}{=} 6$

$6 = 6$

12.  $3y + 2 = 26$

$3y = 24$

$y = 8$

Check:

$3(8) + 2 \stackrel{?}{=} 26$

$24 + 2 \stackrel{?}{=} 26$

$26 = 26$

14.  $\frac{m}{10} - 6 = 20$

$\frac{m}{10} = 26$

$10 \cdot \frac{m}{10} = 10 \cdot 26$

$m = 260$

15.  $6j + 5j = 33$

$11j = 33$

$j = 3$

Check:

$6(3) + 5(3) \stackrel{?}{=} 33$

$18 + 15 \stackrel{?}{=} 33$

$33 = 33$

8.  $z - 8 = -12$

$z = -4$

Check:

$-4 - 8 \stackrel{?}{=} -12$

$-12 = -12$

11.  $15q - 17 = 13$

$15q = 30$

$q = 2$

Check:

$15(2) - 17 \stackrel{?}{=} 13$

$30 - 17 \stackrel{?}{=} 13$

$13 = 13$

13.  $\frac{b}{4} + 5 = 14$

$\frac{b}{4} = 9$

$b = 36$

Check:

$\frac{36}{4} + 5 \stackrel{?}{=} 14$

$9 + 5 \stackrel{?}{=} 14$

$14 = 14$

Check:

$\frac{260}{10} - 6 \stackrel{?}{=} 20$

$26 - 6 \stackrel{?}{=} 20$

$20 = 20$

16.  $4k - 9k = 10$

$-5k = 10$

$k = -2$

Check:

$4(-2) - 9(-2) \stackrel{?}{=} 10$

$-8 + 18 \stackrel{?}{=} 10$

$10 = 10$

17.  $14c - 8c + 7 = 37$

$6c + 7 = 37$

$6c = 30$

$c = 5$

Check:

$14(5) - 8(5) + 7 \stackrel{?}{=} 37$

$70 - 40 + 7 \stackrel{?}{=} 37$

$37 = 37$

19.  $-19.4 - 15d + 22d = 4.4$

$-19.4 + 7d = 4.4$

$7d = 23.8$

$d = 3.4$

Check:

$-19.4 - 15(3.4) + 22(3.4) \stackrel{?}{=} 4.4$

$-19.4 - 51 + 74.8 \stackrel{?}{=} 4.4$

$4.4 = 4.4$

20.  $-12h + 39 = -4h - 17$

$39 = 8h - 17$

$56 = 8h$

$7 = h$

Check:

$-12(7) + 39 \stackrel{?}{=} -4(7) - 17$

$-84 + 39 \stackrel{?}{=} -28 - 17$

$-45 = -45$

21.  $-5.7v - 44.2 = -8.3v$

$-44.2 = -2.6v$

$17 = v$

Check:

$-5.7(17) - 44.2 \stackrel{?}{=} -8.3(17)$

$-96.9 - 44.2 \stackrel{?}{=} -141.1$

$-141.1 = -141.1$

22.  $-6.5t + 15 = -9.7t + 43.8$

$3.2t + 15 = 43.8$

$3.2t = 28.8$

$t = 9$

Check:

$-6.5(9) + 15 \stackrel{?}{=} -9.7(9) + 43.8$

$-58.5 + 15 \stackrel{?}{=} -87.3 + 43.8$

$-43.5 = -43.5$

23.  $3(3n + 4) = 54 + 6n$

$9n + 12 = 54 + 6n$

$3n + 12 = 54$

$3n = 42$

$n = 14$

Check:

$3(3 \cdot 14 + 4) \stackrel{?}{=} 54 + 6 \cdot 14$

$3(42 + 4) \stackrel{?}{=} 54 + 84$

$3(46) \stackrel{?}{=} 138$

$138 = 138$

18.  $4w - 21 + 5w = 51$

$9w - 21 = 51$

$9w = 72$

$w = 8$

Check:

$4(8) - 21 + 5(8) \stackrel{?}{=} 51$

$32 - 21 + 40 \stackrel{?}{=} 51$

$51 = 51$

$$24. \frac{1}{3}(24p - 66) = 3p + 43$$

$$8p - 22 = 3p + 43$$

$$5p - 22 = 43$$

$$5p = 65$$

$$p = 13$$

Check:

$$\frac{1}{3}(24 \cdot 13 - 66) \stackrel{?}{=} 3 \cdot 13 + 43$$

$$\frac{1}{3}(312 - 66) \stackrel{?}{=} 39 + 43$$

$$\frac{1}{3}(246) \stackrel{?}{=} 82$$

$$82 = 82$$

$$25. \frac{3}{4} = \frac{z}{16}$$

$$4z = 3(16)$$

$$4z = 48$$

$$z = 12$$

Check:

$$\frac{3}{4} \stackrel{?}{=} \frac{12}{16}$$

$$4(12) \stackrel{?}{=} 3(16)$$

$$48 = 48$$

$$27. \frac{k}{9} = \frac{63}{81}$$

$$81k = 9(63)$$

$$81k = 567$$

$$k = 7$$

Check:

$$\frac{7}{9} \stackrel{?}{=} \frac{63}{81}$$

$$81(7) \stackrel{?}{=} 9(63)$$

$$567 = 567$$

$$29. \frac{34}{6} = \frac{2x + 1}{3}$$

$$6(2x + 1) = 34(3)$$

$$12x + 6 = 102$$

$$12x = 96$$

$$x = 8$$

Check:

$$\frac{34}{6} \stackrel{?}{=} \frac{2 \cdot 8 + 1}{3}$$

$$\frac{34}{6} \stackrel{?}{=} \frac{17}{3}$$

$$\frac{17}{3} = \frac{17}{3}$$

$$31. 8x + y = 14$$

$$y = 14 - 8x$$

$$26. \frac{72}{45} = \frac{8}{w}$$

$$72w = 45(8)$$

$$72w = 360$$

$$w = 5$$

Check:

$$\frac{72}{45} \stackrel{?}{=} \frac{8}{5}$$

$$72(5) \stackrel{?}{=} 45(8)$$

$$360 = 360$$

$$28. \frac{-5n}{4} = \frac{15}{2}$$

$$2(-5n) = 4(15)$$

$$-10n = 60$$

$$n = -6$$

Check:

$$\frac{-5(-6)}{4} \stackrel{?}{=} \frac{15}{2}$$

$$2(-5)(-6) \stackrel{?}{=} 4(15)$$

$$60 = 60$$

$$30. \frac{-4a - 1}{-10a} = \frac{3}{8}$$

$$3(-10a) = 8(-4a - 1)$$

$$-30a = -32a - 8$$

$$2a = -8$$

$$a = -4$$

Check:

$$\frac{-4(-4) - 1}{-10(-4)} \stackrel{?}{=} \frac{3}{8}$$

$$\frac{16 - 1}{40} \stackrel{?}{=} \frac{3}{8}$$

$$\frac{15}{40} \stackrel{?}{=} \frac{3}{8}$$

$$\frac{3}{8} = \frac{3}{8}$$

$$32. -9x + 3y = 18$$

$$3y = 9x + 18$$

$$y = \frac{9x + 18}{3}$$

$$y = 3x + 6$$

$$33. \quad 4x = -2y + 26$$

$$4x - 26 = -2y$$

$$\frac{4x - 26}{-2} = y$$

$$-2x + 13 = y$$

34. Let  $x$  = price of popcorn.

$$2(8.50) + 3(5.50) + 3x = 40.25$$

$$17 + 16.50 + 3x = 40.25$$

$$33.50 + 3x = 40.25$$

$$3x = 6.75$$

$$x = 2.25$$

Each box of popcorn cost \$2.25.

35. Let  $x$  = number of visits.

$$5x + 30 = 7x$$

$$30 = 2x$$

$$15 = x$$

After 15 visits the total cost is the same for members and nonmembers.

$$36. \frac{1 \text{ in.}}{3 \text{ ft}} = \frac{x}{21}$$

$$21 = 3x$$

$$7 = x$$

The length should be 7 inches.

$$\frac{1 \text{ in.}}{3 \text{ ft}} = \frac{x}{18}$$

$$18 = 3x$$

$$6 = x$$

The width should be 6 inches.

### Extra Practice for the chapter "Solving Linear Equations"

$$1. \quad x + 4 = 20$$

$$x + 4 - 4 = 20 - 4$$

$$x = 16$$

$$2. \quad 8 = m - 13$$

$$8 + 13 = m - 13 + 13$$

$$21 = m$$

$$4. \quad z - 8 = -7$$

$$z - 8 + 8 = -7 + 8$$

$$z = 1$$

Check:

$$z - 8 = -7$$

$$1 - 8 \stackrel{?}{=} -7$$

$$-7 = -7 \checkmark$$

$$\text{Check: } x + 4 = 20$$

$$16 + 4 \stackrel{?}{=} 20$$

$$20 = 20 \checkmark$$

$$3. \quad t + 2 = -10$$

$$t + 2 - 2 = -10 - 2$$

$$t = -12$$

Check:

$$t + 2 = -10$$

$$-12 + 2 \stackrel{?}{=} -10$$

$$-10 = -10 \checkmark$$

$$5. \quad 7h = 63$$

$$\frac{7h}{7} = \frac{63}{7}$$

$$h = 9$$

Check:

$$7h = 63$$

$$7(9) \stackrel{?}{=} 63$$

$$63 = 63 \checkmark$$

6.  $-4t = -44$

$$\frac{-4t}{-4} = \frac{-44}{-4}$$

$$t = 11$$

Check

$$-4t = -44$$

$$-4(11) \stackrel{?}{=} -44$$

$$-44 = -44 \checkmark$$

8.  $\frac{y}{-3} = 8$

$$-3 \cdot \left(\frac{y}{-3}\right) = -3 \cdot 8$$

$$y = -24$$

Check:

$$\frac{y}{-3} = 8$$

$$\frac{-24}{-3} \stackrel{?}{=} 8$$

$$8 = 8 \checkmark$$

10.  $6m - 4 = 14$

$$6m - 4 + 4 = 14 + 4$$

$$6m = 18$$

$$\frac{6m}{6} = \frac{18}{6}$$

$$m = 3$$

The solution is 3.

Check:

$$6m - 4 = 14$$

$$6(3) - 4 \stackrel{?}{=} 14$$

$$14 = 14 \checkmark$$

12.  $\frac{t}{4} - 3 = 9$

$$\frac{t}{4} - 3 + 3 = 9 + 3$$

$$\frac{t}{4} = 12$$

$$4 \cdot \frac{t}{4} = 4 \cdot 12$$

$$t = 48$$

The solution is 48.

Check:

$$\frac{t}{4} - 3 = 9$$

$$\frac{48}{4} - 3 \stackrel{?}{=} 9$$

$$9 = 9 \checkmark$$

7.  $\frac{b}{4} = 13$

$$4 \cdot \left(\frac{b}{4}\right) = 4 \cdot 13$$

$$b = 52$$

Check:

$$\frac{b}{4} = 13$$

$$\frac{52}{4} \stackrel{?}{=} 13$$

$$13 = 13 \checkmark$$

9.  $4x + 3 = 27$

$$4x + 3 - 3 = 27 - 3$$

$$4x = 24$$

$$\frac{4x}{4} = \frac{24}{4}$$

$$x = 6$$

The solution is 6.

Check:

$$4x + 3 = 27$$

$$4(6) + 3 \stackrel{?}{=} 27$$

$$27 = 27 \checkmark$$

11.  $50 = 7y - 6$

$$50 + 6 = 7y - 6 + 6$$

$$56 = 7y$$

$$\frac{56}{7} = \frac{7y}{7}$$

$$8 = y$$

The solution is 8.

Check:

$$50 = 7y - 6$$

$$50 \stackrel{?}{=} 7(8) - 6$$

$$50 = 50 \checkmark$$

13.  $\frac{x}{7} + 3 = -2$

$$\frac{x}{7} + 3 - 3 = -2 - 3$$

$$\frac{x}{7} = -5$$

$$7 \cdot \frac{x}{7} = 7 \cdot (-5)$$

$$x = -35$$

The solution is -35.

Check:

$$\frac{x}{7} = -5$$

$$\frac{-35}{7} \stackrel{?}{=} -5$$

$$-5 = -5 \checkmark$$

14.  $6p - 2p = 28$

$$4p = 28$$

$$\frac{4p}{4} = \frac{28}{4}$$

$$p = 7$$

The solution is 7.

Check:

$$6p - 2p = 28$$

$$6(7) - 2(7) \stackrel{?}{=} 28$$

$$28 = 28 \checkmark$$

15.  $6x + 3x + 8 = 35$

$$9x + 8 = 35$$

$$9x + 8 - 8 = 35 - 8$$

$$9x = 27$$

$$\frac{9x}{9} = \frac{27}{9}$$

$$x = 3$$

The solution is 3.

Check:

$$6x + 3x + 8 = 35$$

$$6(3) + 3(3) + 8 \stackrel{?}{=} 35$$

$$35 = 35 \checkmark$$

16.  $12w - 5 - 3w = 40$

$$9w - 5 = 40$$

$$9w - 5 + 5 = 40 + 5$$

$$9w = 45$$

$$\frac{9w}{9} = \frac{45}{9}$$

$$w = 5$$

The solution is 5.

Check:

$$12w - 5 - 3w = 40$$

$$12(5) - 5 - 3(5) \stackrel{?}{=} 40$$

$$40 = 40 \checkmark$$

17.  $4d - 3 - 2d = -15$

$$2d - 3 = -15$$

$$2d - 3 + 3 = -15 + 3$$

$$2d = -12$$

$$\frac{2d}{2} = \frac{-12}{2}$$

$$d = -6$$

The solution is -6.

Check:

$$4d - 3 - 2d = -15$$

$$4(-6) - 3 - 2(-6) \stackrel{?}{=} -15$$

$$-15 = -15 \checkmark$$

18.  $7m + 3(m + 2) = -24$

$$7m + 3m + 6 = -24$$

$$10m + 6 = -24$$

$$10m = -30$$

$$m = -3$$

The solution is -3.

Check:

$$7m + 3(m + 2) = -24$$

$$7(-3) + 3[(-3) + 2] \stackrel{?}{=} -24$$

$$-21 + 3[-1] \stackrel{?}{=} -24$$

$$-21 + (-3) \stackrel{?}{=} -24$$

$$-24 = -24 \checkmark$$

$$\begin{aligned}
 19. \quad & 5x - 3(x - 5) = 13 \\
 & 5x - 3x + 15 = 13 \\
 & 2x + 15 = 13 \\
 & 2x = -2 \\
 & x = -1
 \end{aligned}$$

The solution is  $-1$ .

Check:

$$\begin{aligned}
 & 5x - 3(x - 5) = 13 \\
 & 5(-1) - 3(-1 - 5) \stackrel{?}{=} 13 \\
 & -5 - 3(-6) \stackrel{?}{=} 13 \\
 & -5 + 18 \stackrel{?}{=} 13 \\
 & 13 = 13 \checkmark
 \end{aligned}$$

$$20. \quad \frac{3}{4}(2y - 8) = 6$$

$$\frac{4}{3} \cdot \frac{3}{4}(2y - 8) = \frac{4}{3} \cdot 6$$

$$2y - 8 = 8$$

$$2y = 16$$

$$y = 8$$

The solution is  $8$ .

Check:

$$\frac{3}{4}(2y - 8) = 6$$

$$\frac{3}{4}[2(8) - 8] \stackrel{?}{=} 6$$

$$\frac{3}{4}(8) \stackrel{?}{=} 6$$

$$6 = 6 \checkmark$$

$$21. \quad 8x - 4 = 3x + 6$$

$$5x - 4 = 6$$

$$5x = 10$$

$$x = 2$$

The solution is  $2$ .

Check:

$$8x - 4 = 3x + 6$$

$$8(2) - 4 \stackrel{?}{=} 3(2) + 6$$

$$16 - 4 \stackrel{?}{=} 6 + 6$$

$$12 = 12 \checkmark$$

$$23. \quad 5 - 5x = 14 - 8x$$

$$5 + 3x = 14$$

$$3x = 9$$

$$x = 3$$

The solution is  $3$ .

Check:

$$5 - 5x = 14 - 8x$$

$$5 - 5(3) \stackrel{?}{=} 14 - 8(3)$$

$$5 - 15 \stackrel{?}{=} 14 - 24$$

$$-10 = -10 \checkmark$$

$$22. \quad 10 - 2x = 3x - 20$$

$$10 = 5x - 20$$

$$30 = 5x$$

$$6 = x$$

The solution is  $6$ .

Check:

$$10 - 2x = 3x - 20$$

$$10 - 2(6) \stackrel{?}{=} 3(6) - 20$$

$$10 - 12 \stackrel{?}{=} 18 - 20$$

$$-2 = -2 \checkmark$$

$$24. \quad 3(2y - 5) = 4y - 7$$

$$6y - 15 = 4y - 7$$

$$2y - 15 = -7$$

$$2y = 8$$

$$y = 4$$

The solution is  $4$ .

Check:

$$3(2y - 5) = 4y - 7$$

$$3[2(4) - 5] \stackrel{?}{=} 4(4) - 7$$

$$3[8 - 5] \stackrel{?}{=} 16 - 7$$

$$9 = 9 \checkmark$$

$$25. \quad 9 + 4y = 2(3 - y)$$

$$9 + 4y = 6 - 2y$$

$$9 + 6y = 6$$

$$6y = -3$$

$$y = -\frac{1}{2}$$

The solution is  $-\frac{1}{2}$ .

Check:

$$9 + 4y = 2(3 - y)$$

$$9 + 4\left(-\frac{1}{2}\right) \stackrel{?}{=} 2\left[3 - \left(-\frac{1}{2}\right)\right]$$

$$9 - 2 \stackrel{?}{=} 2\left[\frac{7}{2}\right]$$

$$7 = 7 \checkmark$$

$$26. \quad 3x - 3 = \frac{3}{4}(2x + 12)$$

$$3x - 3 = \frac{3}{2}x + 9$$

$$\frac{3}{2}x - 3 = 9$$

$$\frac{3}{2}x = 12$$

$$\frac{2}{3} \cdot \frac{3}{2}x = \frac{2}{3} \cdot 12$$

$$x = 8$$

The solution is  $8$ .

Check:

$$3x - 3 = \frac{3}{4}(2x + 12)$$

$$3(8) - 3 \stackrel{?}{=} \frac{3}{4}[2(8) + 12]$$

$$24 - 3 \stackrel{?}{=} \frac{3}{4}(28)$$

$$21 = 21 \checkmark$$

$$27. \quad \frac{7}{2} = \frac{x}{16}$$

$$16 \cdot \frac{7}{2} = 16 \cdot \frac{x}{16}$$

$$\frac{112}{2} = x$$

$$56 = x$$

The solution is  $56$ .

Check:

$$\frac{7}{2} = \frac{x}{16}$$

$$\frac{7}{2} \stackrel{?}{=} \frac{56}{16}$$

$$112 = 112 \checkmark$$

$$28. \quad \frac{m}{9} = \frac{6}{27}$$

$$9 \cdot \frac{m}{9} = 9 \cdot \frac{6}{27}$$

$$m = \frac{54}{27}$$

$$m = 2$$

The solution is  $2$ .

Check:

$$\frac{m}{9} = \frac{6}{27}$$

$$\frac{2}{9} \stackrel{?}{=} \frac{6}{27}$$

$$\frac{2}{9} = \frac{2}{9} \checkmark$$

$$29. \quad \frac{z}{4} = \frac{48}{12}$$

$$4 \cdot \frac{z}{4} = 4 \cdot \frac{48}{12}$$

$$z = \frac{192}{12}$$

$$z = 16$$

The solution is 16.

Check:

$$\frac{z}{4} = \frac{48}{12}$$

$$\frac{16}{4} \stackrel{?}{=} \frac{48}{12}$$

$$4 = 4 \checkmark$$

$$31. \quad \frac{5}{7} = \frac{15}{x}$$

$$x \cdot \frac{5}{7} = x \cdot \frac{15}{x}$$

$$\frac{5}{7}x = 15$$

$$\frac{7}{5} \cdot \left(\frac{5}{7}x\right) = \frac{7}{5} \cdot 15$$

$$x = 21$$

The solution is 21.

$$33. \quad \frac{g}{9} = \frac{16}{12}$$

$$9 \cdot \frac{g}{9} = 9 \cdot \frac{16}{12}$$

$$g = \frac{144}{12}$$

$$g = 12$$

The solution is 12.

$$35. \quad \frac{12}{x} = \frac{6}{7}$$

$$12 \cdot 7 = x \cdot 6$$

$$84 = 6x$$

$$14 = x$$

The solution is 14.

Check:

$$\frac{12}{x} = \frac{6}{7}$$

$$\frac{12}{14} \stackrel{?}{=} \frac{6}{7}$$

$$\frac{6}{7} = \frac{6}{7} \checkmark$$

$$37. \quad \frac{7}{x+3} = \frac{4}{12}$$

$$7 \cdot 12 = (x+3) \cdot 4$$

$$84 = 4x + 12$$

$$72 = 4x$$

$$18 = x$$

$$30. \quad \frac{30}{50} = \frac{t}{10}$$

$$10 \cdot \frac{30}{50} = 10 \cdot \frac{t}{10}$$

$$\frac{300}{50} = t$$

$$6 = t$$

The solution is 6.

Check:

$$\frac{30}{50} = \frac{t}{10}$$

$$\frac{30}{50} \stackrel{?}{=} \frac{6}{10}$$

$$\frac{3}{5} = \frac{3}{5} \checkmark$$

$$32. \quad \frac{9}{3} = \frac{x}{12}$$

$$12 \cdot \frac{9}{3} = 12 \cdot \frac{x}{12}$$

$$\frac{108}{3} = x$$

$$36 = x$$

The solution is 36.

$$34. \quad \frac{6}{18} = \frac{y}{3}$$

$$3 \cdot \frac{6}{18} = 3 \cdot \frac{y}{3}$$

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

$$1 = y$$

The solution is 1.

$$36. \quad \frac{6x}{4} = \frac{18}{12}$$

$$6x \cdot 12 = 4 \cdot 18$$

$$72x = 72$$

$$x = 1$$

The solution is 1.

Check:

$$\frac{6x}{4} = \frac{18}{12}$$

$$\frac{6(1)}{4} \stackrel{?}{=} \frac{18}{12}$$

$$\frac{6}{4} = \frac{6}{4} \checkmark$$

The solution is 18.

Check:

$$\frac{7}{x+3} = \frac{4}{12}$$

$$\frac{7}{18+3} \stackrel{?}{=} \frac{4}{12}$$

$$\frac{7}{21} \stackrel{?}{=} \frac{4}{12}$$

$$\frac{1}{3} = \frac{1}{3} \checkmark$$

$$38. \quad \frac{y+5}{y} = \frac{10}{8}$$

$$8(y+5) = y \cdot 10$$

$$8y + 40 = 10y$$

$$40 = 2y$$

$$20 = y$$

The solution is 20.

Check:

$$\frac{y+5}{y} = \frac{10}{8}$$

$$\frac{20+5}{20} \stackrel{?}{=} \frac{10}{8}$$

$$\frac{25}{20} \stackrel{?}{=} \frac{10}{8}$$

$$\frac{5}{4} = \frac{5}{4} \checkmark$$

$$40. \quad \frac{3b}{5b-7} = \frac{8}{11}$$

$$3b \cdot 11 = (5b-7) \cdot 8$$

$$33b = 40b - 56$$

$$-7b = -56$$

$$b = 8$$

The solution is 8.

Check:

$$\frac{3b}{5b-7} = \frac{8}{11}$$

$$\frac{3(8)}{5(8)-7} \stackrel{?}{=} \frac{8}{11}$$

$$\frac{24}{33} \stackrel{?}{=} \frac{8}{11}$$

$$\frac{8}{11} = \frac{8}{11} \checkmark$$

$$39. \quad \frac{2x+6}{x} = \frac{7}{2}$$

$$2(2x+6) = x \cdot 7$$

$$4x + 12 = 7x$$

$$12 = 3x$$

$$4 = x$$

The solution is 4.

Check:

$$\frac{y+5}{y} = \frac{10}{8}$$

$$\frac{20+5}{20} \stackrel{?}{=} \frac{10}{8}$$

$$\frac{25}{20} \stackrel{?}{=} \frac{10}{8}$$

$$\frac{5}{4} = \frac{5}{4} \checkmark$$

$$41. \quad \frac{8}{2x+12} = \frac{6}{x+8}$$

$$8(x+8) = (2x+12) \cdot 6$$

$$8x + 64 = 12x + 72$$

$$64 = 4x + 72$$

$$-8 = 4x$$

$$-2 = x$$

The solution is -2.

Check:

$$\frac{8}{2x+12} = \frac{6}{x+8}$$

$$\frac{8}{2(-2)+12} \stackrel{?}{=} \frac{6}{-2+8}$$

$$\frac{8}{8} \stackrel{?}{=} \frac{6}{6}$$

$$1 = 1 \checkmark$$

$$42. \quad \frac{4.8 - 2x}{8} = \frac{0.4 + x}{10}$$

$$(4.8 - 2x) \cdot 10 = 8(0.4 + x)$$

$$48 - 20x = 3.2 + 8x$$

$$48 = 3.2 + 28x$$

$$44.8 = 28x$$

$$1.6 = x$$

The solution is 1.6.

Check:

$$\frac{4.8 - 2x}{8} = \frac{0.4 + x}{10}$$

$$\frac{4.8 - 2(1.6)}{8} \stackrel{?}{=} \frac{0.4 + 1.6}{10}$$

$$\frac{1.6}{8} \stackrel{?}{=} \frac{2}{10}$$

$$0.2 = 0.2 \checkmark$$

$$43. \quad \frac{a}{b} = \frac{p}{100}$$

$$\frac{12}{96} = \frac{p}{100}$$

$$1200 = 96p$$

$$12.5 = p$$

12 is 12.5% of 96.

$$45. \quad \frac{a}{b} = \frac{p}{100}$$

$$\frac{14}{b} = \frac{40}{100}$$

$$1400 = 40b$$

$$35 = b$$

14 is 40% of 35.

$$47. \quad a = p\% \cdot b$$

$$= 250\% \cdot 18$$

$$= 2.5 \cdot 18$$

$$= 45$$

45 is 250% of 18.

$$49. \quad a = p\% \cdot b$$

$$30.1 = 35\% \cdot b$$

$$30.1 = 0.35b$$

$$86 = b$$

30.1 is 35% of 86.

$$44. \quad \frac{a}{b} = \frac{p}{100}$$

$$\frac{a}{18} = \frac{35}{100}$$

$$100a = 630$$

$$a = 6.3$$

6.3 is 35% of 18.

$$46. \quad \frac{a}{b} = \frac{p}{100}$$

$$\frac{30}{125} = \frac{p}{100}$$

$$3000 = 125p$$

$$24 = p$$

30 is 24% of 125.

$$48. \quad a = p\% \cdot b$$

$$8.7 = p\% \cdot 58$$

$$8.7 = 58p\%$$

$$0.15 = p\%$$

$$15\% = p\%$$

8.7 is 15% of 58.

$$50. \quad a = p\% \cdot b$$

$$= 70\% \cdot 250$$

$$= 0.70 \cdot 250$$

$$= 175$$

175 is 70% of 250.

$$51. \quad ax - b = c$$

$$ax = c + b$$

$$x = \frac{c + b}{a}$$

When  $a = 6$ ,  $b = 5$ , and  $c = 25$ :

$$6x - 5 = 25$$

$$x = \frac{25 + 5}{6}$$

$$= \frac{30}{6}$$

$$= 5$$

The solution of  $6x - 5 = 25$  is 5.

$$52. \quad a(b - x) = c$$

$$b - x = \frac{c}{a}$$

$$-x = \frac{c}{a} - b$$

$$x = -\left(\frac{c}{a} - b\right) = b - \frac{c}{a}$$

When  $a = 2$ ,  $b = 8$ , and  $c = -6$ :

$$2(8 - x) = -6$$

$$x = 8 - \frac{-6}{2} = 8 - (-3) = 11$$

The solution of  $2(8 - x) = -6$  is 11.

$$53. \quad 5x + y = 10$$

$$y = 10 - 5x$$

$$y = -5x + 10$$

$$54. \quad 8x - 2y = 16$$

$$-2y = 16 - 8x$$

$$y = -8 + 4x$$

$$y = 4x - 8$$

$$55. \quad 7x + 3y = 6 - 5x$$

$$3y = 6 - 12x$$

$$y = 2 - 4x$$

$$y = -4x + 2$$

$$56. \quad 21 = 6x + 7y$$

$$21 - 6x = 7y$$

$$3 - \frac{6}{7}x = y$$

$$y = -\frac{6}{7}x + 3$$