

## Chapter 2

# Equations, Inequalities, and Problem Solving

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### Exercise Set 2.1

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1. c

2. b

3. f

4. a

5. d

6. e

7. d

8. b

9. c

10. a

11.  $6 - x = -2$

$$\begin{array}{r|l} 6-4 & -2 \\ 2 & -2 \end{array} \quad \text{FALSE}$$

No, 4 is not a solution.

12.  $6 - x = -2$

$$\begin{array}{r|l} 6-8 & -2 \\ -2 & -2 \end{array} \quad \text{TRUE}$$

Yes, 8 is a solution.

13.  $\frac{2}{3}t = 12$

$$\begin{array}{r|l} \frac{2}{3}(18) & 12 \\ 12 & 12 \end{array} \quad \text{TRUE}$$

Yes, 18 is a solution.

14.  $\frac{2}{3}t = 12$

$$\begin{array}{r|l} \frac{2}{3}(8) & 12 \\ \frac{16}{3} & 12 \end{array} \quad \text{FALSE}$$

No, 8 is not a solution.

15.  $x + 7 = 3 - x$

$$\begin{array}{r|l} -2+7 & 3-(-2) \\ 5 & 5 \end{array} \quad \text{TRUE}$$

Yes, -2 is a solution.

16.  $-4 + x = 5x$

$$\begin{array}{r|l} -4+(-1) & 5(-1) \\ -5 & -5 \end{array} \quad \text{TRUE}$$

Yes, -1 is a solution.

17.  $4 - \frac{1}{5}n = 8$

$$\begin{array}{r|l} 4-\frac{1}{5}(-20) & 8 \\ 4-(-4) & 8 \\ 8 & 8 \end{array} \quad \text{TRUE}$$

Yes, -20 is a solution.

18.  $-3 = 5 - \frac{n}{2}$

$$\begin{array}{r|l} -3 & 5-\frac{4}{2} \\ -3 & 5-2 \\ -3 & 3 \end{array} \quad \text{FALSE}$$

No, 4 is not a solution.

19.  $x + 6 = 23$

$$x + 6 - 6 = 23 - 6 \quad \text{Subtracting 6 from both sides}$$

$$x = 17 \quad \text{Simplifying}$$

Check:  $x + 6 = 23$

$$\begin{array}{r|l} 17+6 & 23 \\ 23 & 23 \end{array} \quad \text{TRUE}$$

The solution is 17.

20.  $x + 5 = 8$

$$x + 5 - 5 = 8 - 5 \quad \text{Subtracting 5 from both sides}$$

$$x = 3 \quad \text{Simplifying}$$

Check:  $x + 5 = 8$

$$\begin{array}{r|l} 3+5 & 8 \\ 8 & 8 \end{array} \quad \text{TRUE}$$

The solution is 3.

21.  $y + 7 = -4$   
 $y + 7 - 7 = -4 - 7$  Subtracting 7 from both sides  
 $y = -11$  Simplifying  
 Check:  $y + 7 = -4$   

$$\begin{array}{r|l} -11 + 7 & -4 \\ \hline -4 & -4 \end{array} \text{ TRUE}$$
 The solution is  $-11$ .
22.  $t + 6 = 43$   
 $t + 6 - 6 = 43 - 6$  Subtracting 6 from both sides  
 $t = 37$  Simplifying  
 Check:  $t + 6 = 43$   

$$\begin{array}{r|l} 37 + 6 & 43 \\ \hline 43 & 43 \end{array} \text{ TRUE}$$
 The solution is 37.
23.  $-6 = y + 25$   
 $-6 - 25 = y + 25 - 25$  Subtracting 25 from both sides  
 $-31 = y$  Simplifying  
 Check:  $-6 = y + 25$   

$$\begin{array}{r|l} -6 & -31 + 25 \\ \hline -6 & -6 \end{array} \text{ TRUE}$$
 The solution is  $-31$ .
24.  $-5 = x + 8$   
 $-5 - 8 = x + 8 - 8$  Subtracting 8 from both sides  
 $-13 = x$  Simplifying  
 Check:  $-5 = x + 8$   

$$\begin{array}{r|l} -5 & -13 + 8 \\ \hline -5 & -5 \end{array} \text{ TRUE}$$
 The solution is  $-13$ .
25.  $x - 8 = 5$   
 $x - 8 + 8 = 5 + 8$  Adding 8 to both sides  
 $x = 13$  Simplifying  
 Check:  $x - 8 = 5$   

$$\begin{array}{r|l} 13 - 8 & 5 \\ \hline 5 & 5 \end{array} \text{ TRUE}$$
 The solution is 13.
26.  $x - 9 = 6$   
 $x - 9 + 9 = 6 + 9$  Adding 9 to both sides  
 $x = 15$  Simplifying  
 Check:  $x - 9 = 6$   

$$\begin{array}{r|l} 15 - 9 & 6 \\ \hline 6 & 6 \end{array} \text{ TRUE}$$
 The solution is 15.
27.  $12 = -7 + y$   
 $7 + 12 = 7 + (-7) + y$  Adding 7 to both sides  
 $19 = y$  Simplifying  
 Check:  $12 = -7 + y$   

$$\begin{array}{r|l} 12 & -7 + 19 \\ \hline 12 & 12 \end{array} \text{ TRUE}$$
 The solution is 19.
28.  $15 = -8 + z$   
 $8 + 15 = 8 + (-8) + z$  Adding 8 to both sides  
 $23 = z$  Simplifying  
 Check:  $15 = -8 + z$   

$$\begin{array}{r|l} 15 & -8 + 23 \\ \hline 15 & 15 \end{array} \text{ TRUE}$$
 The solution is 23.
29.  $-5 + t = -9$   
 $5 + (-5) + t = 5 + (-9)$  Adding 5 to both sides  
 $t = -4$  Simplifying  
 Check:  $-5 + t = -9$   

$$\begin{array}{r|l} -5 + (-4) & -9 \\ \hline -9 & -9 \end{array} \text{ TRUE}$$
 The solution is  $-4$ .
30.  $-6 + y = -21$   
 $6 + (-6) + y = 6 + (-21)$  Adding 6 to both sides  
 $y = -15$  Simplifying  
 Check:  $-6 + y = -21$   

$$\begin{array}{r|l} -6 + (-15) & -21 \\ \hline -21 & -21 \end{array} \text{ TRUE}$$
 The solution is  $-15$ .

31.  $r + \frac{1}{3} = \frac{8}{3}$   
 $r + \frac{1}{3} + \left(-\frac{1}{3}\right) = \frac{8}{3} + \left(-\frac{1}{3}\right)$  Subtracting  $\frac{1}{3}$  from both sides  
 $r = \frac{7}{3}$  Simplifying  
 Check:  $r + \frac{1}{3} = \frac{8}{3}$   
 $\frac{7}{3} + \frac{1}{3} \left| \frac{8}{3} \right.$   
 $\frac{8}{3} \left| \frac{8}{3} \right.$  TRUE  
 The solution is  $\frac{7}{3}$ .

32.  $t + \frac{3}{8} = \frac{5}{8}$   
 $t + \frac{3}{8} + \left(-\frac{3}{8}\right) = \frac{5}{8} - \frac{3}{8}$  Subtracting  $\frac{3}{8}$  from both sides  
 $t = \frac{2}{8}$  Simplifying  
 $t = \frac{1}{4}$  Simplifying  
 Check:  $t + \frac{3}{8} = \frac{5}{8}$   
 $\frac{1}{4} + \frac{3}{8} \left| \frac{5}{8} \right.$   
 $\frac{2}{8} + \frac{3}{8} \left| \frac{5}{8} \right.$   
 $\frac{5}{8} \left| \frac{5}{8} \right.$  TRUE  
 The solution is  $\frac{1}{4}$ .

33.  $x - \frac{3}{5} = -\frac{7}{10}$   
 $x - \frac{3}{5} + \left(\frac{3}{5}\right) = -\frac{7}{10} + \left(\frac{3}{5}\right)$  Adding  $\frac{3}{5}$  to both sides  
 $x = -\frac{7}{10} + \left(\frac{6}{10}\right)$  Simplifying  
 $x = -\frac{1}{10}$  Simplifying  
 Check:  $x - \frac{3}{5} = -\frac{7}{10}$   
 $-\frac{1}{10} - \frac{3}{5} \left| -\frac{7}{10} \right.$   
 $-\frac{1}{10} - \frac{6}{10} \left| -\frac{7}{10} \right.$   
 $-\frac{7}{10} \left| -\frac{7}{10} \right.$  TRUE  
 The solution is  $-\frac{1}{10}$ .

34.  $x - \frac{2}{3} = -\frac{5}{6}$   
 $x - \frac{2}{3} + \left(\frac{2}{3}\right) = -\frac{5}{6} + \left(\frac{2}{3}\right)$  Adding  $\frac{2}{3}$  to both sides  
 $x = -\frac{5}{6} + \left(\frac{4}{6}\right)$  Simplifying  
 $x = -\frac{1}{6}$  Simplifying  
 Check:  $x - \frac{2}{3} = -\frac{5}{6}$   
 $-\frac{1}{6} - \frac{2}{3} \left| -\frac{5}{6} \right.$   
 $-\frac{1}{6} - \frac{4}{6} \left| -\frac{5}{6} \right.$   
 $-\frac{5}{6} \left| -\frac{5}{6} \right.$  TRUE  
 The solution is  $-\frac{1}{6}$ .

35.  $-\frac{1}{5} + z = -\frac{1}{4}$   
 $\frac{1}{5} + \left(-\frac{1}{5}\right) + z = \frac{1}{5} + \left(-\frac{1}{4}\right)$  Adding  $\frac{1}{5}$  to both sides  
 $z = \frac{4}{20} + \left(-\frac{5}{20}\right)$  Simplifying  
 $z = -\frac{1}{20}$  Simplifying  
 Check:  $-\frac{1}{5} + z = -\frac{1}{4}$   
 $-\frac{1}{5} + \left(-\frac{1}{20}\right) \left| -\frac{1}{4} \right.$   
 $-\frac{4}{20} + \left(-\frac{1}{20}\right) \left| -\frac{1}{4} \right.$   
 $-\frac{5}{20} \left| -\frac{1}{4} \right.$   
 $-\frac{1}{4} \left| -\frac{1}{4} \right.$  TRUE  
 The solution is  $-\frac{1}{20}$ .

36.  $-\frac{1}{8} + y = -\frac{3}{4}$   
 $\frac{1}{8} + \left(-\frac{1}{8}\right) + y = \frac{1}{8} + \left(-\frac{3}{4}\right)$  Adding  $\frac{1}{8}$  to both sides  
 $y = \frac{1}{8} + \left(-\frac{6}{8}\right)$  Simplifying  
 $y = -\frac{5}{8}$  Simplifying  
 Check:  $-\frac{1}{8} + y = -\frac{3}{4}$   
 $-\frac{1}{8} + \left(-\frac{5}{8}\right) \left| -\frac{3}{4} \right.$   
 $-\frac{6}{8} \left| -\frac{3}{4} \right.$   
 $-\frac{3}{4} \left| -\frac{3}{4} \right.$  TRUE  
 The solution is  $-\frac{5}{8}$ .

37.  $m + 3.9 = 5.4$   
 $m + 3.9 - 3.9 = 5.4 - 3.9$  Subtracting 3.9 from both sides  
 $m = 1.5$  Simplifying  
 Check:  $m + 3.9 = 5.4$   
 $1.5 + 3.9 \left| 5.4 \right.$   
 $5.4 \left| 5.4 \right.$  TRUE  
 The solution is 1.5.

38.  $y + 5.3 = 8.7$   
 $y + 5.3 - 5.3 = 8.7 - 5.3$  Subtracting 5.3 from both sides  
 $y = 3.4$  Simplifying  
 Check:  $y + 5.3 = 8.7$   
 $3.4 + 5.3 \left| 8.7 \right.$   
 $8.7 \left| 8.7 \right.$  TRUE  
 The solution is 3.4.

39.  $-9.7 = -4.7 + y$   
 $4.7 + -9.7 = 4.7 + (-4.7) + y$  Adding 4.7 to both sides  
 $-5 = y$  Simplifying  
 Check:  $-9.7 = -4.7 + y$   

$$\begin{array}{r|l} -9.7 & -4.7 + (-5) \\ -9.7 & -9.7 \end{array} \quad \text{TRUE}$$
  
 The solution is  $-5$ .

40.  $-7.8 = 2.8 + x$   
 $-2.8 + (-7.8) = -2.8 + 2.8 + x$  Subtracting 2.8 from both sides  
 $-10.6 = x$  Simplifying  
 Check:  $-7.8 = 2.8 + x$   

$$\begin{array}{r|l} -7.8 & 2.8 + (-10.6) \\ -7.8 & -7.8 \end{array} \quad \text{TRUE}$$
  
 The solution is  $-10.6$ .

41.  $5x = 70$   
 $\frac{5x}{5} = \frac{70}{5}$  Dividing both sides by 5  
 $1 \cdot x = 14$  Simplifying  
 $x = 14$  Identity property of 1  
 Check:  $5x = 70$   

$$\begin{array}{r|l} 5 \cdot 14 & 70 \\ 70 & 70 \end{array} \quad \text{TRUE}$$
  
 The solution is 14.

42.  $3x = 39$   
 $\frac{3x}{3} = \frac{39}{3}$  Dividing both sides by 3  
 $1 \cdot x = 13$  Simplifying  
 $x = 13$  Identity property of 1  
 Check:  $3x = 39$   

$$\begin{array}{r|l} 3 \cdot 13 & 39 \\ 39 & 39 \end{array} \quad \text{TRUE}$$
  
 The solution is 13.

43.  $84 = 7n$   
 $\frac{84}{7} = \frac{7n}{7}$  Dividing both sides by 7  
 $12 = 1 \cdot n$  Simplifying  
 $12 = n$  Identity property of 1

Check:  $84 = 7x$   

$$\begin{array}{r|l} 84 & 7 \cdot 12 \\ 84 & 84 \end{array} \quad \text{TRUE}$$
  
 The solution is 12.

44.  $56 = 7t$   
 $\frac{56}{7} = \frac{7t}{7}$  Dividing both sides by 7  
 $8 = 1 \cdot t$  Simplifying  
 $8 = t$  Identity property of 1  
 Check:  $56 = 7t$   

$$\begin{array}{r|l} 56 & 7 \cdot 8 \\ 56 & 56 \end{array} \quad \text{TRUE}$$
  
 The solution is 8.

45.  $-x = 23$   
 $(-1)(-x) = (-1)23$  Multiply both sides by  $-1$   
 $x = -23$  Simplifying  
 Check:  $-x = 23$   

$$\begin{array}{r|l} -(-23) & 23 \\ 23 & 23 \end{array} \quad \text{TRUE}$$
  
 The solution is  $-23$ .

46.  $100 = -x$   
 $(-1)(100) = (-1)(-x)$  Multiply both sides by  $-1$   
 $-100 = x$  Simplifying  
 Check:  $100 = -x$   

$$\begin{array}{r|l} 100 & -(-100) \\ 100 & 100 \end{array} \quad \text{TRUE}$$
  
 The solution is  $-100$ .

47.  $-t = -8$   
 $(-1)(-t) = (-1)(-8)$  Multiply both sides by  $-1$   
 $t = 8$  Simplifying  
 Check:  $-t = -8$   

$$\begin{array}{r|l} -(8) & -8 \\ -8 & -8 \end{array} \quad \text{TRUE}$$
  
 The solution is 8.

48.  $-68 = -r$   
 $(-1)(-68) = (-1)(-r)$  Multiply both sides  
 by  $-1$   
 $68 = r$  Simplifying  
 Check:  $-68 = -r$   

$$\begin{array}{r|l} -68 & -(68) \\ -68 & -68 \end{array} \text{ TRUE}$$
  
 The solution is 68.

49.  $2x = -5$   
 $\frac{2x}{2} = \frac{-5}{2}$  Dividing both sides by 2  
 $1 \cdot x = -\frac{5}{2}$  Simplifying  
 $x = -\frac{5}{2}$  Identity property of 1  
 Check:  $2x = -5$   

$$\begin{array}{r|l} 2(-\frac{5}{2}) & -5 \\ -5 & -5 \end{array} \text{ TRUE}$$
  
 The solution is  $-\frac{5}{2}$ .

50.  $-3x = 5$   
 $\frac{-3x}{-3} = \frac{5}{-3}$  Dividing both sides by  $-3$   
 $1 \cdot x = \frac{5}{-3}$  Simplifying  
 $x = \frac{5}{-3}$  Identity property of 1  
 Check:  $-3x = 5$   

$$\begin{array}{r|l} -3(-\frac{5}{3}) & 5 \\ 5 & 5 \end{array} \text{ TRUE}$$
  
 The solution is  $-\frac{5}{3}$ .

51.  $-1.3a = -10.4$   
 $\frac{-1.3a}{-1.3} = \frac{-10.4}{-1.3}$  Dividing both sides  
 by  $-1.3$   
 $1 \cdot a = 8$  Simplifying  
 $a = 8$  Identity property of 1  
 Check:  $-1.3a = -10.4$   

$$\begin{array}{r|l} -1.3(8) & -10.4 \\ -10.4 & -10.4 \end{array} \text{ TRUE}$$
  
 The solution is 8.

52.  $-3.4t = -20.4$   
 $\frac{-3.4t}{-3.4} = \frac{-20.4}{-3.4}$  Dividing both sides  
 by  $-3.4$   
 $1 \cdot t = 6$  Simplifying  
 $t = 6$  Identity property of 1  
 Check:  $-3.4t = -20.4$   

$$\begin{array}{r|l} -3.4(6) & -20.4 \\ -20.4 & -20.4 \end{array} \text{ TRUE}$$
  
 The solution is 6.

53.  $\frac{y}{-8} = 11$   
 $\left(-\frac{1}{8}\right) \cdot y = 11$  Rewriting  
 $(-8)\left(-\frac{1}{8}\right) \cdot y = (-8)11$  Multiplying both  
 sides by 8  
 $1 \cdot y = -88$  Simplifying  
 $y = -88$  Identity property  
 of 1

Check:  $\frac{y}{-8} = 11$   

$$\begin{array}{r|l} \frac{-88}{-8} & 11 \\ 11 & 11 \end{array} \text{ TRUE}$$
  
 The solution is  $-88$ .

54.  $\frac{a}{4} = 13$   
 $\left(\frac{1}{4}\right) \cdot a = 13$  Rewriting  
 $4 \cdot \left(\frac{1}{4}\right) \cdot a = 4 \cdot 13$  Multiplying both sides  
 by 4  
 $1 \cdot a = 52$  Simplifying  
 $a = 52$  Identity property of 1  
 Check:  $\frac{a}{4} = 13$   

$$\begin{array}{r|l} \frac{52}{4} & 13 \\ 13 & 13 \end{array} \text{ TRUE}$$
  
 The solution is 52.

55.  $\frac{4}{5}x = 16$

$$\frac{5}{4} \cdot \left(\frac{4}{5}\right) \cdot x = \frac{5}{4} \cdot 16$$
 Multiplying both sides by  $\frac{5}{4}$

$$1 \cdot x = 20$$
 Simplifying

$$x = 20$$
 Identity property of 1

Check:  $\frac{4}{5}x = 16$

$$\frac{4}{5} \cdot 20 \quad | \quad 16$$

$$16 \quad | \quad 16 \quad \text{TRUE}$$

The solution is 20.

56.  $\frac{3}{4}x = 27$

$$\frac{4}{3} \cdot \left(\frac{3}{4}\right) \cdot x = \frac{4}{3} \cdot 27$$
 Multiplying both sides by  $\frac{4}{3}$

$$1 \cdot x = 36$$
 Simplifying

$$x = 36$$
 Identity property of 1

Check:  $\frac{3}{4}x = 27$

$$\frac{3}{4} \cdot 36 \quad | \quad 27$$

$$27 \quad | \quad 27 \quad \text{TRUE}$$

The solution is 36.

57.  $\frac{-x}{6} = 9$

$$6 \cdot \left(\frac{1}{6}\right) \cdot (-x) = 6 \cdot 9$$
 Rewriting and multiplying both sides by 6

$$-x = 54$$
 Simplifying

$$x = -54$$
 Multiplying both sides by  $-1$

Check:  $\frac{-x}{6} = 9$

$$\frac{-(-54)}{6} \quad | \quad 9$$

$$\frac{54}{6} \quad | \quad 9$$

$$9 \quad | \quad 9 \quad \text{TRUE}$$

The solution is  $-54$ .

58.  $\frac{-t}{5} = 9$

$$5 \cdot \left(\frac{1}{5}\right) \cdot (-t) = 5 \cdot 9$$
 Rewriting and multiplying both sides by 5

$$-t = 45$$
 Simplifying

$$t = -45$$
 Multiplying both sides by  $-1$

Check:  $\frac{-t}{5} = 9$

$$\frac{-(-45)}{5} \quad | \quad 9$$

$$\frac{45}{5} \quad | \quad 9$$

$$9 \quad | \quad 9 \quad \text{TRUE}$$

The solution is  $-45$ .

59.  $\frac{1}{9} = \frac{z}{5}$

$$5 \cdot \left(\frac{1}{9}\right) = 5 \cdot \left(\frac{1}{5}\right) \cdot z$$
 Rewriting and multiplying both sides by 5

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

Check:  $\frac{1}{9} = \frac{z}{5}$

$$\frac{1}{9} \quad | \quad \left(\frac{5}{9}\right) / 5$$

$$\frac{1}{9} \quad | \quad \frac{1}{9}$$

TRUE

The solution is  $\frac{5}{9}$ .

60.  $\frac{2}{7} = \frac{x}{3}$

$$3 \cdot \left(\frac{2}{7}\right) = 3 \cdot \left(\frac{1}{3}\right) \cdot x$$
 Rewriting and multiplying both sides by 3

$$\frac{6}{7} = x$$
 Simplifying

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

$$\frac{2}{7} \quad | \quad \left(\frac{6}{7}\right) / 3$$

$$\frac{2}{7} \quad | \quad \frac{2}{7}$$

TRUE

The solution is  $\frac{6}{7}$ .

61.  $-\frac{3}{5}r = -\frac{3}{5}$

Note: The solution of this equation is the number multiplied by  $-\frac{3}{5}$  to get  $-\frac{3}{5}$ . That number is 1. We could also do this exercise as follows:

$$-\frac{3}{5}r = -\frac{3}{5}$$

$$\left(-\frac{5}{3}\right)\left(-\frac{3}{5}\right)r = \left(-\frac{5}{3}\right)\left(-\frac{3}{5}\right) \quad \text{Multiplying both sides by } -\frac{5}{3}$$

$$r = 1 \quad \text{Simplifying}$$

Check:  $-\frac{3}{5}r = -\frac{3}{5}$

$-\frac{3}{5} \cdot 1$	$-\frac{3}{5}$
$-\frac{3}{5}$	$-\frac{3}{5}$

TRUE

The solution is 1.

62.  $-\frac{2}{5}y = -\frac{4}{15}$

$$\left(-\frac{5}{2}\right)\left(-\frac{2}{5}\right)y = \left(-\frac{5}{2}\right)\left(-\frac{4}{15}\right) \quad \text{Multiplying both sides by } -\frac{5}{2}$$

$$y = \frac{2}{3} \quad \text{Simplifying}$$

Check:  $-\frac{2}{5}y = -\frac{4}{15}$

$-\frac{2}{5}\left(\frac{2}{3}\right)$	$-\frac{4}{15}$
$-\frac{4}{15}$	$-\frac{4}{15}$

TRUE

The solution is  $\frac{2}{3}$ .

63.  $\frac{-3r}{2} = -\frac{27}{4}$

$$\left(-\frac{3}{2}\right)r = -\frac{27}{4} \quad \text{Rewriting}$$

$$\left(-\frac{2}{3}\right)\left(-\frac{3}{2}\right)r = \left(-\frac{2}{3}\right)\left(-\frac{27}{4}\right) \quad \text{Multiplying both sides by } -\frac{2}{3}$$

$$r = \frac{9}{2} \quad \text{Simplifying}$$

Check:  $\frac{-3r}{2} = -\frac{27}{4}$

$\left[(-3)\left(\frac{9}{2}\right)\right]/2$	$-\frac{27}{4}$
$(-\frac{27}{2})/2$	$-\frac{27}{4}$
$-\frac{27}{4}$	$-\frac{27}{4}$

TRUE

The solution is  $\frac{9}{2}$ .

64.  $\frac{5x}{7} = -\frac{10}{14}$

$$\left(\frac{5}{7}\right)x = -\frac{10}{14} \quad \text{Rewriting}$$

$$\left(\frac{7}{5}\right)\left(\frac{5}{7}\right)r = \left(\frac{7}{5}\right)\left(-\frac{10}{14}\right) \quad \text{Multiplying both sides by } \frac{7}{5}$$

$$r = -1 \quad \text{Simplifying}$$

Check:  $\frac{5x}{7} = -\frac{10}{14}$

$\frac{5}{7}(-1)$	$-\frac{10}{14}$
$-\frac{5}{7}$	$-\frac{10}{14}$
$-\frac{10}{14}$	$-\frac{10}{14}$

TRUE

The solution is -1.

65.  $4.5 + t = -3.1$

$$4.5 + t - 4.5 = -3.1 - 4.5$$

$$t = -7.6$$

The solution is -7.6.

66.  $\frac{3}{4}x = 18$

$$\left(\frac{4}{3}\right)\left(\frac{3}{4}\right)x = \left(\frac{4}{3}\right)18$$

$$x = 24$$

The solution is 24.

67.  $-8.2x = 20.5$

$$\frac{-8.2}{-8.2}x = \frac{20.5}{-8.2}$$

$$x = -2.5$$

The solution is -2.5.

68.  $t - 7.4 = -12.9$

$$t - 7.4 + 7.4 = -12.9 + 7.4$$

$$t = -5.5$$

The solution is -5.5.

69.  $x - 4 = -19$

$$x - 4 + 4 = -19 + 4$$

$$x = -15$$

The solution is -15.

$$70. \quad y - 6 = -14$$

$$y - 6 + 6 = -14 + 6$$

$$y = -8$$

The solution is  $-8$ .

$$71. \quad -12x = 72$$

$$\frac{-12}{-12}x = \frac{72}{-12}$$

$$x = -6$$

The solution is  $-6$ .

$$72. \quad -15x = 105$$

$$\frac{-15}{-15}x = \frac{105}{-15}$$

$$x = -7$$

The solution is  $-7$ .

$$73. \quad 48 = -\frac{3}{8}y$$

$$\left(-\frac{8}{3}\right) \cdot 48 = \left(-\frac{8}{3}\right)\left(-\frac{3}{8}\right)y$$

$$-128 = y$$

The solution is  $-128$ .

$$74. \quad 14 = t + 27$$

$$14 - 27 = t + 27 - 27$$

$$-13 = t$$

The solution is  $-13$ .

$$75. \quad a - \frac{1}{6} = -\frac{2}{3}$$

$$a - \frac{1}{6} + \frac{1}{6} = -\frac{2}{3} + \frac{1}{6}$$

$$a = -\frac{4}{6} + \frac{1}{6}$$

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

$$a = -\frac{1}{2}$$

The solution is  $-\frac{1}{2}$ .

$$76. \quad -\frac{x}{7} = \frac{2}{9}$$

$$(-7)\left(-\frac{1}{7}\right)x = (-7)\left(\frac{2}{9}\right)$$

$$x = -\frac{14}{9}$$

The solution is  $-\frac{14}{9}$ .

$$77. \quad -24 = \frac{8x}{5}$$

$$\left(\frac{5}{8}\right)(-24) = \left(\frac{5}{8}\right)\left(\frac{8}{5}\right)x$$

$$-15 = x$$

The solution is  $-15$ .

$$78. \quad \frac{1}{5} + y = -\frac{3}{10}$$

$$-\frac{1}{5} + \frac{1}{5} + y = -\frac{1}{5} - \frac{3}{10}$$

$$y = -\frac{2}{10} - \frac{3}{10}$$

$$y = -\frac{5}{10}$$

$$y = -\frac{1}{2}$$

The solution is  $-\frac{1}{2}$ .

$$79. \quad -\frac{4}{3}t = -16$$

$$\left(-\frac{3}{4}\right)\left(-\frac{4}{3}\right)t = \left(-\frac{3}{4}\right)(-16)$$

$$t = 12$$

The solution is  $12$ .

$$80. \quad \frac{17}{35} = -x$$

$$(-1)\left(\frac{17}{35}\right) = (-1)(-x)$$

$$-\frac{17}{35} = x$$

The solution is  $-\frac{17}{35}$ .

81.  $-483.297 = -794.053 + t$   
 $794.053 - 483.297 = 794.053 - 794.053 + t$   
 $310.756 = t$   
 The solution is 310.756.
82.  $-0.2344x = 2028.732$   
 $\frac{-0.2344}{-0.2344}x = \frac{2028.732}{-0.2344}$   
 $x = -8655$   
 The solution is  $-8655$ .
83. *Thinking and Writing Exercise.* For an equation  $x + a = b$ , add the opposite of  $a$  (or subtract  $a$ ) on both sides of the equation to solve for  $x$ . For an equation  $ax = b$ , multiply by  $1/a$  (or divide by  $a$ ) on both sides of the equation to solve for  $x$ .
84. *Thinking and Writing Exercise.* Equivalent expressions have the same value for all possible replacements for the variables. Equivalent equations have the same solution(s).
85.  $3 \cdot 4 - 18$   
 $= 12 - 18$     Multiplying  
 $= -6$         Subtracting
86.  $14 - 2(7 - 1)$   
 $= 14 - 2(6)$     Simplifying inside  
    the parentheses  
 $= 14 - 12$         Multiplying  
 $= 2$                 Subtracting
87.  $16 \div (2 - 3 \cdot 2) + 5$   
 $= 16 \div (2 - 6) + 5$     Simplifying inside  
    the parentheses  
 $= 16 \div (-4) + 5$   
 $= -4 + 5$         Dividing  
 $= 1$                 Adding
88.  $12 - 5 \cdot 2^3 + 4 \cdot 3$   
 $= 12 - 5 \cdot 8 + 4 \cdot 3$     Simplifying the  
    exponential  
 $= 12 - 40 + 4 \cdot 3$     Multiplying from left  
 $= 12 - 40 + 12$         to right  
 $= -28 + 12$             Adding from left  
 $= -16$                 to right
89. *Thinking and Writing Exercise.* Yes, it will form an equivalent equation by the addition principle. It will not help to solve the equation, however. The multiplication principle should be used to solve the equation.
90. *Thinking and Writing Exercise.* Since  $a - c = b - c$  can be written as  $a + (-c) = b + (-c)$ , it is not necessary to state a subtraction principle.
91.  $mx = 9.4m$   
 $\frac{mx}{m} = \frac{9.4m}{m}$   
 $x = 9.4$   
 The solution is 9.4.
92.  $x - 4 + a = a$   
 $x - 4 + a - a = a - a$   
 $x - 4 = 0$   
 $x - 4 + 4 = 0 + 4$   
 $x = 4$   
 The solution is 4.
93.  $cx + 5c = 7c$   
 $-5c + cx + 5c = -5c + 7c$   
 $cx = 2c$   
 $\frac{cx}{c} = \frac{2c}{c}$   
 $x = 2$   
 The solution is 2.

94.  $c \cdot \frac{21}{a} = \frac{7cx}{2a}$   
 $(2a) \cdot c \cdot \frac{21}{a} = (2a) \left( \frac{7cx}{2a} \right)$   
 $42c = 7cx$   
 $\frac{42c}{7c} = \frac{7cx}{7c}$   
 $6 = x$   
 The solution is 6.
95.  $7 + |x| = 20$   
 $-7 + 7 + |x| = -7 + 20$   
 $|x| = 13$   
 $x$  represents a number whose distance from 0 is 13. Thus,  $x = -13$  or  $x = 13$ .
96.  $ax - 3a = 5a$   
 $ax - 3a + 3a = 5a + 3a$   
 $ax = 8a$   
 $\frac{ax}{a} = \frac{8a}{a}$   
 $x = 8$   
 The solution is 8.
97.  $t - 3590 = 1820$   
 $t - 3590 + 7180 = 1820 + 7180$  Adding 7180 to both sides  
 $t + 3590 = 9000$  Simplifying  
 It follows that  $t + 3590$  equals 9000.
98.  $n + 268 = 124$   
 $n + 268 - 536 = 124 - 536$  Subtracting 536 to both sides  
 $n - 268 = -412$  Simplifying  
 It follows that  $n - 268$  equals  $-412$ .
99. To “undo” the last step, divide 22.5 by 0.3.  
 $22.5 \div 0.3 = 75$   
 Now divide 75 by 0.3.  
 $75 \div 0.3 = 250$   
 The answer should be 250 not 22.5.
100. *Thinking and Writing Exercise.* No;  $-5$  is a solution of  $x^2 = 25$  but not of  $x = 5$ .

## Exercise Set 2.2

1. c
2. e
3. a
4. f
5. b
6. d
7.  $2x + 9 = 25$   
 $2x + 9 - 9 = 25 - 9$  Subtracting 9 from both sides  
 $2x = 16$  Simplifying  
 $\frac{2x}{2} = \frac{16}{2}$  Dividing both sides by 2  
 $x = 8$  Simplifying  
 Check:  $2x + 9 = 25$   
 $\begin{array}{r|l} 2 \cdot 8 + 9 & 25 \\ 16 + 9 & 25 \\ \hline 25 & 25 \text{ TRUE} \end{array}$   
 The solution is 8.
8.  $3x + 6 = 18$   
 $3x + 6 - 6 = 18 - 6$  Subtracting 6 from both sides  
 $3x = 12$  Simplifying  
 $\frac{3x}{3} = \frac{12}{3}$  Dividing both sides by 3  
 $x = 4$  Simplifying  
 Check:  $3x + 6 = 18$   
 $\begin{array}{r|l} 3 \cdot 4 + 6 & 18 \\ 12 + 6 & 18 \\ \hline 18 & 18 \text{ TRUE} \end{array}$   
 The solution is 4.

$$\begin{aligned}
 9. \quad 6z + 4 &= -20 \\
 6z + 4 - 4 &= -20 - 4 && \text{Subtracting 4 from both sides} \\
 6z &= -24 && \text{Simplifying} \\
 \frac{6z}{6} &= \frac{-24}{6} && \text{Dividing both sides by 6} \\
 z &= -4 && \text{Simplifying}
 \end{aligned}$$

$$\begin{array}{l|l}
 \text{Check: } 6z + 4 = -20 \\
 6 \cdot (-4) + 4 & -20 \\
 -24 + 4 & -20 \\
 -20 & -20 \quad \text{TRUE}
 \end{array}$$

The solution is  $-4$ .

$$\begin{aligned}
 10. \quad 6z + 3 &= -45 \\
 6z + 3 - 3 &= -45 - 3 && \text{Subtracting 3 from both sides} \\
 6z &= -48 && \text{Simplifying} \\
 \frac{6z}{6} &= \frac{-48}{6} && \text{Dividing both sides by 6} \\
 z &= -8 && \text{Simplifying}
 \end{aligned}$$

$$\begin{array}{l|l}
 \text{Check: } 6z + 3 = -45 \\
 6 \cdot (-8) + 3 & -45 \\
 -48 + 3 & -45 \\
 -45 & -45 \quad \text{TRUE}
 \end{array}$$

The solution is  $-8$ .

$$\begin{aligned}
 11. \quad 7t - 8 &= 27 \\
 7t - 8 + 8 &= 27 + 8 && \text{Adding 8 to both sides} \\
 7t &= 35 && \text{Simplifying} \\
 \frac{7t}{7} &= \frac{35}{7} && \text{Dividing both sides by 7} \\
 t &= 5 && \text{Simplifying}
 \end{aligned}$$

$$\begin{array}{l|l}
 \text{Check: } 7t - 8 = 27 \\
 7 \cdot 5 - 8 & 27 \\
 35 - 8 & 27 \\
 27 & 27 \quad \text{TRUE}
 \end{array}$$

The solution is  $5$ .

$$\begin{aligned}
 12. \quad 6x - 3 &= 15 \\
 6x - 3 + 3 &= 15 + 3 && \text{Adding 3 to both sides} \\
 6x &= 18 && \text{Simplifying} \\
 \frac{6x}{6} &= \frac{18}{6} && \text{Dividing both sides by 6} \\
 x &= 3 && \text{Simplifying}
 \end{aligned}$$

$$\begin{array}{l|l}
 \text{Check: } 6x - 3 = 15 \\
 6 \cdot 3 - 3 & 15 \\
 18 - 3 & 15 \\
 15 & 15 \quad \text{TRUE}
 \end{array}$$

The solution is  $3$ .

$$\begin{aligned}
 13. \quad 3x - 9 &= 33 \\
 3x - 9 + 9 &= 33 + 9 && \text{Adding 9 to both sides} \\
 3x &= 42 && \text{Simplifying} \\
 \frac{3x}{3} &= \frac{42}{3} && \text{Dividing both sides by 3} \\
 x &= 14 && \text{Simplifying}
 \end{aligned}$$

$$\begin{array}{l|l}
 \text{Check: } 3x - 9 = 33 \\
 3 \cdot 14 - 9 & 33 \\
 42 - 9 & 33 \\
 33 & 33 \quad \text{TRUE}
 \end{array}$$

The solution is  $14$ .

$$\begin{aligned}
 14. \quad 5x - 9 &= 41 \\
 5x - 9 + 9 &= 41 + 9 && \text{Adding 9 to both sides} \\
 5x &= 50 && \text{Simplifying} \\
 \frac{5x}{5} &= \frac{50}{5} && \text{Dividing both sides by 5} \\
 x &= 10 && \text{Simplifying}
 \end{aligned}$$

$$\begin{array}{l|l}
 \text{Check: } 5x - 9 = 41 \\
 5 \cdot 10 - 9 & 41 \\
 50 - 9 & 41 \\
 41 & 41 \quad \text{TRUE}
 \end{array}$$

The solution is  $10$ .

15.  $-91 = 9t + 8$   
 $-91 - 8 = 9t + 8 - 8$  Subtracting 8 from both sides  
 $-99 = 9t$  Simplifying  
 $\frac{-99}{9} = \frac{9t}{9}$  Dividing both sides by 9  
 $t = -11$  Simplifying

Check:  $-91 = 9t + 8$

$$\begin{array}{r|l} -91 & 9 \cdot (-11) + 8 \\ -91 & -99 + 8 \\ -91 & -91 \end{array} \quad \text{TRUE}$$

The solution is  $-11$ .

16.  $-39 = 1 + 8x$   
 $-1 - 39 = -1 + 1 + 8x$  Subtracting 1 from both sides  
 $-40 = 8x$  Simplifying  
 $\frac{-40}{8} = \frac{8x}{8}$  Dividing both sides by 8  
 $-5 = x$  Simplifying

Check:  $-39 = 1 + 8x$

$$\begin{array}{r|l} -39 & 1 + 8 \cdot (-5) \\ -39 & 1 - 40 \\ -39 & -39 \end{array} \quad \text{TRUE}$$

The solution is  $-5$ .

17.  $12 - t = 16$   
 $-12 + 12 - t = -12 + 16$  Subtracting 12 from both sides  
 $-t = 4$  Simplifying  
 $\frac{-t}{-1} = \frac{4}{-1}$  Dividing both sides by  $-1$   
 $t = -4$  Simplifying

Check:  $12 - t = 16$

$$\begin{array}{r|l} 12 - (-4) & 16 \\ 12 + 4 & 16 \\ 16 & 16 \end{array} \quad \text{TRUE}$$

The solution is  $-4$ .

18.  $9 - t = 21$   
 $-9 + 9 - t = -9 + 21$  Subtracting 9 from both sides  
 $-t = 12$  Simplifying  
 $\frac{-t}{-1} = \frac{12}{-1}$  Dividing both sides by  $-1$   
 $t = -12$  Simplifying

Check:  $9 - t = 21$

$$\begin{array}{r|l} 9 - (-12) & 21 \\ 9 + 12 & 21 \\ 21 & 21 \end{array} \quad \text{TRUE}$$

The solution is  $-12$ .

19.  $-6z - 18 = -132$   
 $-6z - 18 + 18 = -132 + 18$  Adding 18 to both sides  
 $-6z = -114$  Simplifying  
 $\frac{-6z}{-6} = \frac{-114}{-6}$  Dividing both sides by  $-6$   
 $z = 19$  Simplifying

Check:  $-6z - 18 = -132$

$$\begin{array}{r|l} -6(19) - 18 & -132 \\ -114 - 18 & -132 \\ -132 & -132 \end{array} \quad \text{TRUE}$$

The solution is 19.

20.  $-7x - 24 = -129$   
 $-7x - 24 + 24 = -129 + 24$  Adding 24 to both sides  
 $-7x = -105$  Simplifying  
 $\frac{-7x}{-7} = \frac{-105}{-7}$  Dividing both sides by  $-7$   
 $x = 15$  Simplifying

Check:  $-7x - 24 = -129$

$$\begin{array}{r|l} -7 \cdot 15 - 24 & -129 \\ -105 - 24 & -129 \\ -129 & -129 \end{array} \quad \text{TRUE}$$

The solution is 15.

21.  $5.3 + 1.2n = 1.94$   
 $-5.3 + 5.3 + 1.2n = -5.3 + 1.94$  Subtracting 5.3 from both sides  
 $1.2n = -3.36$  Simplifying  
 $\frac{1.2n}{1.2} = \frac{-3.36}{1.2}$  Dividing both sides by 1.2  
 $x = -2.8$  Simplifying  
 Check:  $5.3 + 1.2n = 1.94$   

$5.3 + 1.2(-2.8)$	$1.94$
$5.3 - 3.36$	$1.94$
$1.94$	$1.94$ TRUE

  
 The solution is  $-2.8$ .

22.  $6.4 - 2.5n = 2.2$   
 $-6.4 + 6.4 - 2.5n = -6.4 + 2.2$  Subtracting 6.4 from both sides  
 $-2.5n = -4.2$  Simplifying  
 $\frac{-2.5n}{-2.5} = \frac{-4.2}{-2.5}$  Dividing both sides by  $-2.5$   
 $x = 1.68$  Simplifying  
 Check:  $6.4 - 2.5n = 2.2$   

$6.4 - 2.5(1.68)$	$2.2$
$6.4 - 4.2$	$2.2$
$2.2$	$2.2$ TRUE

  
 The solution is  $1.68$ .

23.  $4x + 5x = 10$   
 $9x = 10$  Simplifying  
 $\frac{9x}{9} = \frac{10}{9}$  Dividing both sides by 9  
 $x = \frac{10}{9}$  Simplifying  
 Check:  $4x + 5x = 10$   

$4 \cdot \frac{10}{9} + 5 \cdot \frac{10}{9}$	$10$
$\frac{40}{9} + \frac{50}{9}$	$10$
$\frac{90}{9}$	$10$
$10$	$10$ TRUE

  
 The solution is  $\frac{10}{9}$ .

24.  $13 = 5x + 7x$   
 $13 = 12x$  Simplifying  
 $\frac{13}{12} = \frac{12x}{12}$  Dividing both sides by 12  
 $\frac{13}{12} = x$  Simplifying  
 Check:  $13 = 5x + 7x$   

$13$	$5\left(\frac{13}{12}\right) + 7\left(\frac{13}{12}\right)$
$13$	$\frac{65}{12} + \frac{91}{12}$
$13$	$\frac{156}{12}$
$13$	$13$ TRUE

  
 The solution is  $\frac{13}{12}$ .

25.  $32 - 7x = 11$   
 $-32 + 32 - 7x = -32 + 11$  Subtracting 32 from both sides  
 $-7x = -21$  Simplifying  
 $\frac{-7x}{-7} = \frac{-21}{-7}$  Dividing both sides by  $-7$   
 $x = 3$  Simplifying  
 Check:  $32 - 7x = 11$   

$32 - 7 \cdot 3$	$11$
$32 - 21$	$11$
$11$	$11$ TRUE

  
 The solution is  $3$ .

26.  $27 - 6x = 99$   
 $-27 + 27 - 6x = -27 + 99$  Subtracting 27 from both sides  
 $-6x = 72$  Simplifying  
 $\frac{-6x}{-6} = \frac{72}{-6}$  Dividing both sides by  $-6$   
 $x = -12$  Simplifying  
 Check:  $27 - 6x = 99$   

$27 - 6 \cdot (-12)$	$99$
$27 + 72$	$99$
$99$	$99$ TRUE

  
 The solution is  $-12$ .

$$27. \quad \frac{3}{5}t - 1 = 8$$

$$\frac{3}{5}t - 1 + 1 = 8 + 1 \quad \text{Adding 1 to both sides}$$

$$\frac{3}{5}t = 9 \quad \text{Simplifying}$$

$$\left(\frac{5}{3}\right)\left(\frac{3}{5}\right)t = \left(\frac{5}{3}\right) \cdot 9 \quad \text{Multiplying both sides by } \frac{5}{3}$$

$$t = 15 \quad \text{Simplifying}$$

$$\text{Check: } \frac{3}{5}t - 1 = 8$$

$\frac{3}{5} \cdot (15) - 1$	8
$9 - 1$	8
8	8 TRUE

The solution is 15.

$$28. \quad \frac{2}{3}t - 1 = 5$$

$$\frac{2}{3}t - 1 + 1 = 5 + 1 \quad \text{Adding 1 to both sides}$$

$$\frac{2}{3}t = 6 \quad \text{Simplifying}$$

$$\left(\frac{3}{2}\right)\left(\frac{2}{3}\right)t = \left(\frac{3}{2}\right) \cdot 6 \quad \text{Multiplying both sides by } \frac{3}{2}$$

$$t = 9 \quad \text{Simplifying}$$

$$\text{Check: } \frac{2}{3}t - 1 = 5$$

$\frac{2}{3} \cdot (9) - 1$	5
$6 - 1$	5
5	5 TRUE

The solution is 9.

$$29. \quad 4 + \frac{7}{2}x = -10$$

$$-4 + 4 + \frac{7}{2}x = -4 - 10 \quad \text{Subtracting 4 from both sides}$$

$$\frac{7}{2}x = -14 \quad \text{Simplifying}$$

$$\left(\frac{2}{7}\right)\left(\frac{7}{2}\right)x = \left(\frac{2}{7}\right)(-14) \quad \text{Multiplying both sides by } \frac{2}{7}$$

$$x = -4 \quad \text{Simplifying}$$

$$\text{Check: } 4 + \frac{7}{2}x = -10$$

$4 + \frac{7}{2}(-4)$	-10
$4 + (-14)$	-10
-10	-10 TRUE

The solution is -4.

$$30. \quad 6 + \frac{5}{4}x = -4$$

$$-6 + 6 + \frac{5}{4}x = -6 - 4 \quad \text{Subtracting } -6 \text{ from both sides}$$

$$\frac{5}{4}x = -10 \quad \text{Simplifying}$$

$$\left(\frac{4}{5}\right)\left(\frac{5}{4}\right)x = \left(\frac{4}{5}\right)(-10) \quad \text{Multiplying both sides by } \frac{4}{5}$$

$$x = -8 \quad \text{Simplifying}$$

$$\text{Check: } 6 + \frac{5}{4}x = -4$$

$6 + \frac{5}{4}(-8)$	-4
$6 - 10$	-4
-4	-4 TRUE

The solution is -8.

$$31. \quad -\frac{3a}{4} - 5 = 2$$

$$-\frac{3}{4}a - 5 = 2 \quad \text{Rewriting}$$

$$-\frac{3}{4}a - 5 + 5 = 2 + 5 \quad \text{Adding 5 to both sides}$$

$$-\frac{3}{4}a = 7 \quad \text{Simplifying}$$

$$\left(-\frac{4}{3}\right)\left(-\frac{3}{4}\right)a = \left(-\frac{4}{3}\right) \cdot 7 \quad \text{Multiplying both sides by } -\frac{4}{3}$$

$$a = -\frac{28}{3} \quad \text{Simplifying}$$

$$\text{Check: } -\frac{3a}{4} - 5 = 2$$

$\left(-\frac{3}{4}\right)\left(-\frac{28}{3}\right) - 5$	2
$7 - 5$	2
2	2 TRUE

The solution is  $-\frac{28}{3}$ .

$$32. \quad -\frac{7a}{8} - 2 = 1$$

$$-\frac{7}{8}a - 2 = 1 \quad \text{Rewriting}$$

$$-\frac{7}{8}a - 2 + 2 = 1 + 2 \quad \text{Adding 2 to both sides}$$

$$-\frac{7}{8}a = 3 \quad \text{Simplifying}$$

$$\left(-\frac{8}{7}\right)\left(-\frac{7}{8}\right)a = \left(-\frac{8}{7}\right) \cdot 3 \quad \text{Multiplying both sides by } -\frac{8}{7}$$

$$a = -\frac{24}{7} \quad \text{Simplifying}$$

Check:

$$-\frac{7a}{8} - 2 = 1$$

$\left(-\frac{7}{8}\right)\left(-\frac{24}{7}\right) - 2$	1
3 - 2	1
1	1 TRUE

The solution is  $-\frac{24}{7}$ .

33.  $2x = x + x$   
 This equation is true regardless of the replacement for  $x$ , so all real numbers are solutions. The equation is an identity.

34.  $-3z + 8z = 45$

$$5z = 45 \quad \text{Combining like terms}$$

$$\frac{5z}{5} = \frac{45}{5} \quad \text{Dividing both sides by 5}$$

$$z = 9 \quad \text{Simplifying}$$

Check:  $-3z + 8z = 45$

$-3 \cdot 9 + 8 \cdot 9$	45
$-27 + 72$	45
45	45 TRUE

The solution is 9.

35.  $4x - 6 = 6x$

$$4x - 6 - 4x = 6x - 4x \quad \text{Adding } -4x \text{ to both sides}$$

$$-6 = 2x \quad \text{Simplifying}$$

$$\frac{-6}{2} = \frac{2x}{2} \quad \text{Dividing both sides by 2}$$

$$-3 = x \quad \text{Simplifying}$$

Check:  $4x - 6 = 6x$

$4 \cdot (-3) - 6$	$6 \cdot (-3)$
$-12 - 6$	-18
-18	-18 TRUE

The solution is  $-3$ .

36.  $4x - x = 2x + x$

$$3x = 3x \quad \text{Combining like terms}$$

This equation is true regardless of the replacement for  $x$ , so all real numbers are solutions. The equation is an identity.

37.  $2 - 5y = 26 - y$

$$2 - 5y + y = 26 - y + y \quad \text{Adding } y \text{ to both sides}$$

$$2 - 4y = 26 \quad \text{Simplifying}$$

$$-2 + 2 - 4y = -2 + 26 \quad \text{Subtracting 2 from both sides}$$

$$-4y = 24 \quad \text{Simplifying}$$

$$\frac{-4y}{-4} = \frac{24}{-4} \quad \text{Dividing both sides by } -4$$

$$y = -6 \quad \text{Simplifying}$$

Check:  $2 - 5y = 26 - y$

$2 - 5(-6)$	$26 - (-6)$
$2 + 30$	$26 + 6$
32	32 TRUE

The solution is  $-6$ .

38.  $6x - 5 = 7 + 2x$

$$6x - 5 - 2x = 7 + 2x - 2x \quad \text{Subtracting } 2x \text{ from both sides}$$

$$4x - 5 = 7 \quad \text{Simplifying}$$

$$4x - 5 + 5 = 7 + 5 \quad \text{Adding 5 to both sides}$$

$$4x = 12 \quad \text{Simplifying}$$

$$\frac{4x}{4} = \frac{12}{4} \quad \text{Dividing both sides by 4}$$

$$x = 3 \quad \text{Simplifying}$$

Check:  $6x - 5 = 7 + 2x$

$6 \cdot 3 - 5$	$7 + 2 \cdot 3$
$18 - 5$	$7 + 6$
13	13 TRUE

The solution is 3.

$$\begin{aligned}
 39. \quad 7(2a-1) &= 21 \\
 14a-7 &= 21 && \text{Distributive law} \\
 14a-7+7 &= 21+7 && \text{Adding 7 to both sides} \\
 14a &= 28 && \text{Simplifying} \\
 \frac{14a}{14} &= \frac{28}{14} && \text{Dividing both sides by 14} \\
 a &= 2 && \text{Simplifying}
 \end{aligned}$$

$$\text{Check: } 7(2a-1) = 21$$

$$\begin{array}{r|l}
 7(2 \cdot 2 - 1) & 21 \\
 7(4 - 1) & 21 \\
 7(3) & 21 \\
 21 & 21 \quad \text{TRUE}
 \end{array}$$

The solution is 2.

$$\begin{aligned}
 40. \quad 5(3-3t) &= 30 \\
 15-15t &= 30 && \text{Distributive law} \\
 -15+15-15t &= -15+30 && \text{Subtracting 15 from both sides} \\
 -15t &= 15 && \text{Simplifying} \\
 \frac{-15t}{-15} &= \frac{15}{-15} && \text{Dividing both sides by } -15 \\
 t &= -1 && \text{Simplifying}
 \end{aligned}$$

$$\text{Check: } 5(3-3t) = 30$$

$$\begin{array}{r|l}
 5(3-3 \cdot (-1)) & 30 \\
 5(3+3) & 30 \\
 5(6) & 30 \\
 30 & 30 \quad \text{TRUE}
 \end{array}$$

The solution is -1.

$$\begin{aligned}
 41. \quad 8 &= 8(x+1) \\
 8 &= 8x+8 && \text{Distributive law} \\
 8-8 &= 8x+8-8 && \text{Subtracting 8 from both sides} \\
 0 &= 8x && \text{Simplifying} \\
 \frac{0}{8} &= \frac{8x}{8} && \text{Dividing both sides by 8} \\
 0 &= x && \text{Simplifying}
 \end{aligned}$$

$$\text{Check: } 8 = 8(x+1)$$

$$\begin{array}{r|l}
 8 & 8(0+1) \\
 8 & 8(1) \\
 8 & 8 \quad \text{TRUE}
 \end{array}$$

The solution is 0.

$$\begin{aligned}
 42. \quad 9 &= 3(5x-2) \\
 9 &= 15x-6 && \text{Distributive law} \\
 9+6 &= 15x-6+6 && \text{Adding 6 to both sides} \\
 15 &= 15x && \text{Simplifying} \\
 \frac{15}{15} &= \frac{15x}{15} && \text{Dividing both sides by 15} \\
 1 &= x && \text{Simplifying}
 \end{aligned}$$

$$\text{Check: } 9 = 3(5x-2)$$

$$\begin{array}{r|l}
 9 & 3(5 \cdot 1 - 2) \\
 9 & 3(5 - 2) \\
 9 & 3(3) \\
 9 & 9 \quad \text{TRUE}
 \end{array}$$

The solution is 1.

$$\begin{aligned}
 43. \quad 2(3+4m)-6 &= 48 \\
 6+8m-6 &= 48 && \text{Distributive law} \\
 8m &= 48 && \text{Simplifying} \\
 \frac{8m}{8} &= \frac{48}{8} && \text{Dividing both sides by 8} \\
 m &= 6 && \text{Simplifying}
 \end{aligned}$$

$$\text{Check: } 2(3+4m)-6 = 48$$

$$\begin{array}{r|l}
 2(3+4 \cdot 6) - 6 & 48 \\
 2(3+24) - 6 & 48 \\
 2(27) - 6 & 48 \\
 54 - 6 & 48 \\
 48 & 48 \quad \text{TRUE}
 \end{array}$$

The solution is 6.

$$\begin{aligned}
 44. \quad 3(5+3m)-8 &= 7 \\
 15+9m-8 &= 7 && \text{Distributive law} \\
 7+9m &= 7 && \text{Simplifying} \\
 -7+7+9m &= -7+7 && \text{Adding } -7 \text{ to both sides} \\
 9m &= 0 && \text{Simplifying} \\
 \frac{9m}{9} &= \frac{0}{9} && \text{Dividing both sides by 9} \\
 m &= 0
 \end{aligned}$$



$$\begin{array}{ll}
 50. & 10 - 3x = 2x - 8x + 40 \\
 & 10 - 3x = -6x + 40 \quad \text{Simplifying} \\
 & 10 - 3x + 6x = -6x + 6x + 40 \quad \text{Adding } 6x \\
 & \quad \quad \quad \text{to both sides} \\
 & 10 + 3x = 40 \quad \text{Simplifying} \\
 & -10 + 10 + 3x = -10 + 40 \quad \text{Subtracting } 10 \\
 & \quad \quad \quad \text{from both sides} \\
 & 3x = 30 \quad \text{Simplifying} \\
 & \frac{3x}{3} = \frac{30}{3} \quad \text{Dividing both} \\
 & \quad \quad \quad \text{sides by } 3 \\
 & x = 10 \quad \text{Simplifying} \\
 \text{Check: } & 10 - 3x = 2x - 8x + 40 \\
 & \begin{array}{r|l}
 10 - 3 \cdot 10 & 2 \cdot 10 - 8 \cdot 10 + 40 \\
 10 - 30 & 20 - 80 + 40 \\
 -20 & -20 \quad \text{TRUE}
 \end{array}
 \end{array}$$

The solution is 10.

$$\begin{array}{ll}
 51. & 7 + 3x - 6 = 3x + 5 - x \\
 & 1 + 3x = 2x + 5 \quad \text{Simplifying} \\
 & 1 + 3x - 2x = 2x + 5 - 2x \quad \text{Subtracting } 2x \\
 & \quad \quad \quad \text{from both sides} \\
 & 1 + x = 5 \quad \text{Simplifying} \\
 & -1 + 1 + x = -1 + 5 \quad \text{Subtracting } 1 \\
 & \quad \quad \quad \text{from both sides} \\
 & x = 4 \quad \text{Simplifying} \\
 \text{Check: } & 7 + 3x - 6 = 3x + 5 - x \\
 & \begin{array}{r|l}
 7 + 3 \cdot 4 - 6 & 3 \cdot 4 + 5 - 4 \\
 7 + 12 - 6 & 12 + 5 - 4 \\
 19 - 6 & 17 - 4 \\
 13 & 13 \quad \text{TRUE}
 \end{array}
 \end{array}$$

The solution is 4.

$$\begin{array}{ll}
 52. & 5 + 4x - 7 = 4x - 2 - x \\
 & 4x - 2 = 3x - 2 \quad \text{Simplifying} \\
 & 4x - 3x - 2 = \quad \text{Subtracting } 3x \\
 & \quad \quad \quad \text{from both sides} \\
 & 3x - 3x - 2 \\
 & x - 2 = -2 \quad \text{Simplifying} \\
 & x - 2 + 2 = -2 + 2 \quad \text{Adding } 2 \\
 & \quad \quad \quad \text{to both sides} \\
 & x = 0 \quad \text{Simplifying}
 \end{array}$$

$$\begin{array}{l}
 \text{Check: } 5 + 4x - 7 = 4x - 2 - x \\
 \begin{array}{r|l}
 5 + 4 \cdot 0 - 7 & 4 \cdot 0 - 2 - 0 \\
 5 + 0 - 7 & 0 - 2 \\
 -2 & -2 \quad \text{TRUE}
 \end{array}
 \end{array}$$

The solution is 0.

$$\begin{array}{ll}
 53. & 4y - 4 + y + 24 = 6y + 20 - 4y \\
 & 5y + 20 = 2y + 20 \quad \text{Simplifying} \\
 & 5y + 20 - 2y = \quad \text{Subtracting } 2y \\
 & \quad \quad \quad \text{from both sides} \\
 & 2y + 20 - 2y \\
 & 3y + 20 = 20 \quad \text{Simplifying} \\
 & 3y + 20 - 20 = 20 - 20 \quad \text{Subtracting } 20 \\
 & \quad \quad \quad \text{from both sides} \\
 & 3y = 0 \quad \text{Simplifying} \\
 & \frac{3y}{3} = \frac{0}{3} \quad \text{Dividing both} \\
 & \quad \quad \quad \text{sides by } 3 \\
 & y = 0 \quad \text{Simplifying}
 \end{array}$$

Check:

$$\begin{array}{l}
 4y - 4 + y + 24 = 6y + 20 - 4y \\
 \begin{array}{r|l}
 4 \cdot 0 - 4 + 0 + 24 & 6 \cdot 0 + 20 - 4 \cdot 0 \\
 0 - 4 + 0 + 24 & 0 + 20 - 0 \\
 20 & 20 \quad \text{TRUE}
 \end{array}
 \end{array}$$

The solution is 0.

$$\begin{array}{ll}
 54. & 5y - 10 + y = 7y + 18 - 5y \\
 & 6y - 10 = 2y + 18 \quad \text{Simplifying} \\
 & 6y - 10 - 2y = 2y + 18 - 2y \quad \text{Subtracting } 2y \\
 & \quad \quad \quad \text{from both sides} \\
 & 4y - 10 = 18 \quad \text{Simplifying} \\
 & 4y - 10 + 10 = 18 + 10 \quad \text{Adding } 10 \text{ to} \\
 & \quad \quad \quad \text{both sides} \\
 & 4y = 28 \quad \text{Simplifying} \\
 & \frac{4y}{4} = \frac{28}{4} \quad \text{Dividing both} \\
 & \quad \quad \quad \text{sides by } 4 \\
 & y = 7 \quad \text{Simplifying}
 \end{array}$$

Check:  $5y - 10 + y = 7y + 18 - 5y$

$$\begin{array}{r|l}
 5 \cdot 7 - 10 + 7 & 7 \cdot 7 + 18 - 5 \cdot 7 \\
 35 - 10 + 7 & 49 + 18 - 35 \\
 25 + 7 & 67 - 35 \\
 32 & 32 \quad \text{TRUE}
 \end{array}$$

The solution is 7.

55.  $4 + 7a = 7(a - 1)$   
 $4 + 7a = 7a - 7$  Distributive law  
 $4 + 7a - 7a = 7a - 7a - 7$  Subtracting  $7a$   
 from both sides  
 $4 = -7$  Simplifying  
 This is a false statement. The equation is a  
 contradiction and has no solution.

56.  $3(t + 2) + t = 2(3 + 2t)$   
 $3t + 6 + t = 6 + 4t$  Distributive law  
 $4t + 6 = 6 + 4t$  Simplifying  
 $4t + 6 - 4t = 6 + 4t - 4t$  Subtracting  $4t$   
 from both sides  
 $6 = 6$  Simplifying  
 Since this equation is true for all real  
 numbers, this equation is an identity.

57.  $13 - 3(2x - 1) = 4$   
 $13 - 6x + 3 = 4$  Distributive law  
 $16 - 6x = 4$  Simplifying  
 $16 - 6x - 16 = 4 - 16$  Subtracting 16  
 from both sides  
 $-6x = -12$  Simplifying  
 $\frac{-6x}{-6} = \frac{-12}{-6}$  Dividing both sides  
 by  $-6$   
 $x = 2$  Simplifying

Check:  
 $13 - 3(2x - 1) = 4$   

$13 - 3(2 \cdot 2 - 1)$	$4$
$13 - 3(4 - 1)$	$4$
$13 - 3(3)$	$4$
$13 - 9$	$4$
$4$	$4$ TRUE

The solution is 2.

58.  $5(d + 4) = 7(d - 2)$   
 $5d + 20 = 7d - 14$  Distributive law  
 $5d + 20 - 7d =$  Subtracting  $7d$   
 from both sides  
 $7d - 14 - 7d$   
 $-2d + 20 = -14$  Simplifying  
 $-2d + 20 - 20 = -14 - 20$  Subtracting 20  
 from both sides  
 $-2d = -34$  Simplifying  
 $\frac{-2d}{-2} = \frac{-34}{-2}$  Dividing both  
 sides by  $-2$   
 $d = 17$

Check:  
 $5(d + 4) = 7(d - 2)$   

$5(17 + 4)$	$7(17 - 2)$
$5(21)$	$7(15)$
$105$	$105$ TRUE

The solution is 17.

59.  $7(5x - 2) = 6(6x - 1)$   
 $35x - 14 = 36x - 6$  Distributive law  
 $35x - 14 - 35x =$  Subtracting  $35x$   
 from both sides  
 $36x - 6 - 35x$   
 $-14 = x - 6$  Simplifying  
 $-14 + 6 = x - 6 + 6$  Adding 6 to  
 both sides  
 $-8 = x$  Simplifying

Check:  
 $7(5x - 2) = 6(6x - 1)$   

$7[5(-8) - 2]$	$6[6(-8) - 1]$
$7[-40 - 2]$	$6[-48 - 1]$
$7[-42]$	$6[-49]$
$-294$	$-294$ TRUE

The solution is  $-8$ .

$$\begin{aligned}
 60. \quad & 5(t+1)+8=3(t-2)+6 \\
 & 5t+5+8=3t-6+6 \quad \text{Distributive law} \\
 & 5t+13=3t \quad \text{Simplifying} \\
 & -5t+5t+13=-5t+3t \quad \text{Subtracting } 5t \\
 & \quad \text{from both sides} \\
 & 13=-2t \quad \text{Simplifying} \\
 & \frac{13}{-2}=\frac{-2t}{-2} \quad \text{Dividing both} \\
 & \quad \text{sides by } -2 \\
 & t=-\frac{13}{2} \quad \text{Simplifying}
 \end{aligned}$$

Check:

$$5(t+1)+8=3(t-2)+6$$

$5\left(-\frac{13}{2}+1\right)+8$	$3\left(-\frac{13}{2}-2\right)+6$	
$-\frac{65}{2}+5+8$	$-\frac{39}{2}-6+6$	
$-\frac{65}{2}+13$	$-\frac{39}{2}$	
$-\frac{65}{2}+\frac{26}{2}$		
$-\frac{39}{2}$		TRUE

The solution is  $-\frac{13}{2}$ .

$$\begin{aligned}
 61. \quad & 2(7-x)-20=7x-3(2+3x) \\
 & 14-2x-20=7x-6-9x \quad \text{Distributive law} \\
 & -2x-6=-2x-6 \quad \text{Simplifying} \\
 & -2x-6+6=-2x-6+6 \quad \text{Adding } 6 \\
 & \quad \text{to both sides} \\
 & -2x=-2x \quad \text{Simplifying}
 \end{aligned}$$

This equation is true regardless of the replacement for  $x$ , so all real numbers are solutions. The equation is an identity.

$$\begin{aligned}
 62. \quad & 5(x-7)=3(x-2)+2x \\
 & 5x-35=3x-6+2x \quad \text{Distributive Law} \\
 & 5x-35=5x-6 \quad \text{Distributive Law} \\
 & -5x+5x-35=-5x+5x-6 \quad \text{Subtracting } 5x \\
 & \quad \text{from both sides} \\
 & -35=-6 \quad \text{Simplifying}
 \end{aligned}$$

This is a false statement. The equation is a contradiction and has no solution.

$$\begin{aligned}
 63. \quad & 19-(2x+3)=2(x+3)+x \\
 & 19-2x-3=2x+6+x \quad \text{Distributive law} \\
 & 16-2x=3x+6 \quad \text{Simplifying} \\
 & 16-2x+2x= \quad \text{Adding } 2x \text{ to} \\
 & \quad \text{both sides} \\
 & 3x+6+2x \\
 & 16=5x+6 \quad \text{Simplifying} \\
 & 16-6=5x+6-6 \quad \text{Subtracting } 6 \\
 & \quad \text{from both sides} \\
 & 10=5x \quad \text{Simplifying} \\
 & \frac{10}{5}=\frac{5x}{5} \quad \text{Dividing both} \\
 & \quad \text{sides by } 5 \\
 & 2=x \quad \text{Simplifying}
 \end{aligned}$$

Check:

$19-(2x+3)=2(x+3)+x$	
$19-(2 \cdot 2+3)$	$2(2+3)+2$
$19-(4+3)$	$2(5)+2$
$19-(7)$	$10+2$
$12$	$12$ TRUE

The solution is 2.

$$\begin{aligned}
 64. \quad & 13-(2c+2)=2(c+2)+3c \\
 & 13-2c-2=2c+4+3c \quad \text{Distributive law} \\
 & 11-2c=5c+4 \quad \text{Simplifying} \\
 & 11-2c+2c=5c+4+2c \quad \text{Adding } 2c \text{ to} \\
 & \quad \text{both sides} \\
 & 11=7c+4 \quad \text{Simplifying} \\
 & 11-4=7c+4-4 \quad \text{Subtracting } 4 \\
 & \quad \text{from both sides} \\
 & 7=7c \quad \text{Simplifying} \\
 & \frac{7}{7}=\frac{7c}{7} \quad \text{Dividing both} \\
 & \quad \text{sides by } 7 \\
 & 1=c \quad \text{Simplifying}
 \end{aligned}$$

Check:

$13-(2c+2)=2(c+2)+3c$	
$13-(2 \cdot 1+2)$	$2(1+2)+3 \cdot 1$
$13-(2+2)$	$2(3)+3$
$13-4$	$6+3$
$9$	$9$ TRUE

The solution is 1.

65.  $\frac{2}{3} + \frac{1}{4}t = 2$

The number 12 is the least common denominator, so we multiply by 12 on both sides.

$$12\left(\frac{2}{3} + \frac{1}{4}t\right) = 12 \cdot 2$$

$$8 + 3t = 24$$

$$-8 + 8 + 3t = -8 + 24 \quad \text{Subtracting 8 from both sides}$$

$$3t = 16 \quad \text{Simplifying}$$

$$\frac{3t}{3} = \frac{16}{3} \quad \text{Dividing both sides by 3}$$

$$t = \frac{16}{3} \quad \text{Simplifying}$$

Check:

$$\frac{2}{3} + \frac{1}{4}t = 2$$

$\frac{2}{3} + \frac{1}{4}\left(\frac{16}{3}\right)$	2
$\frac{2}{3} + \frac{16}{12}$	2
$\frac{2}{3} + \frac{4}{3}$	2
$\frac{6}{3}$	2
2	2 TRUE

The solution is  $\frac{16}{3}$ .

66.  $-\frac{5}{6} + x = -\frac{1}{2} - \frac{2}{3}$

The number 6 is the least common denominator, so we multiply by 6 on both sides.

$$6\left(-\frac{5}{6} + x\right) = 6\left(-\frac{1}{2} - \frac{2}{3}\right)$$

$$-5 + 6x = -3 - 4$$

$$-5 + 6x = -7 \quad \text{Simplifying}$$

$$5 - 5 + 6x = 5 - 7 \quad \text{Adding 5 to both sides}$$

$$6x = -2 \quad \text{Simplifying}$$

$$\frac{6x}{6} = \frac{-2}{6} \quad \text{Dividing both sides by 6}$$

$$x = -\frac{1}{3} \quad \text{Simplifying}$$

Check:

$$-\frac{5}{6} + x = -\frac{1}{2} - \frac{2}{3}$$

$-\frac{5}{6} + \left(-\frac{1}{3}\right)$	$-\frac{1}{2} - \frac{2}{3}$
$-\frac{5}{6} + \left(-\frac{2}{6}\right)$	$-\frac{3}{6} - \frac{4}{6}$
$-\frac{7}{6}$	$-\frac{7}{6}$ TRUE

The solution is  $-\frac{1}{3}$ .

67.  $\frac{2}{3} + 4t = 6t - \frac{2}{15}$

The number 15 is the least common denominator, so we multiply by 15 on both sides.

$$15\left(\frac{2}{3} + 4t\right) = 15\left(6t - \frac{2}{15}\right)$$

$$10 + 60t = 90t - 2$$

$$10 + 60t - 60t = \quad \text{Subtracting } 60t \text{ from both sides}$$

$$90t - 2 - 60t$$

$$10 = 30t - 2 \quad \text{Simplifying}$$

$$10 + 2 = 30t - 2 + 2 \quad \text{Adding 2 to both sides}$$

$$12 = 30t \quad \text{Simplifying}$$

$$\frac{12}{30} = \frac{30t}{30} \quad \text{Dividing both sides by 30}$$

$$\frac{2}{5} = t \quad \text{Simplifying}$$

Check:

$$\frac{2}{3} + 4t = 6t - \frac{2}{15}$$

$\frac{2}{3} + 4\left(\frac{2}{5}\right)$	$6\left(\frac{2}{5}\right) - \frac{2}{15}$
$\frac{2}{3} + \frac{8}{5}$	$\frac{12}{5} - \frac{2}{15}$
$\frac{10}{15} + \frac{24}{15}$	$\frac{36}{15} - \frac{2}{15}$
$\frac{34}{15}$	$\frac{34}{15}$ TRUE

The solution is  $\frac{2}{5}$ .

68.  $\frac{1}{2} + 4m = 3m - \frac{5}{2}$

The number 2 is the least common denominator, so we multiply by 2 on both sides.

$$2\left(\frac{1}{2} + 4m\right) = 2\left(3m - \frac{5}{2}\right)$$

$$1 + 8m = 6m - 5$$

$$1 + 8m - 6m = 6m - 5 - 6m \quad \text{Subtracting } 6m \text{ from both sides}$$

$$1 + 2m = -5 \quad \text{Simplifying}$$

$$1 + 2m - 1 = -5 - 1 \quad \text{Subtracting 1 from both sides}$$

$$2m = -6 \quad \text{Simplifying}$$

$$\frac{2m}{2} = \frac{-6}{2} \quad \text{Dividing both sides by 2}$$

$$m = -3 \quad \text{Simplifying}$$

Check:

$$\frac{1}{2} + 4m = 3m - \frac{5}{2}$$

$\frac{1}{2} + 4(-3)$	$3(-3) - \frac{5}{2}$
$\frac{1}{2} - 12$	$-9 - \frac{5}{2}$
$\frac{1}{2} - \frac{24}{2}$	$-\frac{18}{2} - \frac{5}{2}$
$-\frac{23}{2}$	$-\frac{23}{2}$ TRUE

The solution is  $-3$ .

69.  $\frac{1}{3}x + \frac{2}{5} = \frac{4}{15} + \frac{3}{5}x - \frac{2}{3}$

The number 15 is the least common denominator, so we multiply by 15 on both sides.

$$15\left(\frac{1}{3}x + \frac{2}{5}\right) = 15\left(\frac{4}{15} + \frac{3}{5}x - \frac{2}{3}\right)$$

$$5x + 6 = 4 + 9x - 10$$

$$5x + 6 = 9x - 6 \quad \text{Simplifying}$$

$$5x + 6 - 5x = 9x - 6 - 5x \quad \text{Subtracting } 5x \text{ from both sides}$$

$$6 = 4x - 6 \quad \text{Simplifying}$$

$$6 + 6 = 4x - 6 + 6 \quad \text{Adding 6 to both sides}$$

$$12 = 4x \quad \text{Simplifying}$$

$$\frac{12}{4} = \frac{4x}{4} \quad \text{Dividing both sides by 4}$$

$$3 = x \quad \text{Simplifying}$$

Check:

$$\frac{1}{3}x + \frac{2}{5} = \frac{4}{15} + \frac{3}{5}x - \frac{2}{3}$$

$\frac{1}{3}(3) + \frac{2}{5}$	$\frac{4}{15} + \frac{3}{5}(3) - \frac{2}{3}$
$1 + \frac{2}{5}$	$\frac{4}{15} + \frac{9}{5} - \frac{2}{3}$
$\frac{5}{5} + \frac{2}{5}$	$\frac{4}{15} + \frac{27}{15} - \frac{10}{15}$
$\frac{7}{5}$	$\frac{21}{15}$
$\frac{7}{5}$	$\frac{7}{5}$ TRUE

The solution is 3.

70.  $1 - \frac{2}{3}y = \frac{9}{5} - \frac{1}{5}y + \frac{3}{5}$

The number 15 is the least common denominator, so we multiply by 15 on both sides.

$$15\left(1 - \frac{2}{3}y\right) = 15\left(\frac{9}{5} - \frac{1}{5}y + \frac{3}{5}\right)$$

$$15 - 10y = 27 - 3y + 9$$

$$15 - 10y = 36 - 3y \quad \text{Simplifying}$$

$$15 - 10y + 10y = \quad \text{Adding } 10y \text{ to both sides}$$

$$36 - 3y + 10y$$

$$15 = 36 + 7y \quad \text{Simplifying}$$

$$15 - 36 = \quad \text{Subtracting } 36 \text{ from both sides}$$

$$36 + 7y - 36$$

$$-21 = 7y \quad \text{Simplifying}$$

$$\frac{-21}{7} = \frac{7y}{7} \quad \text{Dividing both sides by 7}$$

$$-3 = y \quad \text{Simplifying}$$

Check:

$$1 - \frac{2}{3}y = \frac{9}{5} - \frac{1}{5}y + \frac{3}{5}$$

$1 - \frac{2}{3}(-3)$	$\frac{9}{5} - \frac{1}{5}(-3) + \frac{3}{5}$
$1 + 2$	$\frac{9}{5} + \frac{3}{5} + \frac{3}{5}$
$3$	$\frac{15}{5}$
$3$	$3$ TRUE

The solution is  $-3$ .

71.  $2.1x + 45.2 = 3.2 - 8.4x$

We can clear decimals by multiplying both sides by 10.

$$10(2.1x + 45.2) = 10(3.2 - 8.4x)$$

$$21x + 452 = 32 - 84x$$

$$21x + 452 + 84x = \quad \text{Adding } 84x \text{ to both sides}$$

$$32 - 84x + 84x$$

$$105x + 452 = 32 \quad \text{Simplifying}$$

$$105x + 452 - 452 = \quad \text{Subtracting } 452 \text{ from both sides}$$

$$32 - 452$$

$$105x = -420 \quad \text{Simplifying}$$

$$\frac{105x}{105} = \frac{-420}{105} \quad \text{Dividing both sides by 105}$$

$$x = -4 \quad \text{Simplifying}$$

Check:

$$2.1x + 45.2 = 3.2 - 8.4x$$

$2.1(-4) + 45.2$	$3.2 - 8.4(-4)$
$-8.4 + 45.2$	$3.2 + 33.6$
$36.8$	$36.8$ TRUE

The solution is  $-4$ .

72.  $0.91 - 0.2z = 1.23 - 0.6z$   
 We can clear decimals by multiplying both sides by 100.

$$100(0.91 - 0.2z) = 100(1.23 - 0.6z)$$

$$91 - 20z = 123 - 60z$$

$$91 - 20z - 91 = 123 - 60z - 91 \quad \text{Subtracting 91 from both sides}$$

$$-20z = -60z + 32 \quad \text{Simplifying}$$

$$-20z + 60z = -60z + 32 + 60z \quad \text{Adding } 60z \text{ to both sides}$$

$$40z = 32 \quad \text{Simplifying}$$

$$\frac{40z}{40} = \frac{32}{40} \quad \text{Dividing both sides by 40}$$

$$z = 0.8 \quad \text{Simplifying}$$

Check:

$$0.91 - 0.2z = 1.23 - 0.6z$$

$0.91 - 0.2(0.8)$	$1.23 - 0.6(0.8)$
$0.91 - 0.16$	$1.23 - 0.48$
$0.75$	$0.75$ TRUE

The solution is 0.8.

73.  $0.76 + 0.21t = 0.96t - 0.49$   
 We can clear decimals by multiplying both sides by 100.

$$100(0.76 + 0.21t) = 100(0.96t - 0.49)$$

$$76 + 21t = 96t - 49$$

$$76 + 21t - 76 = 96t - 49 - 76 \quad \text{Subtracting 76 from both sides}$$

$$21t = 96t - 125 \quad \text{Simplifying}$$

$$21t - 96t = 96t - 125 - 96t \quad \text{Subtracting } 96t \text{ from both sides}$$

$$-75t = -125 \quad \text{Simplifying}$$

$$\frac{-75t}{-75} = \frac{-125}{-75} \quad \text{Dividing both sides by } -75$$

$$t = 1.\bar{6} \quad \text{Simplifying}$$

Check:

$$0.76 + 0.21t = 0.96t - 0.49$$

$0.76 + 0.21(1.\bar{6})$	$0.96(1.\bar{6}) - 0.49$
$0.76 + 0.35$	$1.6 - 0.49$
$1.11$	$1.11$ TRUE

The solution is  $1.\bar{6}$ .

74.  $1.7t + 8 - 1.62t = 0.4t - 0.32 + 8$

We can clear decimals by multiplying both sides by 100.

$$100(1.7t + 8 - 1.62t) = 100(0.4t - 0.32 + 8)$$

$$170t + 800 - 162t = 40t - 32 + 800$$

$$8t + 800 = 40t + 768$$

$$8t + 800 - 800 = 40t + 768 - 800 \quad \text{Subtracting 800 from both sides}$$

$$8t = 40t - 32 \quad \text{Simplifying}$$

$$8t - 40t = 40t - 32 - 40t \quad \text{Subtracting } 40t \text{ from both sides}$$

$$-32t = -32 \quad \text{Simplifying}$$

$$\frac{-32t}{-32} = \frac{-32}{-32} \quad \text{Dividing both sides by } -32$$

$$t = 1 \quad \text{Simplifying}$$

Check:

$$1.7t + 8 - 1.62t = 0.4t - 0.32 + 8$$

$1.7(1) + 8 - 1.62(1)$	$0.4(1) - 0.32 + 8$
$1.7 + 8 - 1.62$	$0.4 - 0.32 + 8$
$8.08$	$8.08$ TRUE

The solution is 1.

75.  $\frac{2}{5}x - \frac{3}{2}x = \frac{3}{4}x + 2$   
 The number 20 is the least common denominator, so we multiply by 20 on both sides.

$$20\left(\frac{2}{5}x - \frac{3}{2}x\right) = 20\left(\frac{3}{4}x + 2\right)$$

$$8x - 30x = 15x + 40$$

$$-22x = 15x + 40 \quad \text{Simplifying}$$

$$-22x - 15x = 15x + 40 - 15x \quad \text{Subtract } 15x \text{ from both sides}$$

$$-37x = 40 \quad \text{Simplifying}$$

$$\frac{-37x}{-37} = \frac{40}{-37} \quad \text{Divide both sides by } -37$$

$$x = -\frac{40}{37} \quad \text{Simplifying}$$

Check:

$$\frac{2}{5}x - \frac{3}{2}x = \frac{3}{4}x + 2$$

$\frac{2}{5}\left(-\frac{40}{37}\right) - \frac{3}{2}\left(-\frac{40}{37}\right)$	$\frac{3}{4}\left(-\frac{40}{37}\right) + 2$
$-\frac{16}{37} + \frac{60}{37}$	$-\frac{30}{37} + \frac{74}{37}$
$\frac{44}{37}$	$\frac{44}{37}$ TRUE

The solution is  $-\frac{40}{37}$ .

76.  $\frac{5}{16}y + \frac{3}{8}y = 2 + \frac{1}{4}y$

The number 16 is the least common denominator, so we multiply by 16 on both sides.

$$16\left(\frac{5}{16}y + \frac{3}{8}y\right) = 16\left(2 + \frac{1}{4}y\right)$$

$$5y + 6y = 32 + 4y$$

$$11y = 32 + 4y \quad \text{Simplifying}$$

$$11y - 4y = 32 + 4y - 4y \quad \text{Subtract } 4y \text{ from both sides}$$

$$7y = 32 \quad \text{Simplifying}$$

$$\frac{7y}{7} = \frac{32}{7} \quad \text{Divide both sides by 7}$$

$$y = \frac{32}{7} \quad \text{Simplifying}$$

Check:

$$\begin{array}{r|l} \frac{5}{16}y + \frac{3}{8}y = 2 + \frac{1}{4}y & \\ \frac{5}{16}\left(\frac{32}{7}\right) + \frac{3}{8}\left(\frac{32}{7}\right) & 2 + \frac{1}{4}\left(\frac{32}{7}\right) \\ \frac{10}{7} + \frac{12}{7} & \frac{14}{7} + \frac{8}{7} \\ \frac{22}{7} & \frac{22}{7} \quad \text{TRUE} \end{array}$$

The solution is  $\frac{32}{7}$ .

77.  $\frac{1}{3}(2x-1) = 7$

The number 3 is the least common denominator, so we multiply by 3 on both sides.

$$3\left[\frac{1}{3}(2x-1)\right] = 3 \cdot 7$$

$$2x - 1 = 21$$

$$2x - 1 + 1 = 21 + 1 \quad \text{Add 1 to both sides}$$

$$2x = 22 \quad \text{Simplifying}$$

$$\frac{2x}{2} = \frac{22}{2} \quad \text{Divide both sides by 2}$$

$$x = 11 \quad \text{Simplifying}$$

Check:

$$\begin{array}{r|l} \frac{1}{3}(2x-1) = 7 & \\ \frac{1}{3}(2 \cdot 11 - 1) & 7 \\ \frac{1}{3}(22 - 1) & 7 \\ \frac{1}{3}(21) & 7 \\ 7 & 7 \quad \text{TRUE} \end{array}$$

The solution is 11.

78.  $\frac{4}{3}(5x+1) = 8$

$$\frac{3}{4}\left[\frac{4}{3}(5x+1)\right] = \frac{3}{4} \cdot 8 \quad \text{Multiply both sides by } \frac{3}{4}$$

$$5x + 1 = 6 \quad \text{Simplifying}$$

$$5x + 1 - 1 = 6 - 1 \quad \text{Subtract 1 from both sides}$$

$$5x = 5 \quad \text{Simplifying}$$

$$\frac{5x}{5} = \frac{5}{5} \quad \text{Divide both sides by 5}$$

$$x = 1 \quad \text{Simplifying}$$

Check:

$$\begin{array}{r|l} \frac{4}{3}(5x+1) = 8 & \\ \frac{4}{3}(5 \cdot 1 + 1) & 8 \\ \frac{4}{3}(5 + 1) & 8 \\ \frac{4}{3}(6) & 8 \\ 8 & 8 \quad \text{TRUE} \end{array}$$

The solution is 1.

79.  $\frac{3}{4}(3t-6) = 9$

$$\frac{4}{3}\left[\frac{3}{4}(3t-6)\right] = \frac{4}{3}(9) \quad \text{Multiply both sides by } \frac{4}{3}$$

$$3t - 6 = 12 \quad \text{Simplifying}$$

$$3t - 6 + 6 = 12 + 6 \quad \text{Add 6 to both sides}$$

$$3t = 18 \quad \text{Simplifying}$$

$$\frac{3t}{3} = \frac{18}{3} \quad \text{Divide both sides by 3}$$

$$t = 6 \quad \text{Simplifying}$$

Check:

$$\begin{array}{r|l} \frac{3}{4}(3t-6) = 9 & \\ \frac{3}{4}(3 \cdot 6 - 6) & 9 \\ \frac{3}{4}(18 - 6) & 9 \\ \frac{3}{4}(12) & 9 \\ 9 & 9 \quad \text{TRUE} \end{array}$$

The solution is 6.

$$80. \quad \frac{3}{2}(2x+5) = -\frac{15}{2}$$

$$\frac{2}{3}\left[\frac{3}{2}(2x+5)\right] = \frac{2}{3}\left(-\frac{15}{2}\right) \quad \text{Multiply both sides by } \frac{2}{3}$$

$$2x+5 = -5 \quad \text{Simplifying}$$

$$2x+5-5 = -5-5 \quad \text{Subtract 5 from both sides}$$

$$2x = -10 \quad \text{Simplifying}$$

$$\frac{2x}{2} = \frac{-10}{2} \quad \text{Divide both sides by 2}$$

$$x = -5 \quad \text{Simplifying}$$

Check:

$$\frac{3}{2}(2x+5) = -\frac{15}{2}$$

$$\frac{3}{2}[2(-5)+5] \quad \left| \quad -\frac{15}{2} \right.$$

$$\frac{3}{2}(-10+5) \quad \left| \quad -\frac{15}{2} \right.$$

$$\frac{3}{2}(-5) \quad \left| \quad -\frac{15}{2} \right.$$

$$-\frac{15}{2} \quad \left| \quad -\frac{15}{2} \right. \quad \text{TRUE}$$

The solution is  $-5$ .

$$81. \quad \frac{1}{6}\left(\frac{3}{4}x-2\right) = -\frac{1}{5}$$

$$30\left[\frac{1}{6}\left(\frac{3}{4}x-2\right)\right] = 30\left(-\frac{1}{5}\right) \quad \text{Multiply both sides by 30}$$

$$5\left(\frac{3}{4}x-2\right) = -6 \quad \text{Simplifying}$$

$$\frac{15}{4}x-10 = -6 \quad \text{Distributive Law}$$

$$\frac{15}{4}x-10+10 = -6+10 \quad \text{Add 10 to both sides}$$

$$\frac{15}{4}x = 4 \quad \text{Simplifying}$$

$$\left(\frac{4}{15}\right)\left(\frac{15}{4}\right)x = \left(\frac{4}{15}\right)(4) \quad \text{Multiply both sides by } \frac{4}{15}$$

$$x = \frac{16}{15} \quad \text{Simplifying}$$

Check:

$$\frac{1}{6}\left(\frac{3}{4}x-2\right) = -\frac{1}{5}$$

$$\frac{1}{6}\left[\frac{3}{4}\left(\frac{16}{15}\right)-2\right] \quad \left| \quad -\frac{1}{5} \right.$$

$$\frac{1}{6}\left(\frac{4}{5}-2\right) \quad \left| \quad -\frac{1}{5} \right.$$

$$\frac{1}{6}\left(\frac{4}{5}-\frac{10}{5}\right) \quad \left| \quad -\frac{1}{5} \right.$$

$$\frac{1}{6}\left(-\frac{6}{5}\right) \quad \left| \quad -\frac{1}{5} \right.$$

$$-\frac{1}{5} \quad \left| \quad -\frac{1}{5} \right. \quad \text{TRUE}$$

The solution is  $\frac{16}{15}$ .

$$82. \quad \frac{2}{3}\left(\frac{7}{8}-4x\right) - \frac{5}{8} = \frac{3}{8}$$

$$24\left[\frac{2}{3}\left(\frac{7}{8}-4x\right) - \frac{5}{8}\right] = 24\left(\frac{3}{8}\right) \quad \text{Multiply both sides by 24}$$

$$16\left(\frac{7}{8}-4x\right) - 15 = 9 \quad \text{Simplifying and}$$

$$14-64x-15 = 9 \quad \text{Distributive Law}$$

$$-64x-1 = 9 \quad \text{Simplifying}$$

$$-64x-1+1 = 9+1 \quad \text{Add 1 to both sides}$$

$$-64x = 10 \quad \text{Simplifying}$$

$$\frac{-64x}{-64} = \frac{10}{-64} \quad \text{Divide both sides by } -64$$

$$x = -\frac{5}{32} \quad \text{Simplifying}$$

Check:

$$\frac{2}{3}\left(\frac{7}{8}-4x\right) - \frac{5}{8} = \frac{3}{8}$$

$$\frac{2}{3}\left[\frac{7}{8}-4\left(-\frac{5}{32}\right)\right] - \frac{5}{8} \quad \left| \quad \frac{3}{8} \right.$$

$$\frac{2}{3}\left[\frac{7}{8}+\frac{5}{8}\right] - \frac{5}{8} \quad \left| \quad \frac{3}{8} \right.$$

$$\frac{2}{3}\left[\frac{12}{8}\right] - \frac{5}{8} \quad \left| \quad \frac{3}{8} \right.$$

$$\frac{8}{8} - \frac{5}{8} \quad \left| \quad \frac{3}{8} \right.$$

$$\frac{3}{8} \quad \left| \quad \frac{3}{8} \right. \quad \text{TRUE}$$

The solution is  $-\frac{5}{32}$ .

$$83. \quad 0.7(3x+6) = 1.1-(x+2)$$

We can clear decimals by multiplying both sides by 10.

$$10[0.7(3x+6)] = 10[1.1-(x+2)]$$

$$7(3x+6) = 11-10(x+2)$$

$$21x+42 = 11-10x-20 \quad \text{Distributive Law}$$

$$21x+42 = -10x-9 \quad \text{Simplifying}$$

$$21x+42+10x = \quad \text{Adding } 10x \text{ to both sides}$$

$$-10x-9+10x$$

$$31x+42 = -9 \quad \text{Simplifying}$$

$$31x+42-42 = -9-42 \quad \text{Subtracting 42 from both sides}$$

$$31x = -51 \quad \text{Simplifying}$$

$$\frac{31x}{31} = \frac{-51}{31} \quad \text{Dividing both sides by 31}$$

$$x = -\frac{51}{31} \quad \text{Simplifying}$$

Check:

$$0.7(3x+6) = 1.1 - (x+2)$$

$\frac{7}{10} \left[ 3 \left( -\frac{51}{31} \right) + 6 \right]$	$\frac{11}{10} - \left( -\frac{51}{31} + 2 \right)$
$\frac{7}{10} \left( -\frac{153}{31} + \frac{186}{31} \right)$	$\frac{11}{10} - \left( -\frac{51}{31} + \frac{62}{31} \right)$
$\frac{7}{10} \left( \frac{33}{31} \right)$	$\frac{11}{10} - \left( \frac{11}{31} \right)$
$\frac{231}{310}$	$\frac{341}{310} - \frac{110}{310}$
$\frac{231}{110}$	$\frac{231}{110}$ TRUE

The solution is  $-\frac{51}{31}$ .

84.  $0.9(2x+8) = 20 - (x+5)$

We can clear decimals by multiplying both sides by 10.

$$10[0.9(2x+8)] = 10[20 - (x+5)]$$

$$9(2x+8) = 200 - 10(x+5)$$

$$18x + 72 = 200 - 10x - 50 \quad \text{Distributive Law}$$

$$18x + 72 = 150 - 10x \quad \text{Simplifying}$$

$$18x + 72 + 10x = 150 - 10x + 10x \quad \text{Adding } 10x \text{ to both sides}$$

$$28x + 72 = 150 \quad \text{Simplifying}$$

$$28x + 72 - 72 = 150 - 72 \quad \text{Subtracting } 72 \text{ from both sides}$$

$$28x = 78 \quad \text{Simplifying}$$

$$\frac{28x}{28} = \frac{78}{28} \quad \text{Dividing both sides by } 28$$

$$x = \frac{39}{14} \quad \text{Simplifying}$$

Check:

$$0.9(2x+8) = 20 - (x+5)$$

$\frac{9}{10} \left[ 2 \left( \frac{39}{14} \right) + 8 \right]$	$20 - \left( \frac{39}{14} + 5 \right)$
$\frac{9}{10} \left( \frac{39}{7} + \frac{56}{7} \right)$	$20 - \left( \frac{39}{14} + \frac{70}{14} \right)$
$\frac{9}{10} \left( \frac{95}{7} \right)$	$\frac{280}{14} - \frac{109}{14}$
$\frac{171}{14}$	$\frac{171}{14}$ TRUE

The solution is  $\frac{39}{14}$ .

85.  $a + (a-3) = (a+2) - (a+1)$

$$a + a - 3 = a + 2 - a - 1 \quad \text{Simplifying Distributive Law}$$

$$2a - 3 = 1 \quad \text{Simplifying}$$

$$2a - 3 + 3 = 1 + 3 \quad \text{Adding } 3 \text{ to both sides}$$

$$2a = 4 \quad \text{Simplifying}$$

$$\frac{2a}{2} = \frac{4}{2} \quad \text{Dividing both sides by } 2$$

$$a = 2 \quad \text{Simplifying}$$

Check:

$$a + (a-3) = (a+2) - (a+1)$$

$2 + (2-3)$	$(2+2) - (2+1)$
$2 + (-1)$	$4 - 3$
$1$	$1$ TRUE

The solution is 2.

86.  $0.8 - 4(b-1) = 0.2 + 3(4-b)$

We can clear decimals by multiplying both sides by 10.

$$10[0.8 - 4(b-1)] = 10[0.2 + 3(4-b)]$$

$$8 - 40(b-1) = 2 + 30(4-b)$$

$$8 - 40b + 40 = 2 + 120 - 30b \quad \text{Distributive Law}$$

$$-40b + 48 = 122 - 30b \quad \text{Simplifying}$$

$$-40b + 48 + 30b = 122 - 30b + 30b \quad \text{Add } 30b \text{ to both sides}$$

$$-10b + 48 = 122 \quad \text{Simplifying}$$

$$-10b + 48 - 48 = 122 - 48 \quad \text{Subtract } 48 \text{ from both sides}$$

$$-10b = 74 \quad \text{Simplifying}$$

$$\frac{-10b}{-10} = \frac{74}{-10} \quad \text{Dividing both sides by } -10$$

$$b = -7.4$$

Check:

$$0.8 - 4(b-1) = 0.2 + 3(4-b)$$

$0.8 - 4(-7.4 - 1)$	$0.2 + 3(4 - (-7.4))$
$0.8 - 4(-8.4)$	$0.2 + 3(4 + 7.4)$
$0.8 + 33.6$	$0.2 + 3(11.4)$
$34.4$	$0.2 + 34.2$
$34.4$	$34.4$ TRUE

The solution is  $-7.4$ .

87. *Thinking and Writing Exercise.* No; although it might be easier to use the addition and multiplication principles when an equation does not contain decimals, it is possible to use these principles when an equation does contain decimals.

88. *Thinking and Writing Exercise.* Since the rules for order of operations tell us to multiply (and divide) before we add (and subtract), we “undo” multiplication and additions in opposite order when we solve equations. That is, we add or subtract first and then multiply or divide to isolate the variable.

89.  $3 - 5a$   
We substitute 2 for  $a$  and evaluate.  
 $3 - 5a = 3 - 5 \cdot 2$   
 $= 3 - 10$   
 $= -7$

90.  $12 \div 4 \cdot t$   
We substitute 5 for  $t$  and evaluate.  
 $12 \div 4 \cdot t = 12 \div 4 \cdot 5$   
 $= 3 \cdot 5$   
 $= 15$

95.  $8.43x - 2.5(3.2 - 0.7x) = -3.455x + 9.04$   
We can clear decimals by multiplying both sides by 1000.

$$1000[8.43 - 2.5(3.2 - 0.7x)] = 1000[-3.455x + 9.04]$$

$$8430x - 2500(3.2 - 0.7x) = -3455x + 9040$$

$$8430x - 8000 + 1750x = -3455x + 9040$$

$$10,180x - 8000 = -3455x + 9040$$

$$10,180x - 8000 + 3455x = -3455x + 9040 + 3455x$$

$$13,635x - 8000 = 9040$$

$$13,635x - 8000 + 8000 = 9040 + 8000$$

$$13,635x = 17,040$$

$$\frac{13,635x}{13,635} = \frac{17,040}{13,635}$$

$$x = \frac{1136}{909}$$

The solution is  $\frac{1136}{909}$ , or 1.2497.

91.  $7x - 2x$   
We substitute  $-3$  for  $x$  and evaluate.  
 $7x - 2x = 7(-3) - 2(-3)$   
 $= -21 + 6$   
 $= -15$

92.  $t(8 - 3t)$   
We substitute  $-2$  for  $t$  and evaluate.  
 $t(8 - 3t) = -2[8 - 3(-2)]$   
 $= -2(8 + 6)$   
 $= -2(14)$   
 $= -28$

93. *Thinking and Writing Exercise.* Multiply by 100 to clear decimals. Next multiply by 12 to clear fractions. (These steps could be reversed.) Then proceed as usual. The procedure could be streamlined by multiplying by 1200 to clear decimals and fractions in one step.

94. *Thinking and Writing Exercise.* Joseph should first use the addition principle to eliminate the 4 on the left side of the equation. Then he could use the multiplication principle to eliminate the 3.

Distributive Law

Simplifying

Adding  $3455x$  to both sides

Simplifying

Adding 8000 to both sides

Simplifying

Dividing both sides by 13,635

Simplifying

96.  $0.008 + 9.62x - 42.8 = 0.944x + 0.0083 - x$

We can clear decimals by multiplying both sides by 10,000.

$$10,000[0.008 + 9.62x - 42.8] = 10,000[0.944x + 0.0083 - x]$$

$$80 + 96,200x - 428,000 = 9440x + 83 - 10,000x$$

$$96,200x - 427,920 = -560x + 83$$

Simplifying

$$96,200x - 427,920 + 560x = -560x + 83 + 560x$$

Adding  $560x$  to both sides

$$96,760x - 427,920 = 83$$

Simplifying

$$96,760x - 427,920 + 427,920 = 83 + 427,920$$

Adding 427,920 to both sides

$$96,760x = 428,003$$

Simplifying

$$\frac{96,760x}{96,760} = \frac{428,003}{96,760}$$

Dividing both sides by 96,760

$$x \approx 4.423346424$$

Simplifying

The solution is  $\frac{428,003}{96,760}$ , or approximately 4.423346424.

97.  $-2[3(x-2)+4] = 4(5-x) - 2x$

$$-2[3x - 6 + 4] = 20 - 4x - 2x \quad \text{Distributive Law}$$

$$-6x + 12 - 8 = 20 - 4x - 2x \quad \text{Distributive Law}$$

$$-6x + 4 = 20 - 6x \quad \text{Simplifying}$$

$$-6x + 4 + 6x = 20 - 6x + 6x \quad \text{Add } 6x \text{ to both sides}$$

$$4 = 20 \quad \text{Simplifying}$$

This is a false statement. The equation is a contradiction and has no solution.

98.  $0 = y - (-14) - (-3y)$

$$0 = y + 14 + 3y$$

$$0 = 4y + 14$$

$$-14 = 4y$$

$$-\frac{7}{2} = y$$

The solution is  $-\frac{7}{2}$ .

99.  $2x(x+5) - 3(x^2 + 2x - 1) = 9 - 5x - x^2$

$$2x^2 + 10x - 3x^2 - 6x + 3 = 9 - 5x - x^2$$

$$-x^2 + 4x + 3 = 9 - 5x - x^2$$

$$9x = 6$$

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

The solution is  $\frac{2}{3}$ .

100.

$$x(x-4) = 3x(x+1) - 2(x^2 + x - 5)$$

$$x^2 - 4x = 3x^2 + 3x - 2x^2 - 2x + 10$$

$$0 = -x^2 + 4x + 3x^2 + 3x - 2x^2 - 2x + 10$$

$$0 = 5x + 10$$

$$-10 = 5x$$

$$-2 = x$$

The solution is  $-2$ .

101.  $9 - 3x = 2(5 - 2x) - (1 - 5x)$

$$9 - 3x = 10 - 4x - 1 + 5x$$

$$0 = -9 + 3x + 10 - 4x - 1 + 5x$$

$$0 = 4x$$

$$0 = x$$

The solution is 0.

102.  $[7 - 2(8 \div (-2))]x = 0$

$$[7 - 2(-4)]x = 0$$

$$(7 + 8)x = 0$$

$$15x = 0$$

The solution is 0.

$$103. \quad \frac{x}{14} - \frac{5x+2}{49} = \frac{3x-4}{7}$$

$$98\left(\frac{x}{14} - \frac{5x+2}{49}\right) = 98\left(\frac{3x-4}{7}\right)$$

$$7x - 10x - 4 = 14(3x - 4)$$

$$7x - 10x - 4 = 42x - 56$$

$$-3x - 4 = 42x - 56$$

$$-4 + 56 = 42x + 3x$$

$$52 = 45x$$

$$\frac{52}{45} = x$$

The solution is  $\frac{52}{45}$ .

$$104. \quad \frac{5x+3}{4} + \frac{25}{12} = \frac{5+2x}{3}$$

$$12\left(\frac{5x+3}{4} + \frac{25}{12}\right) = 12\left(\frac{5+2x}{3}\right)$$

$$15x + 9 + 25 = 20 + 8x$$

$$15x + 34 = 20 + 8x$$

$$15x - 8x = 20 - 34$$

$$7x = -14$$

$$x = -2$$

The solution is  $-2$ .

$$105. \quad 2\{9 - 3[-2x - 4]\} = 12x + 42$$

$$2\{9 + 6x + 12\} = 12x + 42$$

$$2\{21 + 6x\} = 12x + 42$$

$$42 + 12x = 12x + 42$$

$$42 = 42$$

Since this equation is true for all real numbers, this equation is an identity.

$$106. \quad -9t + 2 = 2 - 9t - 5(8 \div 4(1 + 3^4))$$

$$-9t + 2 = 2 - 9t - 5(8 \div 4(1 + 81))$$

$$-9t + 2 = 2 - 9t - 5(8 \div 4 \cdot (82))$$

$$-9t + 2 = 2 - 9t - 5(2(82))$$

$$-9t + 2 = 2 - 9t - 820$$

$$-9t + 2 = -9t - 818$$

$$2 = -818$$

This is a false statement. The equation is a contradiction and has no solution.

$$107. \quad 3|x| - 2 = 10$$

$$3|x| = 12$$

$$|x| = 4$$

$$x = \pm 4$$

The solution is  $-4$  and  $4$ .

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 Exercise Set 2.3
 

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1. We substitute 21,345 for  $n$  and calculate  $f$ .

$$f = \frac{n}{15} = \frac{21,345}{15} = 1423$$

The number of students is 1423.

2. We substitute 10 for  $t$  and calculate  $M$ .

$$M = \frac{1}{5}t = \frac{1}{5} \cdot 10 = 2$$

The storm is 2 miles away.

3. We substitute 30 for  $I$  and 115 for  $V$  and calculate  $P$ .

$$P = I \cdot V = 30 \cdot 115 = 3450$$

The power consumed is 3450 watts.

4. We substitute 344 for  $r$  and 24 for  $f$ .

$$w = \frac{r}{f} = \frac{344}{24} = \frac{43}{3}$$

The wavelength is  $\frac{43}{3}$  m/cycle, or  $14.\bar{3}$  m/cycle.

5. We substitute 0.025 for  $I$  and 0.044 for  $U$  and solve for  $f$ .

$$f = 8.5 + 1.4(I - U)$$

$$= 8.5 + 1.4(0.025 - 0.044)$$

$$= 8.5 + 1.4(-0.019)$$

$$= 8.5 - 0.0266$$

$$= 8.4734$$

The federal funds rate should be 8.4734.

6. We substitute 84 for  $c$  and 8 for  $w$  and solve for  $D$ .

$$D = \frac{c}{w} = \frac{84}{8} = 10.5$$

The calorie density is 10.5 cal/oz.

7. We substitute 1 for  $t$  and solve for  $n$ .  
 $n = 0.5t^4 + 3.45t^3 - 96.65t^2 + 347.7t$   
 $= 0.5(1)^4 + 3.45(1)^3 - 96.65(1)^2 + 347.7(1)$   
 $= 0.5 + 3.45 - 96.65 + 347.7$   
 $= 255$   
 After 1 hour, 255 mg of ibuprofen remains in the bloodstream.
8. We substitute 7 for  $n$  and solve for  $N$ .  
 $N = n^2 - n$   
 $= 7^2 - 7$   
 $= 49 - 7$   
 $= 42$   
 The number of games played is 42.
9.  $A = bh$   
 $\frac{A}{h} = \frac{bh}{h}$      Dividing both sides by  $h$   
 $\frac{A}{h} = b$
10.  $A = bh$   
 $\frac{A}{b} = \frac{bh}{b}$      Dividing both sides by  $b$   
 $\frac{A}{b} = h$
11.  $I = Prt$   
 $\frac{I}{rt} = \frac{Prt}{rt}$      Dividing both sides by  $rt$   
 $\frac{I}{rt} = P$
12.  $I = Prt$   
 $\frac{I}{Pr} = \frac{Prt}{Pr}$      Dividing both sides by  $Pr$   
 $\frac{I}{Pr} = t$
13.  $H = 65 - m$   
 $H + m = 65$      Adding  $m$  to both sides  
 $m = 65 - H$      Subtracting  $H$  from both sides
14.  $d = h - 64$   
 $d + 64 = h$      Adding 64 to both sides
15.  $P = 2l + 2w$   
 $P - 2w = 2l + 2w - 2w$      Subtracting  $2w$  from both sides  
 $P - 2w = 2l$   
 $\frac{P - 2w}{2} = \frac{2l}{2}$      Dividing both sides by 2  
 $\frac{P - 2w}{2} = l$ , or  
 $\frac{P}{2} - w = l$
16.  $P = 2l + 2w$   
 $P - 2l = 2l + 2w - 2l$      Subtracting  $2l$  from both sides  
 $P - 2l = 2w$   
 $\frac{P - 2l}{2} = \frac{2w}{2}$      Dividing both sides by 2  
 $\frac{P - 2l}{2} = w$ , or  
 $\frac{P}{2} - l = w$
17.  $A = \pi r^2$   
 $\frac{A}{r^2} = \frac{\pi r^2}{r^2}$      Divide both sides by  $r^2$   
 $\frac{A}{r^2} = \pi$
18.  $A = \pi r^2$   
 $\frac{A}{\pi} = \frac{\pi r^2}{\pi}$      Divide both sides by  $\pi$   
 $\frac{A}{\pi} = r^2$
19.  $A = \frac{1}{2}bh$   
 $2A = bh$      Multiplying both sides by 2  
 $\frac{2A}{b} = \frac{bh}{b}$      Dividing both sides by  $b$   
 $\frac{2A}{b} = h$

20.  $A = \frac{1}{2}bh$   
 $2A = bh$       Multiplying both sides by 2  
 $\frac{2A}{h} = \frac{bh}{h}$       Dividing both sides by  $h$   
 $\frac{2A}{h} = b$

26.  $p = \frac{r-q}{2}$   
 $2p = r - q$       Multiplying both sides by 2  
 $q = r - 2p$       Subtracting  $2p$  and adding  $q$

21.  $E = mc^2$   
 $\frac{E}{c^2} = \frac{mc^2}{c^2}$       Divide both sides by  $c^2$   
 $\frac{E}{c^2} = m$

27.  $w = \frac{r}{f}$   
 $wf = r$       Multiplying both sides by  $f$

22.  $E = mc^2$   
 $\frac{E}{m} = \frac{mc^2}{m}$       Divide both sides by  $m$   
 $\frac{E}{m} = c^2$

28.  $M = \frac{A}{s}$   
 $M \cdot s = \frac{A}{s} \cdot s$       Multiplying both sides by  $s$   
 $Ms = A$

23.  $Q = \frac{c+d}{2}$   
 $2Q = c + d$       Multiplying both sides by 2  
 $2Q - c = c + d - c$       Subtracting  $c$  from both sides  
 $2Q - c = d$

29.  $H = \frac{TV}{550}$   
 $550H = TV$       Multiplying both sides by 550  
 $\frac{550H}{V} = T$       Dividing both sides by  $V$

30.  $P = \frac{ab}{c}$   
 $P \cdot \frac{c}{a} = \frac{ab}{c} \cdot \frac{c}{a}$       Multiplying both sides by  $\frac{c}{a}$   
 $\frac{Pc}{a} = b$

24.  $A = \frac{a+b+c}{3}$   
 $3A = a + b + c$       Multiplying both sides by 3  
 $3A - a - c = a + b + c - a - c$       Subtracting  $a$  and  $c$  from both sides  
 $3A - a - c = b$

31.  $F = \frac{9}{5}C + 32$   
 $F - 32 = \frac{9}{5}C + 32 - 32$       Subtracting 32 from both sides  
 $F - 32 = \frac{9}{5}C$

25.  $p - q + r = 2$   
 $p - q + r + q = 2 + q$       Adding  $q$  to both sides  
 $p + r - 2 = 2 + q - 2$       Subtracting 2 from both sides  
 $q = p + r - 2$

$\frac{5}{9}(F - 32) = \frac{5}{9}\left(\frac{9}{5}C\right)$       Multiplying both sides by  $\frac{5}{9}$   
 $\frac{5}{9}(F - 32) = C$

$$32. \quad M = \frac{3}{7}n + 29$$

$$M - 29 = \frac{3}{7}n + 29 - 29 \quad \text{Subtracting 29 from both sides}$$

$$M - 29 = \frac{3}{7}n$$

$$\frac{7}{3} \cdot (M - 29) = \frac{7}{3} \cdot \left(\frac{3}{7}n\right) \quad \text{Multiplying both sides by } \frac{7}{3}$$

$$\frac{7}{3}(M - 29) = n$$

$$33. \quad 2x - y = 1$$

$$2x - y + y = 1 + y \quad \text{Adding } y \text{ to both sides}$$

$$2x - 1 = 1 - 1 + y \quad \text{Subtracting 1 from both sides}$$

$$2x - 1 = y$$

$$34. \quad 3x - y = 7$$

$$3x - y + y = 7 + y \quad \text{Adding } y \text{ to both sides}$$

$$3x - 7 = 7 - 7 + y \quad \text{Subtracting 7 from both sides}$$

$$3x - 7 = y$$

$$35. \quad 2x + 5y = 10$$

$$-2x + 2x + 5y = -2x + 10 \quad \text{Subtracting } 2x \text{ from both sides}$$

$$\frac{5y}{5} = \frac{-2x + 10}{5} \quad \text{Dividing both sides by 5}$$

$$y = -\frac{2}{5}x + 2$$

$$36. \quad 3x + 2y = 12$$

$$-3x + 3x + 2y = -3x + 12 \quad \text{Subtracting } 3x \text{ from both sides}$$

$$\frac{2y}{2} = \frac{-3x + 12}{2} \quad \text{Dividing both sides by 2}$$

$$y = -\frac{3}{2}x + 6$$

$$37. \quad 4x - 3y = 6$$

$$-4x + 4x - 3y = -4x + 6 \quad \text{Subtracting } 4x \text{ from both sides}$$

$$\frac{-3y}{-3} = \frac{-4x + 6}{-3} \quad \text{Dividing both sides by } -3$$

$$y = \frac{4}{3}x - 2$$

$$38. \quad 5x - 4y = 8$$

$$-5x + 5x - 4y = -5x + 8 \quad \text{Subtracting } 5x \text{ from both sides}$$

$$\frac{-4y}{-4} = \frac{-5x + 8}{-4} \quad \text{Dividing both sides by } -4$$

$$y = \frac{5}{4}x - 2$$

$$39. \quad 9x + 8y = 4$$

$$-9x + 9x + 8y = -9x + 4 \quad \text{Subtracting } 9x \text{ from both sides}$$

$$\frac{8y}{8} = \frac{-9x + 4}{8} \quad \text{Dividing both sides by 8}$$

$$y = -\frac{9}{8}x + \frac{1}{2}$$

$$40. \quad x + 10y = 2$$

$$-x + x + 10y = -x + 2 \quad \text{Subtracting } x \text{ from both sides}$$

$$\frac{10y}{10} = \frac{-x + 2}{10} \quad \text{Dividing both sides by 10}$$

$$y = -\frac{1}{10}x + \frac{1}{5}$$

$$41. \quad 3x - 5y = 8$$

$$-3x + 3x - 5y = -3x + 8 \quad \text{Subtracting } 3x \text{ from both sides}$$

$$\frac{-5y}{-5} = \frac{-3x + 8}{-5} \quad \text{Dividing both sides by } -5$$

$$y = \frac{3}{5}x - \frac{8}{5}$$

42.  $7x - 6y = 7$   
 $-7x + 7x - 6y = -7x + 7$  Subtracting  $7x$   
 from both sides  
 $\frac{-6y}{-6} = \frac{-7x+7}{-6}$  Dividing both  
 sides by  $-6$   
 $y = \frac{7}{6}x - \frac{7}{6}$

43.  $A = at + bt$   
 $A = (a + b)t$  Factoring  
 $\frac{A}{a+b} = \frac{(a+b)t}{a+b}$  Dividing both sides  
 by  $a + b$   
 $\frac{A}{a+b} = t$

44.  $S = rx + sx$   
 $S = (r + s)x$  Factoring  
 $\frac{S}{r+s} = \frac{(r+s)x}{r+s}$  Dividing both sides  
 by  $r + s$   
 $\frac{S}{r+s} = x$

45.  $A = \frac{1}{2}ah + \frac{1}{2}bh$   
 $2A = 2(\frac{1}{2}ah + \frac{1}{2}bh)$  Multiplying both  
 sides by 2  
 $2A = ah + bh$   
 $2A = (a + b)h$  Factoring  
 $\frac{2A}{a+b} = \frac{(a+b)h}{a+b}$  Dividing both  
 sides by  $a + b$   
 $\frac{2A}{a+b} = h$

46.  $A = P + Prt$   
 $A = P(1 + rt)$  Factoring  
 $\frac{A}{1+rt} = \frac{P(1+rt)}{1+rt}$  Dividing both  
 sides by  $1 + rt$   
 $\frac{A}{1+rt} = P$

47.  $z = 13 + 2(x + y)$   
 $z = 13 + 2x + 2y$  Distributive law  
 $z - 13 = 2x + 2y$  Subtracting both sides  
 by 13  
 $z - 13 - 2y = 2x$  Subtracting both sides  
 by  $2y$   
 $\frac{z-13-2y}{2} = \frac{2x}{2}$  Dividing both sides by 2  
 $\frac{z-13}{2} - y = x$

48.  $A = 115 + \frac{1}{2}(p + s)$   
 $A = 115 + \frac{1}{2}p + \frac{1}{2}s$  Distributive law  
 $A - 115 = \frac{1}{2}p + \frac{1}{2}s$  Subtracting both sides  
 by 115  
 $A - 115 - \frac{1}{2}p = \frac{1}{2}s$  Subtracting both sides  
 by  $\frac{1}{2}p$   
 $2(A - 115) - p = s$  Multiplying both sides  
 by 2

49.  $t = 27 - \frac{1}{4}(w - l)$   
 $t = 27 - \frac{1}{4}w + \frac{1}{4}l$  Distributive law  
 $t - 27 = -\frac{1}{4}w + \frac{1}{4}l$  Subtracting both sides  
 by 27  
 $t - 27 + \frac{1}{4}w = \frac{1}{4}l$  Adding  $-\frac{1}{4}w$   
 to both sides  
 $4(t - 27) + w = l$  Multiplying both sides  
 by 4

50.  $m = 19 - 5(x - n)$   
 $m = 19 - 5x + 5n$  Distributive law  
 $m - 19 = -5x + 5n$  Subtracting both sides  
 by 19  
 $m - 19 + 5x = 5n$  Adding  $5x$  to both sides  
 $\frac{m-19}{5} + x = n$  Dividing both sides  
 by 5

$$51. \quad R = r + \frac{400(W - L)}{N}$$

$$R - r = r + \frac{400(W - L)}{N} - r \quad \text{Subtract } r \text{ from both sides}$$

$$R - r = \frac{400(W - L)}{N}$$

$$N(R - r) = N \left[ \frac{400(W - L)}{N} \right] \quad \text{Multiplying both sides by } N$$

$$NR - Nr = 400(W - L)$$

$$NR - Nr = 400W - 400L \quad \text{Distributive Law}$$

$$NR - Nr - 400W = 400W - 400L - 400W \quad \text{Subtracting } 400W \text{ from both sides}$$

$$NR - Nr - 400W = -400L$$

$$\frac{NR - Nr - 400W}{-400} = \frac{-400L}{-400} \quad \text{Dividing both sides by } -400$$

$$\frac{N(R - r)}{-400} + W = L, \text{ or}$$

$$W - \frac{N(R - r)}{400} = L, \text{ or}$$

$$\frac{400W - NR + Nr}{400} = L$$

$$52. \quad S = \frac{360A}{\pi r^2}$$

$$(\pi r^2)S = (\pi r^2) \left( \frac{360A}{\pi r^2} \right) \quad \text{Multiplying both sides by } \pi r^2$$

$$\pi r^2 S = 360A$$

$$\frac{\pi r^2 S}{\pi S} = \frac{360A}{\pi S} \quad \text{Dividing both sides by } \pi S$$

$$r^2 = \frac{360A}{\pi S}$$

53. *Thinking and Writing Exercise.* Given the formula for converting Celsius temperature  $C$  to Fahrenheit  $F$ , solve for  $C$ . This yields a formula for converting Fahrenheit temperature to Celsius temperature.

54. *Thinking and Writing Exercise.* Answers may vary. When you are given a time  $t$  and interest rate  $r$  and want to find how much principal  $P$  you need to invest (or deposit) to obtain a given dollar amount of interest  $I$ .

$$55. \quad -2 + 5 - (-4) - 17$$

$$= 3 - (-4) - 17$$

$$= 7 - 17$$

$$= -10$$

$$56. \quad -98 \div \frac{1}{2} = -98 \cdot \frac{2}{1} = -196$$

$$57. \quad 4.2(-11.75)(0) = -49.35(0) = 0$$

$$58. \quad (-2)^5 = (-2)(-2)(-2)(-2)(-2) = -32$$

$$59. \quad 20 \div (-4) \cdot 2 - 3 = -5 \cdot 2 - 3$$

$$= -10 - 3$$

$$= -13$$

$$60. \quad 5|8 - (2 - 7)| = 5|8 - (-5)|$$

$$= 5|8 + 5|$$

$$= 5|13|$$

$$= 5 \cdot 13$$

$$= 65$$

61. *Thinking and Writing Exercise.* Answers may vary. A decorator wants to have a carpet cut for a bedroom. The perimeter of the room is 54 ft and its length is 15 ft. How wide should the carpet be?

62. *Thinking and Writing Exercise.* The expression on the left,  $\frac{2A - ah}{b}$  still has a

term containing  $h$ . Dee should have factored out the  $h$  to begin with. That is

$$2A = ah + bh$$

$$2A = (a + b)h.$$

Finally, Dee should divide both sides by

$$a + b:$$

$$\frac{2A}{a + b} = \frac{(a + b)h}{a + b}$$

$$\frac{2A}{a + b} = h$$

63. We substitute 80 for  $w$ , 190 for  $h$ , and 2852 for  $K$  and solve for  $a$ .

$$K = 21.235w + 7.75h - 10.54a + 102.3$$

$$2852 = 21.235(80) + 7.75(190) - 10.54a + 102.3$$

$$2852 = 1698.8 + 1472.5 - 10.54a + 102.3$$

$$2852 = 3273.6 - 10.54a$$

$$2852 - 3273.6 = 3273.6 - 10.54a - 3273.6$$

$$-421.6 = -10.54a$$

$$40 = a$$

Janos is 40 years old.

64. To find the number of 100 meter rises in  $h$  meters we divide:  $\frac{h}{100}$ . Then

$$T = t - \frac{h}{100}$$

Note that  $12 \text{ km} = 12 \text{ km} \cdot \frac{1000 \text{ m}}{1 \text{ km}} = 12,000$

m. Thus, we have  $T = t - \frac{h}{100}$  °C, where

$$0 \leq h \leq 12,000$$

65. We substitute 54 for  $A$  and solve for  $s$ .

$$A = 6s^2$$

$$54 = 6s^2$$

$$\frac{54}{6} = \frac{6s^2}{6}$$

$$9 = s^2$$

So,  $s = -3$  and  $s = 3$ . Since length cannot be negative, we disregard  $-3$ .

The volume of a cube is given by  $V = s^3$ , so we substitute 3 for  $s$  and solve for  $V$ .

$$V = s^3$$

$$= 3^3$$

$$= 27$$

The volume of the cube is  $27 \text{ in}^3$ .

66.  $c = \frac{w}{a} \cdot d$

$$c = \frac{wd}{a} \quad \text{Rewriting}$$

$$a \cdot c = a \left( \frac{wd}{a} \right) \quad \text{Multiplying both sides by } a$$

$$ac = wd$$

$$\frac{ac}{c} = \frac{wd}{c} \quad \text{Dividing both sides by } c$$

$$a = \frac{w}{c} \cdot d$$

67.  $\frac{y}{z} \div \frac{z}{t} = 1$

$$\frac{y}{z} \times \frac{t}{z} = 1 \quad \text{Rewriting}$$

$$\frac{yt}{z^2} = 1$$

$$z^2 \left( \frac{yt}{z^2} \right) = z^2 \cdot 1 \quad \text{Multiplying both sides by } z^2$$

$$yt = z^2$$

$$\frac{yt}{t} = \frac{z^2}{t} \quad \text{Dividing both sides by } t$$

$$y = \frac{z^2}{t}$$

68.  $ac = bc + d$

$$ac - bc = bc + d - bc \quad \text{Subtract } bc \text{ from both sides}$$

$$(a - b)c = d \quad \text{Factoring}$$

$$\frac{(a - b)c}{a - b} = \frac{d}{a - b} \quad \text{Dividing both sides by } a - b$$

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

69.  $qt = r(s + t)$

$$qt = rs + rt$$

$$qt - rt = rs + rt - rt \quad \text{Subtracting } rt \text{ from both sides}$$

$$(q - r)t = rs$$

$$\frac{(q - r)t}{q - r} = \frac{rs}{q - r} \quad \text{Dividing both sides by } q - r$$

$$t = \frac{rs}{q - r}$$

70.  $3a = c - a(b + d)$

$3a = c - ab - ad$       Distributive law

$3a + ab + ad = c - ab - ad + ab + ad$   
Adding  $ab$  and  $ad$  to both sides

$(3 + b + d)a = c$       Factoring

$\frac{3 + b + d}{3 + b + d}a = \frac{c}{3 + b + d}$       Dividing both sides by  $3 + b + d$

$a = \frac{c}{3 + b + d}$

71. We subtract the minimum output for a well-insulated house with
- $a$
- square feet from the minimum output for a poorly-insulated house with
- $a$
- square feet. Let
- $S$
- represent the number of Btu's saved.

$S = 50a - 30a = 20a$

72. To solve, divide the coefficients for weight and height by the conversion factors for pounds and inches:

$K = 21.235w + 7.75h - 10.54a + 102.3$

$K = \frac{21.235}{2.2046}w + \frac{7.75}{0.3937}h - 10.54a + 102.3$

$K = 9.6321w + 19.6850h - 10.54a + 102.3$

2.  $2 - x = -1$

$2 - 2 - x = -1 - 2$

$-x = -3$

$-1 \cdot (-x) = -1 \cdot (-3)$

$x = 3$

3.  $3t = 5$

$\frac{3}{3}t = \frac{5}{3}$

$t = \frac{5}{3}$

4.  $-\frac{3}{2}x = 12$

$\left(-\frac{2}{3}\right) \cdot -\frac{3}{2}x = \left(-\frac{2}{3}\right)12$

$x = -8$

5.  $\frac{y}{8} = 6$

$\left(\frac{8}{1}\right) \cdot \frac{y}{8} = \left(\frac{8}{1}\right) \cdot 6$

$y = 48$

6.  $0.06x = 0.03$

$\frac{0.06x}{0.06} = \frac{0.03}{0.06}$

$x = \frac{1}{2}$  or 0.5

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**Mid-Chapter Review**

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**Guided Solutions**

1.  $2x + 3 - 3 = 10 - 3$

$2x = 7$

$\frac{1}{2} \cdot 2x = \frac{1}{2} \cdot 7$

$x = \frac{7}{2}$

2.  $6 \cdot \frac{1}{2}(x - 3) = 6 \cdot \frac{1}{3}(x - 4)$

$3(x - 3) = 2(x - 4)$

$3x - 9 = 2x - 8$

$3x - 9 + 9 = 2x - 8 + 9$

$3x - 2x = 2x + 1 - 2x$

$x = 1$

7.  $3x - 7x = 20$

$-4x = 20$

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

$x = -5$

8.  $9x - 7 = 17$

$9x - 7 + 7 = 17 + 7$

$9x = 24$

$\frac{9x}{9} = \frac{24}{9}$

$x = \frac{8}{3}$

**Mixed Review**

1.  $x - 2 = -1$

$x - 2 + 2 = -1 + 2$

$x = 1$

9.  $4(t-3) - t = 6$   
 $4t - 12 - t = 6$   
 $3t - 12 = 6$   
 $3t - 12 + 12 = 6 + 12$   
 $3t = 18$   
 $\frac{3t}{3} = \frac{18}{3}$   
 $t = 6$
10.  $3(y+5) = 8y$   
 $3y + 15 = 8y$   
 $3y + 15 - 3y = 8y - 3y$   
 $15 = 5y$   
 $\frac{15}{5} = \frac{5y}{5}$   
 $3 = y$
11.  $8n - (3n - 5) = 5 - n$   
 $8n - 3n + 5 = 5 - n$   
 $5n + 5 = 5 - n$   
 $5n + 5 + n = 5 - n + n$   
 $6n + 5 = 5$   
 $6n + 5 - 5 = 5 - 5$   
 $6n = 0$   
 $n = 0$
12.  $\frac{9}{10}y - \frac{7}{10} = \frac{21}{5}$   
 $10\left(\frac{9}{10}y - \frac{7}{10}\right) = 10 \cdot \left(\frac{21}{5}\right)$   
 $9y - 7 = 42$   
 $9y - 7 + 7 = 42 + 7$   
 $9y = 49$   
 $y = \frac{49}{9}$
13.  $2(t-5) - 3(2t-7) = 12 - 5(3t+1)$   
 $2t - 10 - 6t + 21 = 12 - 15t - 5$   
 $-4t + 11 = -15t + 7$   
 $-4t + 11 + 15t = -15t + 7 + 15t$   
 $11t + 11 = 7$   
 $11t + 11 - 11 = 7 - 11$   
 $11t = -4$   
 $t = -\frac{4}{11}$
14.  $\frac{2}{3}(x-2) - 1 = -\frac{1}{2}(x-3)$   
 $6\left(\frac{2}{3}(x-2) - 1\right) = 6\left(-\frac{1}{2}(x-3)\right)$   
 $4(x-2) - 6 = -3(x-3)$   
 $4x - 8 - 6 = -3x + 9$   
 $4x - 14 = -3x + 9$   
 $4x - 14 + 3x = -3x + 9 + 3x$   
 $7x - 14 = 9$   
 $7x - 14 + 14 = 9 + 14$   
 $7x = 23$   
 $x = \frac{23}{7}$
15.  $E = wA$   
 $\frac{E}{w} = \frac{wA}{w}$   
 $\frac{E}{w} = A$
16.  $V = lwh$   
 $\frac{V}{lh} = \frac{lwh}{lh}$   
 $\frac{V}{lh} = w$
17.  $Ax + By = C$   
 $Ax + By - Ax = C - Ax$   
 $By = C - Ax$   
 $\frac{By}{B} = \frac{C - Ax}{B}$   
 $y = \frac{C - Ax}{B}$
18.  $at + ap = m$   
 $a(t + p) = m$   
 $\frac{a(t + p)}{(t + p)} = \frac{m}{(t + p)}$   
 $a = \frac{m}{(t + p)}$

$$19. \quad m = \frac{F}{a}$$

$$m \cdot a = \frac{F}{a} \cdot a$$

$$ma = F$$

$$\frac{ma}{m} = \frac{F}{m}$$

$$a = \frac{F}{m}$$

$$20. \quad v = \frac{d_2 - d_1}{t}$$

$$v \cdot t = \frac{d_2 - d_1}{t} \cdot t$$

$$vt = d_2 - d_1$$

$$vt - d_2 = d_2 - d_1 - d_2$$

$$vt - d_2 = -d_1$$

$$-1(vt - d_2) = -1 \cdot (-d_1)$$

$$d_2 - vt = d_1$$

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 Exercise Set 2.4
 

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1. d

2. c

3. e

4. b

5. c

6. d

7. f

8. a

9. b

10. e

$$11. \quad 67\% = 67 \times 0.01 \quad \text{Replacing \% by } \times 0.01$$

$$= 0.67$$

$$12. \quad 55\% = 55 \times 0.01 \quad \text{Replacing \% by } \times 0.01$$

$$= 0.55$$

$$13. \quad 2\% = 2 \times 0.01 \quad \text{Replacing \% by } \times 0.01$$

$$= 0.02$$

$$14. \quad 7\% = 7 \times 0.01 \quad \text{Replacing \% by } \times 0.01$$

$$= 0.07$$

$$15. \quad 3.5\% = 3.5 \times 0.01 \quad \text{Replacing \% by } \times 0.01$$

$$= 0.035$$

$$16. \quad 41.6\% = 41.6 \times 0.01 \quad \text{Replacing \% by } \times 0.01$$

$$= 0.416$$

$$17. \quad 40\% = 40 \times 0.01 \quad \text{Replacing \% by } \times 0.01$$

$$= 0.40$$

$$18. \quad 20\% = 20 \times 0.01 \quad \text{Replacing \% by } \times 0.01$$

$$= 0.20$$

$$19. \quad 62.58\%$$

$$= 62.58 \times 0.01 \quad \text{Replacing \% by } \times 0.01$$

$$= 0.6258$$

$$20. \quad 39.81\%$$

$$= 39.81 \times 0.01 \quad \text{Replacing \% by } \times 0.01$$

$$= 0.3981$$

$$21. \quad 0.7\%$$

$$= 0.7 \times 0.01 \quad \text{Replacing \% by } \times 0.01$$

$$= 0.007$$

$$22. \quad 0.3\%$$

$$= 0.3 \times 0.01 \quad \text{Replacing \% by } \times 0.01$$

$$= 0.003$$

$$23. \quad 125\%$$

$$= 125 \times 0.01 \quad \text{Replacing \% by } \times 0.01$$

$$= 1.25$$

$$24. \quad 150\%$$

$$= 150 \times 0.01 \quad \text{Replacing \% by } \times 0.01$$

$$= 1.5$$

$$25. \quad 0.13$$

First move the decimal point two places to the right; then write a % symbol:

$$0.13 \rightarrow 13\%$$





51. **Translate.**

What number is 35% of 240?

$$\begin{array}{cccc} \downarrow & \downarrow & \downarrow & \downarrow \\ y & = & 35\% & \cdot & 240 \end{array}$$

We convert to percent notation, then solve the equation.

$$y = 0.35 \cdot 240 \quad (35\% = 0.35)$$

$$y = 84 \quad \text{Multiplying}$$

The answer is 84.

52. **Translate.**

What number is 1% of 1,000,000?

$$\begin{array}{cccc} \downarrow & \downarrow & \downarrow & \downarrow \\ y & = & 1\% & \cdot & 1,000,000 \end{array}$$

We convert to percent notation, then solve the equation.

$$y = 0.01 \cdot 1,000,000 \quad (1\% = 0.01)$$

$$y = 10,000 \quad \text{Multiplying}$$

The answer is 10,000.

53. **Translate.**

What percent of 60 is 75?

$$\begin{array}{cccc} \downarrow & \downarrow & \downarrow & \downarrow \\ y & \cdot & 60 & = & 75 \end{array}$$

We solve the equation and then convert to percent notation.

$$y \cdot 60 = 75$$

$$y = \frac{75}{60}$$

$$y = 1.25 = 125\%$$

The answer is 125%.

54. Any number of 100% of itself, so 70 is 100% of 70. We could also do this exercise as follows:

Solve and convert to percent notation:

$$y \cdot 70 = 70$$

$$y = 1 = 100\%$$

55. **Translate.**

What is 2% of 40?

$$\begin{array}{cccc} \downarrow & \downarrow & \downarrow & \downarrow \\ y & = & 2\% & \cdot & 40 \end{array}$$

We convert to percent notation, then solve the equation.

$$y = 0.02 \cdot 40 \quad (2\% = 0.02)$$

$$y = 0.8 \quad \text{Multiplying}$$

The answer is 0.8.

56. **Translate.**

What is 40% of 2?

$$\begin{array}{cccc} \downarrow & \downarrow & \downarrow & \downarrow \\ y & = & 40\% & \cdot & 2 \end{array}$$

We convert to percent notation, then solve the equation.

$$y = 0.4 \cdot 2 \quad (40\% = 0.4)$$

$$y = 0.8 \quad \text{Multiplying}$$

The answer is 0.8.

57. Observe that 25 is half of 50. Thus, the answer is 0.5, or 50%. We could also do this exercise by translating to an equation.

**Translate.**

25 is what percent of 50?

$$\begin{array}{ccc} \downarrow & \downarrow & \downarrow \\ 25 = & y & \cdot 50 \end{array}$$

We solve the equation and then convert to percent notation.

$$25 = y \cdot 50$$

$$\frac{25}{50} = y$$

$$0.5 = y, \text{ or } 50\% = y$$

The answer is 50%.

58. **Translate.**

8 is 2% of what number?

$$\begin{array}{ccc} \downarrow & \downarrow & \downarrow \\ 8 = 2\% \cdot & y & \end{array}$$

We convert to percent notation, then solve the equation.

$$8 = 0.02y \quad (2\% = 0.02)$$

$$\frac{8}{0.02} = y$$

$$400 = y$$

The answer is 400.

59. **Translate.**

What percent of 69 is 23?

$$\begin{array}{ccc} \downarrow & \downarrow & \downarrow \\ p & \cdot & 69 = 23 \end{array}$$

$$\frac{69p}{69} = \frac{23}{69}$$

$$p = 0.3\bar{3}$$

The answer is 33.3%, or 33 $\frac{1}{3}$ %.

60. **Translate.**

What percent of 40 is 9?

$$\begin{array}{r} \downarrow \qquad \downarrow \downarrow \downarrow \downarrow \\ p \qquad \cdot 40 = 9 \\ \hline 40p \quad 9 \\ 40 \quad 40 \\ p \quad 0.225 \end{array}$$

The answer is 22.5%.

61. Let  $v$  = the cost of surgical vet visits. Then we have:

$$\begin{array}{r} v \text{ is } 32\% \text{ of } \$1425 \\ \downarrow \downarrow \downarrow \downarrow \downarrow \\ v = 0.32 \cdot \$1425 \\ v = \$456 \end{array}$$

The cost of surgical vet visits is \$456.

62. Let  $f$  = the cost of food. Then we have:

$$\begin{array}{r} f \text{ is } 15\% \text{ of } \$1425 \\ \downarrow \downarrow \downarrow \downarrow \downarrow \\ f = 0.15 \cdot \$1425 \\ f = \$213.75 \end{array}$$

The cost of food is \$213.75.

63. Let  $t$  = the cost of treats. Then we have:

$$\begin{array}{r} t \text{ is } 5\% \text{ of } \$1425 \\ \downarrow \downarrow \downarrow \downarrow \downarrow \\ t = 0.05 \cdot \$1425 \\ t = \$71.25 \end{array}$$

The cost of treats is \$71.25.

64. Let  $t$  = the cost of toys. Then we have:

$$\begin{array}{r} t \text{ is } 3\% \text{ of } \$1425 \\ \downarrow \downarrow \downarrow \downarrow \downarrow \\ t = 0.03 \cdot \$1425 \\ t = \$42.75 \end{array}$$

The cost of toys is \$42.75.

65. Let  $c$  = the number of credit hours Clayton completed. Then we have:

$$\begin{array}{r} c \text{ is } 60\% \text{ of } 125? \\ \downarrow \downarrow \downarrow \downarrow \downarrow \\ c = 0.6 \cdot 125 \\ c = 75 \end{array}$$

Clayton has completed 75 credit hours.

66. Let  $c$  = the number of credit hours Lydia needs to complete. Then we have:

$$\begin{array}{r} c \text{ is } 20\% \text{ of } 125? \\ \downarrow \downarrow \downarrow \downarrow \downarrow \\ c = 0.2 \cdot 125 \\ c = 25 \end{array}$$

Lydia still needs to complete 25 credit hours.

67. Let  $x$  = the number of at-bats. Then we have:

$$\begin{array}{r} 35.5\% \text{ of } x \text{ is } 213. \\ \downarrow \downarrow \downarrow \downarrow \downarrow \\ 0.355 \cdot x = 213 \end{array}$$

$$x = \frac{213}{0.355}$$

$$x = 600$$

Ichiro Suzuki had 600 at-bats.

68. Let  $x$  = the number of attempted passes.

Then we have:

$$\begin{array}{r} 66.8\% \text{ of } x \text{ is } 371. \\ \downarrow \downarrow \downarrow \downarrow \downarrow \\ 0.668 \cdot x = 371 \end{array}$$

$$x = \frac{371}{0.668}$$

$$x \approx 555$$

Peyton Manning attempted about 555 passes.

69. a) Let  $x$  = the percent of the cost of the meal representing Shane's tip. Then we have:

$$\begin{array}{r} x \cdot \$25 \text{ is } \$4. \\ \downarrow \downarrow \downarrow \downarrow \downarrow \\ x \cdot \$25 = \$4 \end{array}$$

$$x = \frac{4}{25}$$

$$x = 0.16, \text{ or } 16\%$$

The tip was 16% of the cost of the meal.

b) The total cost of the meal, including the tip was \$25 + \$4, or \$29.

70. a) Let  $x$  = the percent of the cost of the meal representing Selena's tip. Then we have:

$$\begin{array}{r} x \cdot \$58 \text{ is } \$12.76. \\ \downarrow \downarrow \downarrow \downarrow \downarrow \\ x \cdot \$58 = \$12.76 \end{array}$$

$$x = \frac{12.76}{58}$$

$$x = 0.22, \text{ or } 22\%$$

The tip was 22% of the cost of the meal.

b) The total cost of the meal, including the tip was \$58 + \$12.76, or \$70.76.

71. Let  $x$  = the percent of crude oil imports from Canada and Mexico. Then we have:

$$\begin{array}{c} x \cdot 8.9 \text{ is } 3.1. \\ \downarrow \downarrow \downarrow \downarrow \\ x \cdot 8.9 = 3.1 \end{array}$$

$$x = \frac{3.1}{8.9}$$

$$x = 0.34831461$$

The percent of crude oil imports from Canada and Mexico was about 34.8%. The percent that came from the rest of the world was about  $100 - 34.8 = 65.2\%$ .

72. Let  $x$  = the percent of the votes that Barack Obama received. Then we have:

$$x \cdot \underline{131.3 \text{ million}} \text{ is } \underline{69.5 \text{ million}}.$$

$$\begin{array}{c} \downarrow \quad \downarrow \quad \downarrow \quad \downarrow \\ x \cdot \quad 131.3 \quad = \quad 69.5 \end{array}$$

$$x = \frac{69.5}{131.3}$$

$$x \approx 0.529322$$

Obama received about 52.9% of the votes. About  $100 - 52.9 = 47.1\%$  of the votes were cast for other candidates.

73. Let  $I$  = the amount of interest Irena will pay. Then we have:

$$\begin{array}{c} I \text{ is } 6\% \text{ of } \$3500? \\ \downarrow \downarrow \downarrow \downarrow \downarrow \\ I = 0.06 \cdot \$3500 \\ I = \$210 \end{array}$$

Irena will pay \$210 in interest.

74. Let  $I$  = the amount of interest Glenn will pay. Then we have:

$$\begin{array}{c} I \text{ is } 5\% \text{ of } \$2400? \\ \downarrow \downarrow \downarrow \downarrow \downarrow \\ I = 0.05 \cdot \$2400 \\ I = \$120 \end{array}$$

Glenn will pay \$120 in interest.

75. Let  $x$  = the number of women who had babies in good or excellent health. Then we have:

$$\begin{array}{c} x \text{ is } 95\% \text{ of } 300? \\ \downarrow \downarrow \downarrow \downarrow \downarrow \\ x = 0.95 \cdot 300 \\ x = 285 \end{array}$$

285 women had babies in good or excellent health.

76. Let  $x$  = the number of women who had babies in good or excellent health. Then we have:

$$\begin{array}{c} x \text{ is } 8\% \text{ of } 300? \\ \downarrow \downarrow \downarrow \downarrow \downarrow \\ x = 0.08 \cdot 300 \\ x = 24 \end{array}$$

24 women had babies in good or excellent health.

77. Let  $x$  = the amount of income Sara would need to earn on her own to be comparable to her hourly rate at Village Copy. Then we have:

$$\begin{array}{c} x \text{ is } 120\% \text{ of } \$16? \\ \downarrow \downarrow \downarrow \downarrow \downarrow \\ x = 1.2 \cdot \$16 \\ x = 19.2 \end{array}$$

Sara would need to earn \$19.20/ hr if she worked on her own.

78. Let  $x$  = the amount of income Adam would need to earn on his own to be comparable to his hourly rate at Round Edge stairbuilders. Then we have:

$$\begin{array}{c} x \text{ is } 120\% \text{ of } \$18? \\ \downarrow \downarrow \downarrow \downarrow \downarrow \\ x = 1.2 \cdot \$18 \\ x = 21.6 \end{array}$$

Adam would need to earn \$21.60/ hr if he worked on his own.

79. Let  $x$  = the percentage by which the number of minutes users spent on Facebook increased. Since the number of minutes grew from 1.7 million to 13.9 million, the increase was 12.2 million minutes. Then we have:

$$\begin{array}{c} x \cdot 1.7 \text{ is } 12.2. \\ \downarrow \downarrow \downarrow \downarrow \\ x \cdot 1.7 = 12.2 \\ x = \frac{12.2}{1.7} \\ x \approx 7.17647059, \text{ or } 718\% \end{array}$$

The percentage by which the number of minutes users spent on Facebook increased is about 718%.

80. Let  $x$  = the percentage by which the number of minutes users spent on Myspace.com decreased. Since the number of minutes fell from 7.3 million to 5.0 million, the decrease was 2.3 million minutes. Then we have:
- $$x \cdot 7.3 \text{ is } 2.3.$$
- $$\downarrow \downarrow \downarrow \downarrow \downarrow$$
- $$x \cdot 7.3 = 2.3$$
- $$x = \frac{2.3}{7.3}$$
- $$x \approx 0.31506849, \text{ or } 32\%$$
- The percentage by which the number of minutes users spent on Myspace.com decreased is about 32%.
81. Let  $c$  = the cost of the merchandise. Then we have:
- Cost plus tax is \$37.80.
- $$\downarrow \downarrow \downarrow \downarrow \downarrow$$
- $$c + 0.05c = \$37.80$$
- $$1.05c = \$37.80$$
- $$c = \frac{\$37.80}{1.05}$$
- $$c = \$36$$
- The cost of the merchandise is \$36.
82. Let  $c$  = the cost of only the building materials. Then we have:
- Cost plus tax is \$987.
- $$\downarrow \downarrow \downarrow \downarrow \downarrow$$
- $$c + 0.05c = \$987$$
- $$1.05c = \$987$$
- $$c = \frac{\$987}{1.05}$$
- $$c = \$940$$
- The cost of the building materials was \$940.
83. Let  $c$  = the cost of only the software. Then we have:
- Cost plus tax is \$157.41.
- $$\downarrow \downarrow \downarrow \downarrow \downarrow$$
- $$c + 0.06c = \$157.41$$
- $$1.06c = \$157.41$$
- $$c = \frac{\$157.41}{1.06}$$
- $$c = \$148.50$$
- The cost of the software alone would have been \$148.50.
84. Let  $c$  = the cost of the sump pump. Then we have:
- Cost plus tax is \$145.90.
- $$\downarrow \downarrow \downarrow \downarrow \downarrow$$
- $$c + 0.05c = \$145.90$$
- $$1.05c = \$145.90$$
- $$c = \frac{\$145.90}{1.05}$$
- $$c = \$138.952381$$
- The cost of only the sump pump would have been \$138.95.
85. Let  $p$  = the number of pounds of body weight in fat. Then we have:
- 16.5% of 191 pounds is weight of fat.
- $$\downarrow \downarrow \downarrow \downarrow \downarrow$$
- $$0.165 \cdot 191 = p$$
- $$0.165 \cdot 191 = p$$
- $$31.515 = p$$
- The part, in pounds, of the author's body weight in fat is about 31.5 pounds.
86. Let  $x$  = the area of Arizona. Then we have:
- Area of Arizona is 19% of area of Alaska.
- $$\downarrow \downarrow \downarrow \downarrow \downarrow$$
- $$x = 0.19 \cdot 586,400$$
- $$x = 111,416$$
- The area of Arizona is 111,416 mi<sup>2</sup>.
87. Let  $x$  = the number of a sale or a response from a customer. Then we have:
- Number of sales  
or response is 2.15% of 114 billion.
- $$\downarrow \downarrow \downarrow \downarrow \downarrow$$
- $$x = 0.0215 \cdot 114$$
- $$x = 2.451$$
- The number of pieces of mail that led to a sale or a response from a customer was about 2.45 billion pieces of mail.

88. Let  $p$  = the percentage of people who kiss a person with a cold who actually come down with a cold. Then we have:

$$p \cdot 800 \text{ is } 56.$$

$$\downarrow \downarrow \downarrow \downarrow \downarrow$$

$$p \cdot 800 = 56$$

$$800p = 56$$

$$p = \frac{56}{800}$$

$$p = 0.07, \text{ or } 7\%$$

7% of those who kiss a person with a cold will get a cold.

89. Let  $c$  = the number of calories in a 1-oz serving of Lay's® Classic potato chips. Then we have:

$$\underbrace{\text{Baked Lay's calories}} \text{ is } \underbrace{20\% \text{ less calories than Lay's Classic}} \\ \downarrow \quad \quad \downarrow \quad \quad \downarrow \\ 120 \quad = \quad c - 0.20c$$

$$120 = c - 0.20c$$

$$120 = 0.80c$$

$$150 = c$$

The number of calories in a serving of Lay's Classic Potato Chips is 150 calories.

90. Let  $c$  = the number of calories of fat in of Baked Lay's® Original Potato Crisps. Then we have:

$$\underbrace{\text{Baked Lay's calories of fat}} \text{ is } \underbrace{83\frac{1}{3}\% \text{ less fat than Lay's Classic.}} \\ \downarrow \quad \quad \downarrow \quad \quad \downarrow \\ 15 \quad = \quad c - 0.833c$$

$$15 = c - 0.833c$$

$$15 = 0.167c$$

$$89.82035928 = c$$

The number of calories of fat in Lay's Classic Potato Chips is about 90 calories.

91. *Thinking and Writing Exercise.* The book is marked up \$30. Since Campus Bookbuyers paid \$30 for the book, this is a 100% markup.

92. *Thinking and Writing Exercise.* \$12 is  $13\frac{1}{3}\%$  of \$90. He would be considered to be stingy, since the standard tip rate is 15%.

93. Let  $l$  represent the length and  $w$  represent the width;  $2l + 2w$ .

94.  $5\% = 0.05$ , so 5% of \$180 is  $0.05 \cdot 180$ . (Note: replace "of" with multiplication).

95. Let  $p$  represent the number of points Tino scored. 5 fewer means subtract 5 from  $p$ , or  $p - 5$ .

96. Product means multiplication, so  $15 + 1.5 \cdot x$ , or  $15 + 1.5x$ .

97. The product of 10 and half of  $a$ , or  $\frac{1}{2}a$ ,  $10 \cdot (\frac{1}{2}a)$ .

98. Let  $n$  represent the number. So 10 more than three times a number is  $10 + 3n$ , or  $3n + 10$ .

99. Let  $l$  represent the length and  $w$  represent the width;  $w = l - 2$ .

100. Let  $x$  represent the first number and  $y$  represent the second number;  $x = 4y$ .

101. a) Together Monday and Friday make up  $\frac{2}{5}$  or 40% of the work week. So citing the survey indicates that Monday and Friday do not appear to involve excessive sick leave. b) Memorial Day is the last Monday of May and Labor Day is the first Monday in September. This means there are 3 months and a few days between these two dates, and  $\frac{3}{12} = \frac{1}{4}$  which is about 25% of the entire year. So, if 26% of home burglaries occur between Memorial Day and Labor Day that is not more than would be expected.

102. *Thinking and Writing Exercise.* No; Erin paid 75% of the original price and was offered credit for 125% of this amount, not to be used on sale items. Now 125% of 75% is 93.75%, so Erin would have a credit of 93.75% of the original price. Since this credit can be applied only to non-sale items, she has less purchasing power than if the amount she paid were refunded and she could spend it on sale items.

103. Let  $p$  = the population of Bardville. Then we have:

1332 is 15% of 48% of the population.

↓ ↓ ↓ ↓ ↓ ↓ ↓

$$1332 = 0.15 \cdot 0.48 \cdot p$$

$$\frac{1332}{0.15(0.48)} = p$$

$$18,500 = p$$

The population of Bardville is 18,500.

104. Let  $h$  = Jaaran's final adult height. Jaaran's height of 6 ft 4 in is equivalent to 76 in (6 ft  $\times$  12 in/ft + 4 in). Then we have:

76 in is 96.1% of adult height.

↓ ↓ ↓ ↓ ↓

$$76 = 0.961 \cdot h$$

$$76 = 0.961h$$

$$\frac{76}{0.961} = h$$

$$79.0842872 = h$$

Jaaran's adult height would be about 6 ft 7 in.

105. Let  $h$  = Dana's final adult height. Dana's height of 4 ft 8 in is equivalent to 56 in (4 ft  $\times$  12 in/ft + 8 in). Then we have:

56 in is 84.4% of adult height.

↓ ↓ ↓ ↓ ↓

$$56 = 0.844 \cdot h$$

$$56 = 0.844h$$

$$\frac{56}{0.844} = h$$

$$66.3507109 = h$$

Dana's adult height would be about 5 ft 6 in.

106. The area of the photo is 8 in.  $\times$  6 in., or 48 in.<sup>2</sup>. The mat is intended for a photo having an area of 5 in.  $\times$  7 in., or 35 in.<sup>2</sup>. Thus the mat window is 35 in.<sup>2</sup>. The area of the photo covered by the mat would then be:

Area of photo – Mat Window = 48 in.<sup>2</sup> – 35 in.<sup>2</sup>, or 13 in.<sup>2</sup>. The percentage of the photo covered by the mat is:

$$\frac{13 \text{ in.}^2}{48 \text{ in.}^2} = 0.270833333, \text{ or about } 27\%.$$

107. Between 2005 and 2007, the high school dropout rate in the US decreased from 94 to 87 per thousand, or by  $94 - 87 = 7$ . Let  $p$  = the percent by which the dropout rate decreased. Then we have:

7 is what percent of 94?

↓ ↓ ↓ ↓ ↓

$$7 = \frac{p}{100} \cdot 94$$

$$\frac{7}{94} = p$$

$$0.07446809 \approx p$$

The dropout rate between 2005 and 2007 decreased by about 7.4%, which is about  $7.4 \div 2$  years, or 3.7% per year. Assuming the dropout rate continues to decrease at the same rate, in 2008 it will be  $87 - (0.037 \times 87) \approx 83.8$ , or 84 per thousand, and in 2009 it will be  $83.8 - (0.037 \times 83.8) \approx 80.7$ , or 81 per thousand.

108. *Thinking and Writing Exercise.* The end result is the same either way. If  $s$  is the original salary, the new salary, after a 5% raise followed by an 8% raise is  $1.08(1.05s)$ . The new salary if raises occur the other way around is  $1.05(1.08s)$ . By the commutative and associative laws of multiplication we see that these are equal. However, it would be better to receive the 8% raise first, because this increase yields a higher new salary the first year than a 5% raise.
109. *Thinking and Writing Exercise.* Suppose Jose has  $x$  dollars of taxable income. If he makes a \$50 tax-deductible contribution, then he pays tax of  $0.3(x - \$50)$ , or  $0.3x - \$15$  and his assets are reduced by  $0.3x + \$35$  in all. If he makes a \$40 non-tax-deductible contribution, he pays tax of  $0.3x$  and his assets are reduced by  $0.3x + \$40$ . Thus, it costs him less to make a \$50 tax-deductible contribution.