Chapter 2

Section 2.1 Practice Exercises

1. **a.** The numerical coefficient of t is 1, since t is $1t$.

b. The numerical coefficient of $-7x$ is -7.

c. The numerical coefficient of $-\frac{w}{5}$ is $-\frac{1}{5}$, since $-\frac{w}{5}$ means $-\frac{1}{5}\cdot w$.

d. The numerical coefficient of $43x^4$ is 43.

e. The numerical coefficient of $-b$ is -1, since $-b$ is $-1b$.

2. **a.** $-4xy$ and $5yx$ are like terms, since $xy = yx$ by the commutative property.

b. $5q$ and $-3q^2$ are unlike terms, since the exponents on q are not the same.

c. $3ab^2, -2ab^2$, and $43ab^2$ are like terms, since each variable and its exponent match.

d. y^5 and $\frac{y^5}{2}$ are like terms, since the exponents on y are the same.

3. **a.** $-3y + 11y = (-3 + 11)y = 8y$

b. $4x^2 + x^2 = 4x^2 + 1x^2 = (4+1)x^2 = 5x^2$

c. $5x - 3x^2 + 8x^2 = 5x + (-3+8)x^2 = 5x + 5x^2$

d.
$$\begin{aligned}20y^2 + 2y^2 - y^2 &= 20y^2 + 2y^2 - 1y^2\\ &= (20+2-1)y^2\\ &= 21y^2\end{aligned}$$

4. **a.** $3y + 8y - 7 + 2 = (3+8)y + (-7+2) = 11y - 5$

b.
$$\begin{aligned}6x - 3 - x - 3 &= 6x - 1x + (-3-3)\\ &= (6-1)x + (-3-3)\\ &= 5x - 6\end{aligned}$$

c. $\frac{3}{4}t - t = \frac{3}{4}t - 1t = \left(\frac{3}{4} - 1\right)t = -\frac{1}{4}t$

d.
$$\begin{aligned}9y + 3.2y + 10 + 3 &= (9+3.2)y + (10+3)\\ &= 12.2y + 13\end{aligned}$$

e. $5z - 3z^4$
These two terms cannot be combined because they are unlike terms.

5. **a.** $3(2x - 7) = 3(2x) + 3(-7) = 6x - 21$

b. $-5(x - 0.5z - 5)$
$= -5(x) + (-5)(-0.5z) + (-5)(-5)$
$= -5x + 2.5z + 25$

c.
$$\begin{aligned}&-(2x - y + z - 2)\\ &= -1(2x - y + z - 2)\\ &= -1(2x) - 1(-y) - 1(z) - 1(-2)\\ &= -2x + y - z + 2\end{aligned}$$

6. **a.** $4(9x + 1) + 6 = 36x + 4 + 6 = 36x + 10$

b.
$$\begin{aligned}-7(2x-1) - (6-3x) &= -14x + 7 - 6 + 3x\\ &= -11x + 1\end{aligned}$$

c. $8 - 5(6x + 5) = 8 - 30x - 25 = -30x - 17$

7. "Subtract $7x - 1$ from $2x + 3$" translates to $(2x+3) - (7x-1) = 2x + 3 - 7x + 1 = -5x + 4$

8. **a.**

Three	added to	double a number
↓	↓	↓
3	+	$2x$

or $2x + 3$

b.

the sum of 5 and a number	subtract	six	
↓	↓	↓	
$(5 + x)$	–	6	$= 5 + x - 6$

$(5 + x) - 6 = 5 + x - 6 = x - 1$

c.

two	times	the sum of 3 and a number	increased by	4
↓	↓	↓	↓	↓
2	·	$(3 + x)$	+	4

$2(3 + x) + 4 = 6 + 2x + 4 = 2x + 10$

d.

a number	added to	half the number	added to	5 times the number
↓	↓	↓	↓	↓
x	+	$\frac{1}{2}x$	+	$5x$

$x + \frac{1}{2}x + 5x = \frac{13}{2}x$

Vocabulary, Readiness & Video Check 2.1

1. $23y^2 + 10y - 6$ is called an <u>expression</u> while $23y^2$, $10y$, and -6 are each called a <u>term</u>.
2. To simplify $x + 4x$, we <u>combine like terms</u>.
3. The term y has an understood <u>numerical coefficient</u> of 1.
4. The terms $7z$ and $7y$ are <u>unlike</u> terms and the terms $7z$ and $-z$ are <u>like</u> terms.
5. For the term $-\frac{1}{2}xy^2$, the number $-\frac{1}{2}$ is the <u>numerical coefficient</u>.
6. $5(3x - y)$ equals $15x - 5y$ by the <u>distributive</u> property.
7. Although these terms have exactly the same variables, the exponents on each are not exactly the same—the exponents on x differ in each term.
8. distributive property
9. -1
10. The sum of 5 times a number and -2, added to 7 times the number; $5x + (-2) + 7x$; because there are like terms.

Exercise Set 2.1

2. The numerical coefficient of $3x$ is 3.

4. The numerical coefficient of $-y$ is -1, since $-y = -1y$.

6. The numerical coefficient of $1.2xyz$ is 1.2.

8. $-2x^2y$ and $6xy$ are unlike terms, since the exponents on x are not the same.

10. ab^2 and $-7ab^2$ are like terms, since each variable and its exponent match.

12. $7.4p^3q^2$ and $6.2p^3q^2r$ are unlike terms, since the exponents on r are not the same.

14. $3x + 2x = (3 + 2)x = 5x$

16. $c - 7c + 2c = (1 - 7 + 2)c = -4c$

18. $$\begin{aligned} 6g+5-3g-7 &= 6g-3g+5-7 \\ &= (6-3)g-2 \\ &= 3g-2 \end{aligned}$$

20. $$\begin{aligned} a+3a-2-7a &= a+3a-7a-2 \\ &= (1+3-7)a-2 \\ &= -3a-2 \end{aligned}$$

22. $$\begin{aligned} 8p+4-8p-15 &= (8p-8p)+(4-15) \\ &= (8-8)p+(-11) \\ &= 0p-11 \\ &= -11 \end{aligned}$$

24. $$\begin{aligned} 7.9y-0.7-y+0.2 &= 7.9y-y-0.7+0.2 \\ &= (7.9-1)y-0.5 \\ &= 6.9y-0.5 \end{aligned}$$

26. $$\begin{aligned} 8h+13h-6+7h-h &= 8h+13h+7h-h-6 \\ &= (8+13+7-1)h-6 \\ &= 27h-6 \end{aligned}$$

28. $8x^3 + x^3 - 11x^3 = (8+1-11)x^3 = -2x^3$

30. $$\begin{aligned} &0.4y - 6.7 + y - 0.3 - 2.6y \\ &= 0.4y + y - 2.6y - 6.7 - 0.3 \\ &= (0.4 + 1 - 2.6)y - 7.0 \\ &= -1.2y - 7 \end{aligned}$$

32. $7(r - 3) = 7(r) - 7(3) = 7r - 21$

34. $-4(y + 6) = -4(y) + (-4)(6) = -4y - 24$

36. $9(z + 7) - 15 = 9z + 63 - 15 = 9z + 48$

38. $$\begin{aligned} -2(4x-3z-1) &= -2(4x)-(-2)(3z)-(-2)(1) \\ &= -8x+6z+2 \end{aligned}$$

40. $-(y + 5z - 7) = -y - 5z + 7$

42. $$\begin{aligned} 4(2x-3)-2(x+1) &= 8x-12-2x-2 \\ &= 6x-14 \end{aligned}$$

44. $$\begin{array}{cccl} 3y-5 & \begin{array}{c}\text{added}\\ \text{to}\end{array} & y+16 & \\ \downarrow & \downarrow & \downarrow & \\ (3y-5) & + & (y+16) & = 3y+y-5+16 \\ & & & = 4y+11 \end{array}$$

46. $$\begin{array}{cccl} 12+x & \text{minus} & 4x-7 & \\ \downarrow & \downarrow & \downarrow & \\ (12+x) & - & (4x-7) & = 12+x-4x+7 \\ & & & = 12+7+x-4x \\ & & & = 19-3x \end{array}$$

48. $$\begin{array}{cccl} 2m-6 & \text{minus} & m-3 & \\ \downarrow & \downarrow & \downarrow & \\ (2m-6) & - & (m-3) & = 2m-6-m+3 \\ & & & = 2m-m-6+3 \\ & & & = m-3 \end{array}$$

50. $7c - 8 - c = 7c - c - 8 = (7 - 1)c - 8 = 6c - 8$

52. $$\begin{aligned} 5y-14+7y-20y &= 5y+7y-20y-14 \\ &= (5+7-20)y-14 \\ &= -8y-14 \end{aligned}$$

54. $$\begin{aligned} -3(2x+5)-6x &= -3(2x)+(-3)(5)-6x \\ &= -6x-15-6x \\ &= -6x-6x-15 \\ &= -12x-15 \end{aligned}$$

56. $$\begin{aligned} 2(6x-1)-(x-7) &= 12x-2-x+7 \\ &= 11x+5 \end{aligned}$$

58. $8y-2-3(y+4) = 8y-2-3y-12 = 5y-14$

60. $-11c - (4 - 2c) = -11c - 4 + 2c = -9c - 4$

62. $(8-5y)-(4+3y) = 8-5y-4-3y = -8y+4$

64. $$\begin{aligned} 2.8w-0.9-0.5-2.8w &= 2.8w-2.8w-0.9-0.5 \\ &= -1.4 \end{aligned}$$

66. $$\begin{aligned}\frac{1}{5}(9y+2)+\frac{1}{10}(2y-1) &= \frac{9}{5}y+\frac{2}{5}+\frac{2}{10}y-\frac{1}{10}\\ &= \frac{9}{5}y+\frac{1}{5}y+\frac{2}{5}-\frac{1}{10}\\ &= \frac{10}{5}y+\frac{4}{10}-\frac{1}{10}\\ &= 2y+\frac{3}{10}\end{aligned}$$

68. $8 + 4(3x - 4) = 8 + 12x - 16 = -8 + 12x$

70. $0.2(k+8)-0.1k = 0.2k+1.6-0.1k = 0.1k+1.6$

72. $14 - 11(5m + 3n) = 14 - 55m - 33n$

74. $$\begin{aligned}7(2x+5)-4(x+2)-20x &= 14x+35-4x-8-20x\\ &= 14x-4x-20x+35-8\\ &= -10x+27\end{aligned}$$

76. $$\begin{aligned}\frac{1}{3}(9x-6)-(x-2) &= 3x-2-x+2\\ &= 2x\end{aligned}$$

78.

The difference of a number and 2	divided by	5
↓	↓	↓
$(x-2)$	$\div$	$5 = \frac{x-2}{5}$

80.

8	more than	triple a number
↓	↓	↓
8	+	$3x$

82.

Eleven	increased by	two-thirds of a number
↓	↓	↓
11	+	$\frac{2}{3}x$

84.

9 times a number	subtract	3 times the number and 10
↓	↓	↓
$9x$	$-$	$(3x+10)$

$9x - (3x + 10) = 9x - 3x - 10 = 6x - 10$

86.

Six	times	the difference of a number and 5
↓	↓	↓
6	·	$(x-5)$

$6(x-5) = 6x - 30$

88.

Half a number	minus	the product of the number and 8
↓	↓	↓
$\frac{1}{2}x$	$-$	$8x$

$\frac{1}{2}x - 8x = -7.5x$

90.

Twice a number	added to	-1	added to	5 times the number	added to	-12
↓	↓	↓	↓	↓	↓	↓
$2x$	$+$	-1	$+$	$5x$	$+$	-12

$2x + (-1) + 5x + (-12) = 7x - 13$

92. $gh - h^2 = 0(-4) - (-4)^2 = 0 - 16 = -16$

94.
$$\begin{aligned} x^3 - x^2 + 4 &= (-3)^3 - (-3)^2 + 4 \\ &= -27 - 9 + 4 \\ &= -32 \end{aligned}$$

96.
$$\begin{aligned} x^3 - x^2 - x &= (-2)^3 - (-2)^2 - (-2) \\ &= -8 - 4 + 2 \\ &= -10 \end{aligned}$$

98.
$$\begin{aligned} 5 + (3x - 1) + (2x + 5) &= 5 + 3x - 1 + 2x + 5 \\ &= 5x + 9 \end{aligned}$$
The perimeter is $(5x + 9)$ centimeters.

100.
2 cylinders 0 3 cubes
2 cubes + 2 cubes 0 3 cubes
4 cubes = 3 cubes: Not balanced

102.
1 cylinder 0 1 cone + 1 cube
2 cubes 0 1 cube + 1 cube
2 cubes = 2 cubes: Balanced

104. answers may vary

106.
$$\begin{aligned} 5x + 10(3x) + 25(30x - 1) &= 5x + 30x + 750x - 25 \\ &= 785x - 25 \end{aligned}$$
The total value is $(785x - 25)$¢.

108. no; answers may vary

110. $4m^4p^2 + m^4p^2 - 5m^2p^4 = 5m^4p^2 - 5m^2p^4$

112. $$\begin{aligned}&9y^2 - (6xy^2 - 5y^2) - 8xy^2\\&= 9y^2 - 6xy^2 + 5y^2 - 8xy^2\\&= 14y^2 - 14xy^2\end{aligned}$$

114. $$\begin{aligned}&-(7c^3d - 8c) - 5c - 4c^3d\\&= -7c^3d + 8c - 5c - 4c^3d\\&= -11c^3d + 3c\end{aligned}$$

Section 2.2 Practice Exercises

1. $$\begin{aligned}x + 3 &= -5\\x + 3 - 3 &= -5 - 3\\x &= -8\end{aligned}$$

Check: $$\begin{aligned}x + 3 &= -5\\-8 + 3 &\stackrel{?}{=} -5\\-5 &= -5\end{aligned}$$

The solution is –8.

2. $$\begin{aligned}y - 0.3 &= -2.1\\y - 0.3 + 0.3 &= -2.1 + 0.3\\y &= -1.8\end{aligned}$$

Check: $$\begin{aligned}y - 0.3 &= -2.1\\-1.8 - 0.3 &\stackrel{?}{=} -2.1\\-2.1 &= -2.1\end{aligned}$$

The solution is –1.8.

3. $$\begin{aligned}\frac{2}{5} &= x + \frac{3}{10}\\\frac{2}{5} - \frac{3}{10} &= x + \frac{3}{10} - \frac{3}{10}\\\frac{2}{2}\cdot\frac{2}{5} - \frac{3}{10} &= x\\\frac{4}{10} - \frac{3}{10} &= x\\\frac{1}{10} &= x\end{aligned}$$

Check: $$\begin{aligned}\frac{2}{5} &= x + \frac{3}{10}\\\frac{2}{5} &\stackrel{?}{=} \frac{1}{10} + \frac{3}{10}\\\frac{2}{5} &= \frac{2}{5}\end{aligned}$$

The solution is $\frac{1}{10}$.

4. $$\begin{aligned}4t + 7 &= 5t - 3\\4t + 7 - 4t &= 5t - 3 - 4t\\7 &= t - 3\\7 + 3 &= t - 3 + 3\\10 &= t\end{aligned}$$

Check: $$\begin{aligned}4t + 7 &= 5t - 3\\4(10) + 7 &\stackrel{?}{=} 5(10) - 3\\40 + 7 &\stackrel{?}{=} 50 - 3\\47 &= 47\end{aligned}$$

The solution is 10.

5. $$\begin{aligned}8x - 5x - 3 + 9 &= x + x + 3 - 7\\3x + 6 &= 2x - 4\\3x + 6 - 2x &= 2x - 4 - 2x\\x + 6 &= -4\\x + 6 - 6 &= -4 - 6\\x &= -10\end{aligned}$$

Check:
$$\begin{aligned}8x - 5x - 3 + 9 &= x + x + 3 - 7\\8(-10) - 5(-10) - 3 + 9 &\stackrel{?}{=} -10 + (-10) + 3 - 7\\-80 + 50 - 3 + 9 &\stackrel{?}{=} -10 + (-10) + 3 - 7\\-24 &= -24\end{aligned}$$

The solution is –10.

6. $$\begin{aligned}4(2a - 3) - (7a + 4) &= 2\\4(2a) + 4(-3) - 7a - 4 &= 2\\8a - 12 - 7a - 4 &= 2\\a - 16 &= 2\\a - 16 + 16 &= 2 + 16\\a &= 18\end{aligned}$$

Check by replacing *a* with 18 in the original equation.

7. $$\begin{aligned}12 - x &= 20\\12 - x - 12 &= 20 - 12\\-x &= 8\\x &= -8\end{aligned}$$

Check: $$\begin{aligned}12 - x &= 20\\12 - (-8) &\stackrel{?}{=} 20\\20 &= 20\end{aligned}$$

The solution is –8.

8. **a.** The other number is 9 – 2 = 7.

b. The other number is 9 – *x*.

c. The other piece has length (9 – *x*) feet.

9. The speed of the French TGV is (*s* – 67.2) mph.

Vocabulary, Readiness & Video Check 2.2

1. The difference between an equation and an expression is that an <u>equation</u> contains an equal sign, whereas an <u>expression</u> does not.

2. <u>Equivalent</u> equations are equations that have the same solution.

3. A value of the variable that makes the equation a true statement is called a <u>solution</u> of the equation.

4. The process of finding the solution of an equation is called <u>solving</u> the equation for the variable.

5. By the <u>addition</u> property of equality, $x = -2$ and $x + 10 = -2 + 10$ are equivalent equations.

6. The equations $x = \frac{1}{2}$ and $\frac{1}{2} = x$ are equivalent equations. The statement is true.

7. The addition property of equality means that if we have an equation, we can add the same real number to <u>both sides</u> of the equation and have an equivalent equation.

8. To confirm our solution, we replace the variable with the solution in the original equation to make sure we have a true statement.

9. $\frac{1}{7}x$

Exercise Set 2.2

2.
$$x+14=25$$
$$x+14-14=25-14$$
$$x=11$$
Check: $x+14=25$
$$11+14 \; 0 \; 25$$
$$25=25$$
The solution is 11.

4.
$$y-9=1$$
$$y-9+9=1+9$$
$$y=10$$
Check: $y-9=1$
$$10-9 \; 0 \; 1$$
$$1=1$$
The solution is 10.

6.
$$-17=x+3$$
$$-17-3=x+3-3$$
$$-20=x$$
Check: $-17=x+3$
$$-17 \; 0 \; -20+3$$
$$-17=-17$$
The solution is -20.

8.
$$t-9.2=-6.8$$
$$5-9.2+9.2=-6.8+9.2$$
$$t=2.4$$
Check: $t-9.2=-6.8$
$$2.4-9.2 \; 0 \; -6.8$$
$$-6.8=-6.8$$
The solution is 2.4.

10.
$$\frac{3}{8}=c+\frac{1}{6}$$
$$\frac{3}{8}-\frac{1}{6}=c+\frac{1}{6}-\frac{1}{6}$$
$$\frac{9}{24}-\frac{4}{24}=c$$
$$\frac{5}{24}=c$$
Check: $\frac{3}{8}=c+\frac{1}{6}$
$$\frac{3}{8} \; 0 \; \frac{5}{24}+\frac{1}{6}$$
$$\frac{3}{8} \; 0 \; \frac{5}{24}+\frac{4}{24}$$
$$\frac{3}{8} \; 0 \; \frac{9}{24}$$
$$\frac{3}{8}=\frac{3}{8}$$
The solution is $\frac{5}{24}$.

12.
$$9x+5.5=10x$$
$$9x-9x+5.5=10x-9x$$
$$5.5=x$$
Check: $9x+5.5=10x$
$$9(5.5)+5.5 \; 0 \; 10(5.5)$$
$$49.5+5.5 \; 0 \; 55$$
$$55=55$$
The solution is 5.5.

14.
$$\begin{aligned} 18x-9&=19x\\ 18x-18x-9&=19x-18x\\ -9&=x \end{aligned}$$
Check:
$$\begin{aligned} 18x-9&=19x\\ 18(-9)-9&\stackrel{?}{=}19(-9)\\ -162-9&\stackrel{?}{=}-171\\ -171&=171 \end{aligned}$$
The solution is –9.

16.
$$\begin{aligned} z+\frac{9}{19}&=-\frac{2}{19}\\ z+\frac{9}{19}-\frac{9}{19}&=-\frac{2}{19}-\frac{9}{19}\\ z&=-\frac{11}{19} \end{aligned}$$
Check:
$$\begin{aligned} z+\frac{9}{19}&=-\frac{2}{19}\\ -\frac{11}{19}+\frac{9}{19}&\stackrel{?}{=}-\frac{2}{19}\\ -\frac{2}{19}&=-\frac{2}{19} \end{aligned}$$
The solution is $-\frac{11}{19}$.

18.
$$\begin{aligned} 3n+2n&=7+4n\\ 5n&=7+4n\\ 5n-4n&=7+4n-4n\\ n&=7 \end{aligned}$$
Check:
$$\begin{aligned} 3n+2n&=7+4n\\ 3(7)+2(7)&\stackrel{?}{=}7+4(7)\\ 21+14&\stackrel{?}{=}7+28\\ 35&=35 \end{aligned}$$
The solution is 7.

20.
$$\begin{aligned} \frac{13}{11}y-\frac{2}{11}y&=-3\\ \frac{11}{11}y&=-3\\ y&=-3 \end{aligned}$$
Check:
$$\begin{aligned} \frac{13}{11}y-\frac{2}{11}y&=-3\\ \frac{13}{11}(-3)-\frac{2}{11}(-3)&\stackrel{?}{=}-3\\ -\frac{39}{11}+\frac{6}{11}&\stackrel{?}{=}-3\\ -3&=-3 \end{aligned}$$
The solution is –3.

22.
$$\begin{aligned} 4x-4&=10x-7x\\ 4x-4&=3x\\ 4x-3x-4&=3x-3x\\ x-4&=0\\ x-4+4&=0+4\\ x&=4 \end{aligned}$$
Check:
$$\begin{aligned} 4x-4&=10x-7x\\ 4(4)-4&\stackrel{?}{=}10(4)-7(4)\\ 16-4&\stackrel{?}{=}40-28\\ 12&=12 \end{aligned}$$
The solution is 4.

24.
$$\begin{aligned} -4(z-3)&=2-3z\\ -4z+12&=2-3z\\ -4z+4z+12&=2-3z+4z\\ 12&=2+z\\ 12-2&=2-2+z\\ 10&=z \end{aligned}$$
Check:
$$\begin{aligned} -4(z-3)&=2-3z\\ -4(10-3)&\stackrel{?}{=}2-3(10)\\ -4(7)&\stackrel{?}{=}2-30\\ -28&=-28 \end{aligned}$$
The solution is 10.

26.
$$\begin{aligned} \frac{1}{5}x-1&=-\frac{4}{5}x-13\\ \frac{1}{5}x-1+\frac{4}{5}x&=-\frac{4}{5}x-13+\frac{4}{5}x\\ \frac{5}{5}x-1&=-13\\ x-1+1&=-13+1\\ x&=-12 \end{aligned}$$
Check:
$$\begin{aligned} \frac{1}{5}x-1&=-\frac{4}{5}x-13\\ \frac{1}{5}(-12)-1&\stackrel{?}{=}-\frac{4}{5}(-12)-13\\ -\frac{12}{5}-\frac{5}{5}&\stackrel{?}{=}\frac{48}{5}-\frac{65}{5}\\ -\frac{17}{5}&=-\frac{17}{5} \end{aligned}$$
The solution is –12.

28.
$$\begin{aligned} 2x+7&=x-10\\ 2x+7-x&=x-10-x\\ x+7&=-10\\ x+7-7&=-10-7\\ x&=-17 \end{aligned}$$

Check:
$$\begin{aligned} 2x+7 &= x-10 \\ 2(-17)+7 &\;0\; (-17)-10 \\ -34+7 &\;0\; -27 \\ -27 &= -27 \end{aligned}$$
The solution is −17.

30.
$$\begin{aligned} 4p-11-p &= 2+2p-20 \\ 3p-11 &= 2p-18 \\ 3p-2p-11 &= 2p-2p-18 \\ p-11 &= -18 \\ p-11+11 &= -18+11 \\ p &= -7 \end{aligned}$$

Check:
$$\begin{aligned} 4p-11-p &= 2+2p-20 \\ 4(-7)-11-(-7) &\;0\; 2+2(-7)-20 \\ -28-11+7 &\;0\; 2-14-20 \\ -32 &= -32 \end{aligned}$$
The solution is −7.

32.
$$\begin{aligned} -2(x-1) &= -3x \\ -2x+2 &= -3x \\ -2x+2+2x &= -3x+2x \\ 2 &= -x \\ x &= -2 \end{aligned}$$
Check:
$$\begin{aligned} -2(x-1) &= -3x \\ -2(-2-1) &\;0\; -3(-2) \\ -2(-3) &\;0\; 6 \\ 6 &= 6 \end{aligned}$$
The solution is −2.

34.
$$\begin{aligned} \frac{2}{5}x-\frac{1}{12} &= -\frac{3}{5}x-\frac{3}{4} \\ \frac{2}{5}x+\frac{3}{5}x-\frac{1}{12} &= -\frac{3}{5}x+\frac{3}{5}x-\frac{3}{4} \\ \frac{5}{5}x-\frac{1}{12} &= -\frac{3}{4} \\ x-\frac{1}{12}+\frac{1}{12} &= -\frac{3}{4}+\frac{1}{12} \\ x &= -\frac{9}{12}+\frac{1}{12} \\ x &= -\frac{8}{12} \\ x &= -\frac{2}{3} \end{aligned}$$

Check:
$$\begin{aligned} \frac{2}{5}x-\frac{1}{12} &= -\frac{3}{5}x-\frac{3}{4} \\ \frac{2}{5}\left(-\frac{2}{3}\right)-\frac{1}{12} &\;0\; -\frac{3}{5}\left(-\frac{2}{3}\right)-\frac{3}{4} \\ -\frac{4}{15}-\frac{1}{12} &\;0\; \frac{6}{15}-\frac{3}{4} \\ -\frac{16}{60}-\frac{5}{60} &\;0\; \frac{24}{60}-\frac{45}{60} \\ -\frac{21}{60} &= -\frac{21}{60} \end{aligned}$$
The solution is $-\frac{2}{3}$.

36.
$$\begin{aligned} 3(y+7) &= 2y-5 \\ 3y+21 &= 2y-5 \\ 3y-2y+21 &= 2y-2y-5 \\ y+21 &= -5 \\ y+21-21 &= -5-21 \\ y &= -26 \end{aligned}$$

Check:
$$\begin{aligned} 3(y+7) &= 2x-5 \\ 3(-26+7) &\;0\; 2(-26)-5 \\ 3(-19) &\;0\; -52-5 \\ -57 &= -57 \end{aligned}$$
The solution is −26.

38.
$$\begin{aligned} 5(3+z)-(8z+9) &= -4z \\ 15+5z-8z-9 &= -4z \\ 6-3z &= -4z \\ 6-3z+4z &= -4z+4z \\ 6+z &= 0 \\ 6-6+z &= -6 \\ z &= -6 \end{aligned}$$
Check:
$$\begin{aligned} 5(3+z)-(8z+9) &= -4z \\ 5(3+(-6))-(8(-6)+9) &\;0\; -4(-6) \\ 5(-3)-(-48+9) &\;0\; 24 \\ -15-(-39) &\;0\; 24 \\ 24 &= 24 \end{aligned}$$
The solution is −6.

40.
$$\begin{aligned} -5(x+1)+4(2x-3) &= 2(x+2)-8 \\ -5x-5+8x-12 &= 2x+4-8 \\ 3x-17 &= 2x-4 \\ 3x-2x-17 &= 2x-2x-4 \\ x-17 &= -4 \\ x-17+17 &= -4+17 \\ x &= 13 \end{aligned}$$

Check:
$$\begin{aligned} -5(x+1)+4(2x-3) &= 2(x+2)-8 \\ -5(13+1)+4(2(13)-3) &\overset{?}{=} 2(13+2)-8 \\ -5(14)+4(26-3) &\overset{?}{=} 2(15)-8 \\ -70+4(23) &\overset{?}{=} 30-8 \\ -70+92 &\overset{?}{=} 22 \\ 22 &= 22 \end{aligned}$$

The solution is 13.

42.
$$\begin{aligned} -8 &= 8+z \\ -8-8 &= 8+z-8 \\ -16 &= z \end{aligned}$$

44.
$$\begin{aligned} y-\frac{4}{7} &= -\frac{3}{14} \\ y-\frac{4}{7}+\frac{4}{7} &= -\frac{3}{14}+\frac{4}{7} \\ y &= -\frac{3}{14}+\frac{8}{14} \\ y &= \frac{5}{14} \end{aligned}$$

46.
$$\begin{aligned} 7y+2 &= 6y+2 \\ 7y-6y+2 &= 6y-6y+2 \\ y+2 &= 2 \\ y+2-2 &= 2-2 \\ y &= 0 \end{aligned}$$

48.
$$\begin{aligned} 15x+20-10x-9 &= 25x+8-21x-7 \\ 5x+11 &= 4x+1 \\ 5x+11-4x &= 4x+1-4x \\ x+11 &= 1 \\ x+11-11 &= 1-11 \\ x &= -10 \end{aligned}$$

50.
$$\begin{aligned} 6(5+c) &= 5(c-4) \\ 30+6c &= 5c-20 \\ 30+6c-5c &= 5c-5c-20 \\ 30+c &= 20 \\ 30-30+c &= -20-30 \\ c &= -50 \end{aligned}$$

52.
$$\begin{aligned} m+2 &= 7.1 \\ m+2-2 &= 7.1-2 \\ m &= 5.1 \end{aligned}$$

54.
$$\begin{aligned} 15-(6-7k) &= 2+6k \\ 15-6+7k &= 2+6k \\ 9+7k &= 2+6k \\ 9+7k-6k &= 2+6k-6k \\ 9+k &= 2 \\ 9-9+k &= 2-9 \\ k &= -7 \end{aligned}$$

56.
$$\begin{aligned} \frac{1}{11} &= y+\frac{10}{11} \\ \frac{1}{11}-\frac{10}{11} &= y+\frac{10}{11}-\frac{10}{11} \\ -\frac{9}{11} &= y \end{aligned}$$

58.
$$\begin{aligned} -1.4-7x-3.6-2x &= -8x+4.4 \\ -9x-5.0 &= -8x+4.4 \\ -9x+9x-5.0 &= -8x+9x+4.4 \\ -5.0 &= x+4.4 \\ -5.0-4.4 &= x+4.4-4.4 \\ -9.4 &= x \end{aligned}$$

60.
$$\begin{aligned} -2\left(x-\frac{1}{7}\right) &= -3x \\ -2x+\frac{2}{7} &= -3x \\ -2x+3x+\frac{2}{7} &= -3x+3x \\ x+\frac{2}{7} &= 0 \\ x+\frac{2}{7}-\frac{2}{7} &= 0-\frac{2}{7} \\ x &= -\frac{2}{7} \end{aligned}$$

62.
$$\begin{aligned} -4(x-1)-5(2-x) &= -6 \\ -4x+4-10+5x &= -6 \\ x-6 &= -6 \\ x-6+6 &= -6+6 \\ x &= 0 \end{aligned}$$

64.
$$\begin{aligned} 0.6v+0.4(0.3+v) &= 2.34 \\ 0.6v+0.12+0.4v &= 2.34 \\ 1v+0.12 &= 2.34 \\ v+0.12-0.12 &= 2.34-0.12 \\ v &= 2.22 \end{aligned}$$

66. The other number is $13 - y$.

68. The length of the other piece is $(5 - x)$ feet.

70. The complement of the angle $x°$ is $(90 - x)°$.

72. If the length of I-80 is m miles and the length of I-90 is 178.5 miles longer than I-80, the length of I-90 is $m + 178.5$.

74. The weight of the Hoba West meteorite is $3y$ kilograms.

76. The reciprocal of $\frac{7}{6}$ is $\frac{6}{7}$ since $\frac{7}{6}\cdot\frac{6}{7}=1$.

78. The reciprocal of 5 is $\frac{1}{5}$ since $5\cdot\frac{1}{5}=1$.

80. The reciprocal of $-\frac{3}{5}$ is $-\frac{5}{3}$ since $-\frac{3}{5}\cdot-\frac{5}{3}=1$.

82. $\frac{-2y}{-2}=y$

84. $7\left(\frac{1}{7}r\right)=r$

86. $\frac{9}{2}\left(\frac{2}{9}x\right)=x$

88. $360 - (x + 3x + 5x) = 360 - (9x) = 360 - 9x$
The fourth angle is $(360 - 9x)°$.

90. answers may vary

92. answers may vary

94.
$$\begin{aligned}100+250+500+x&=1000\\850+x&=1000\\850+x-850&=1000-850\\x&=150\end{aligned}$$
The fluid needed by the patient is 150 ml.

96. answers may vary.

98.
$$\begin{aligned}a+9&=15\\a+9+(-9)&=15+(-9)\\a&=6\end{aligned}$$
The answer is −9.

100. answers may vary

102. Check $y = 1.2$: $8.13 + 5.85y = 20.05y - 8.91$
$$\begin{aligned}8.13+5.85(1.2)&\stackrel{?}{=}20.05(1.2)-8.91\\8.13+7.02&\stackrel{?}{=}24.06-8.91\\15.15&=15.15\end{aligned}$$
Solution

104. Check $z = 4.8$:
$$\begin{aligned}7(z-1.7)+9.5&=5(z+3.2)-9.2\\7(4.8-1.7)+9.5&\stackrel{?}{=}5(4.8+3.2)-9.2\\7(3.1)+9.55&\stackrel{?}{=}5(8.0)-9.2\\21.7+9.55&\stackrel{?}{=}40.0-9.2\\31.2&\neq 30.8\end{aligned}$$
Not a solution

Section 2.3 Practice Exercises

1.
$$\begin{aligned}\frac{4}{5}x&=16\\\frac{5}{4}\cdot\frac{4}{5}x&=\frac{5}{4}\cdot16\\\left(\frac{5}{4}\cdot\frac{4}{5}\right)x&=\frac{5}{4}\cdot16\\1x&=20\\x&=20\end{aligned}$$
Check: $\frac{4}{5}x=16$
$$\begin{aligned}\frac{4}{5}\cdot20&\stackrel{?}{=}16\\16&=16\end{aligned}$$
The solution is 20.

2.
$$\begin{aligned}8x&=-96\\\frac{8x}{8}&=\frac{-96}{8}\\x&=-12\end{aligned}$$
Check: $8x=-96$
$$\begin{aligned}8(-12)&\stackrel{?}{=}-96\\-96&=-96\end{aligned}$$
The solution is −12.

3.
$$\begin{aligned}\frac{x}{5}&=13\\5\cdot\frac{x}{5}&=5\cdot13\\x&=65\end{aligned}$$
Check: $\frac{x}{5}=13$
$$\begin{aligned}\frac{65}{5}&\stackrel{?}{=}13\\13&=13\end{aligned}$$
The solution is 65.

4. $2.7x = 4.05$
$$\frac{2.7x}{2.7} = \frac{4.05}{2.7}$$
$$x = 1.5$$
The solution is 1.5.
Check by replacing *x* with 1.5 in the original equation.

5. $-\frac{5}{3}x = \frac{4}{7}$
$$-\frac{3}{5}\cdot -\frac{5}{3}x = -\frac{3}{5}\cdot\frac{4}{7}$$
$$x = -\frac{12}{35}$$
Check by replacing *x* with $-\frac{12}{35}$ in the original equation. The solution is $-\frac{12}{35}$.

6. $-y + 3 = -8$
$$-y + 3 - 3 = -8 - 3$$
$$-y = -11$$
$$\frac{-y}{-1} = \frac{-11}{-1}$$
$$y = 11$$
To check, replace *y* with 11 in the original equation. The solution is 11.

7. $6b - 11b = 18 + 2b - 6 + 9$
$$-5b = 21 + 2b$$
$$-5b - 2b = 21 + 2b - 2b$$
$$-7b = 21$$
$$\frac{-7b}{-7} = \frac{21}{-7}$$
$$b = -3$$
Check by replacing *b* with –3 in the original equation. The solution is –3.

8. $10x - 4 = 7x + 14$
$$10x - 4 - 7x = 7x + 14 - 7x$$
$$3x - 4 = 14$$
$$3x - 4 + 4 = 14 + 4$$
$$3x = 18$$
$$\frac{3x}{3} = \frac{18}{3}$$
$$x = 6$$
To check, replace *x* with 6 in the original equation to see that a true statement results. The solution is 6.

9. $4(3x - 2) = -1 + 4$
$$4(3x) - 4(2) = -1 + 4$$
$$12x - 8 = 3$$
$$12x - 8 + 8 = 3 + 8$$
$$12x = 11$$
$$\frac{12x}{12} = \frac{11}{12}$$
$$x = \frac{11}{12}$$
To check, replace *x* with $\frac{11}{12}$ in the original equation to see that a true statement results. The solution is $\frac{11}{12}$.

10. Let *x* = first integer.
x + 2 = second even integer.
x + 4 = third even integer.
x + (*x* + 2) + (*x* + 4) = 3*x* + 6

Vocabulary, Readiness & Video Check 2.3

1. By the <u>multiplication</u> property of equality, $y = \frac{1}{2}$ and $5\cdot y = 5\cdot\frac{1}{2}$ are equivalent equations.

2. The equations $\frac{z}{4} = 10$ and $4\cdot\frac{z}{4} = 10$ are not equivalent equations. The statement is false.

3. The equations –7*x* = 30 and $\frac{-7x}{-7} = \frac{30}{7}$ are not equivalent equations. The statement is false.

4. By the <u>multiplication</u> property of equality, 9*x* = –63 and $\frac{9x}{9} = \frac{-63}{9}$ are equivalent equations.

5. We can multiply both sides of an equation by the <u>same</u> nonzero number and have an equivalent equation.

6. addition property; multiplication property; answers may vary

7. (*x* + 1) + (*x* + 3) = 2*x* + 4

Exercise Set 2.3

2. $-7x = -49$

$$\frac{-7x}{-7} = \frac{-49}{-7}$$
$$x = 7$$

Check: $-7x = -49$

$$-7(7) \stackrel{?}{=} -49$$
$$-49 = -49$$

The solution is 7.

4. $2x = 0$

$$\frac{2x}{2} = \frac{0}{2}$$
$$x = 0$$

Check: $2x = 0$

$$2(0) \stackrel{?}{=} 0$$
$$0 = 0$$

The solution is 0.

6. $-y = 8$

$$\frac{-y}{-1} = \frac{8}{-1}$$
$$y = -8$$

Check: $-y = 8$

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

The solution is –8.

8. $\frac{3}{4}n = -15$

$$\frac{4}{3}\left(\frac{3}{4}n\right) = \frac{4}{3}(-15)$$
$$n = -20$$

Check: $\frac{3}{4}n = -15$

$$\frac{3}{4}(-20) \stackrel{?}{=} -15$$
$$-15 = -15$$

The solution is –20.

10. $\frac{1}{4} = \frac{1}{8}v$

$$8\left(\frac{1}{4}\right) = 8\left(\frac{1}{8}v\right)$$
$$2 = v$$

Check: $\frac{1}{4} = \frac{1}{8}v$

$$\frac{1}{4} \stackrel{?}{=} \frac{1}{8}(2)$$
$$\frac{1}{4} = \frac{1}{4}$$

The solution is 2.

12. $\frac{d}{15} = 2$

$$15\left(\frac{d}{15}\right) = 15(2)$$
$$d = 30$$

Check: $\frac{d}{15} = 2$

$$\frac{30}{15} \stackrel{?}{=} 2$$
$$2 = 2$$

The solution is 30.

14. $\frac{f}{-5} = 0$

$$-5\left(\frac{f}{-5}\right) = -5(0)$$
$$f = 0$$

Check: $\frac{f}{-5} = 0$

$$\frac{0}{-5} \stackrel{?}{=} 0$$
$$0 = 0$$

The solution is 0.

16. $19.55 = 8.5y$

$$\frac{19.55}{8.5} = \frac{8.5y}{8.5}$$
$$2.3 = y$$

Check: $19.55 = 8.5y$

$$19.55 \stackrel{?}{=} 8.5(2.3)$$
$$19.55 = 19.55$$

The solution is 2.3.

18. $3x - 1 = 26$

$$3x - 1 + 1 = 26 + 1$$
$$3x = 27$$
$$\frac{3x}{3} = \frac{27}{3}$$
$$x = 9$$

Check: $$\begin{aligned} 3x-1 &= 26 \\ 3(9)-1 &\stackrel{?}{=} 26 \\ 27-1 &\stackrel{?}{=} 26 \\ 26 &= 26 \end{aligned}$$
The solution is 9.

20. $$\begin{aligned} -x+4 &= -24 \\ -x+4-4 &= -24-4 \\ -x &= -28 \\ x &= 28 \end{aligned}$$
Check: $$\begin{aligned} -x+4 &= -24 \\ -(28)+4 &\stackrel{?}{=} -24 \\ -28+4 &\stackrel{?}{=} -24 \\ -24 &= -24 \end{aligned}$$
The solution is 28.

22. $$\begin{aligned} 8t+5 &= 5 \\ 8t+5-5 &= 5-5 \\ 8t &= 0 \\ \frac{8t}{8} &= \frac{0}{8} \\ t &= 0 \end{aligned}$$
Check: $$\begin{aligned} 8t+5 &= 5 \\ 8(0)+5 &\stackrel{?}{=} 5 \\ 0+5 &\stackrel{?}{=} 5 \\ 5 &= 5 \end{aligned}$$
The solution is 0.

24. $$\begin{aligned} \frac{b}{4}-1 &= -7 \\ \frac{b}{4}-1+1 &= -7+1 \\ \frac{b}{4} &= -6 \\ 4\left(\frac{b}{4}\right) &= 4(-6) \\ b &= -24 \end{aligned}$$
Check: $$\begin{aligned} \frac{b}{4}-1 &= -7 \\ \frac{-24}{4}-1 &\stackrel{?}{=} -7 \\ -6-1 &\stackrel{?}{=} -7 \\ -7 &= -7 \end{aligned}$$
The solution is −24.

26. $$\begin{aligned} 4a+a &= -1+3a-1-2 \\ 5a &= 3a-4 \\ 5a-3a &= 3a-4-3a \\ 2a &= -4 \\ \frac{2a}{2} &= \frac{-4}{2} \\ a &= -2 \end{aligned}$$
Check: $$\begin{aligned} 4a+a &= -1+3a-1-2 \\ 4(-2)+(-2) &\stackrel{?}{=} -1+3(-2)-1-2 \\ -8-2 &\stackrel{?}{=} -1-6-1-2 \\ -10 &= -10 \end{aligned}$$
The solution is −2.

28. $$\begin{aligned} 19 &= 0.4x-0.9x-6 \\ 19 &= -0.5x-6 \\ 19+6 &= -0.5x-6+6 \\ 25 &= -0.5x \\ \frac{25}{-0.5} &= \frac{-0.5x}{-0.5} \\ -50 &= x \end{aligned}$$
Check: $$\begin{aligned} 19 &= 0.4x-0.9x-6 \\ 19 &\stackrel{?}{=} 0.4(-50)-0.9(-50)-6 \\ 19 &\stackrel{?}{=} -20+45-6 \\ 19 &= 19 \end{aligned}$$
The solution is −50.

30. $$\begin{aligned} \frac{3}{5}x-14 &= -8 \\ \frac{3}{5}x-14+14 &= -8+14 \\ \frac{3}{5}x &= 6 \\ \frac{5}{3}\cdot\frac{3}{5}x &= \frac{5}{3}\cdot 6 \\ x &= 10 \end{aligned}$$
Check: $$\begin{aligned} \frac{3}{5}x-14 &= -8 \\ \frac{3}{5}\cdot 10-14 &\stackrel{?}{=} -8 \\ 6-14 &\stackrel{?}{=} -8 \\ -8 &= -8 \end{aligned}$$
The solution is 10.

32.
$$\begin{aligned} \frac{2}{7}z-\frac{1}{5}&=\frac{1}{2}\\ \frac{2}{7}z-\frac{1}{5}+\frac{1}{5}&=\frac{1}{2}+\frac{1}{5}\\ \frac{2}{7}z&=\frac{7}{10}\\ \frac{7}{2}\cdot\frac{2}{7}z&=\frac{7}{2}\cdot\frac{7}{10}\\ z&=\frac{49}{20} \end{aligned}$$

Check:
$$\begin{aligned} \frac{2}{7}z-\frac{1}{5}&=\frac{1}{2}\\ \frac{2}{7}\left(\frac{49}{20}\right)-\frac{1}{5}&\ 0\ \frac{1}{2}\\ \frac{7}{10}-\frac{1}{5}&\ 0\ \frac{1}{2}\\ \frac{5}{10}&\ 0\ \frac{1}{2}\\ \frac{1}{2}&=\frac{1}{2} \end{aligned}$$

The solution is $\frac{49}{20}$.

34.
$$\begin{aligned} 11x+13&=9x+9\\ 11x+13-9x&=9x+9-9x\\ 2x+13&=9\\ 2x+13-13&=9-13\\ 2x&=-4\\ \frac{2x}{2}&=\frac{-4}{2}\\ x&=-2 \end{aligned}$$

36.
$$\begin{aligned} 2(4x+1)&=-12+6\\ 8x+2&=-6\\ 8x+2-2&=-6-2\\ 8x&=-8\\ \frac{8x}{8}&=\frac{-8}{8}\\ x&=-1 \end{aligned}$$

38.
$$\begin{aligned} 6x-4&=-2x-10\\ 6x-4+2x&=-2x-10+2x\\ 8x-4&=-10\\ 8x-4+4&=-10+4\\ 8x&=-6\\ \frac{8x}{8}&=\frac{-6}{8}\\ x&=-\frac{3}{4} \end{aligned}$$

40.
$$\begin{aligned} 8+4&=-6(5x-2)\\ 12&=-30x+12\\ 12-12&=-30x+12-12\\ 0&=-30x\\ \frac{0}{-30}&=\frac{-30x}{-30}\\ 0&=x \end{aligned}$$

42.
$$\begin{aligned} -17z-4&=-16z-20\\ -17z-4+17z&=-16z-20+17z\\ -4&=z-20\\ -4+20&=z-20+20\\ 16&=z \end{aligned}$$

44.
$$\begin{aligned} \frac{1}{3}(3x-1)&=-\frac{1}{10}-\frac{2}{10}\\ x-\frac{1}{3}&=-\frac{3}{10}\\ x-\frac{1}{3}+\frac{1}{3}&=-\frac{3}{10}+\frac{1}{3}\\ x&=-\frac{9}{30}+\frac{10}{30}\\ x&=\frac{1}{30} \end{aligned}$$

46.
$$\begin{aligned} -14y-1.8&=-24y+3.9\\ -14y-1.8+24y&=-24y+3.9+24y\\ 10y-1.8&=3.9\\ 10y-1.8+1.8&=3.9+1.8\\ 10y&=5.7\\ \frac{10y}{10}&=\frac{5.7}{10}\\ y&=0.57 \end{aligned}$$

48.
$$\begin{aligned} -3x+15&=3x-15\\ -3x+15+3x&=3x-15+3x\\ 15&=6x-15\\ 15+15&=6x-15+15\\ 30&=6x\\ \frac{30}{6}&=\frac{6x}{6}\\ 5&=x \end{aligned}$$

50.
$$\begin{aligned} 81&=3x\\ \frac{81}{3}&=\frac{3x}{3}\\ 27&=x \end{aligned}$$

52.
$$\begin{aligned} 6.3 &= -0.6x \\ \frac{6.3}{-0.6} &= \frac{-0.6x}{-0.6} \\ -10.5 &= x \end{aligned}$$

54.
$$\begin{aligned} 10y+15 &= -5 \\ 10y+15-15 &= -5-15 \\ 10y &= -20 \\ \frac{10y}{10} &= \frac{-20}{10} \\ y &= -2 \end{aligned}$$

56.
$$\begin{aligned} 2-0.4p &= 2 \\ 2-2-0.4p &= 2-2 \\ -0.4p &= 0 \\ \frac{-0.4p}{-0.4} &= \frac{0}{-0.4} \\ p &= 0 \end{aligned}$$

58.
$$\begin{aligned} 20x-20 &= 16x-40 \\ 20x-20-16x &= 16x-40-16x \\ 4x-20 &= -40 \\ 4x-20+20 &= -40+20 \\ 4x &= -20 \\ \frac{4x}{4} &= \frac{-20}{4} \\ x &= -5 \end{aligned}$$

60.
$$\begin{aligned} 7(2x+1) &= 18x-19x \\ 14x+7 &= -x \\ 14x+7-14x &= -x-14x \\ 7 &= -15x \\ \frac{7}{-15} &= \frac{-15x}{-15} \\ -\frac{7}{15} &= x \end{aligned}$$

62.
$$\begin{aligned} -\frac{4}{5}r &= -5 \\ -\frac{5}{4}\left(-\frac{4}{5}r\right) &= -\frac{5}{4}(-5) \\ r &= \frac{25}{4} \end{aligned}$$

64.
$$\begin{aligned} -\frac{10}{3}x &= 30 \\ -\frac{3}{10}\left(-\frac{10}{3}x\right) &= -\frac{3}{10}(30) \\ x &= -9 \end{aligned}$$

66.
$$\begin{aligned} -3n-\frac{1}{3} &= \frac{8}{3} \\ -3n-\frac{1}{3}+\frac{1}{3} &= \frac{8}{3}+\frac{1}{3} \\ -3n &= \frac{9}{3} \\ -3n &= 3 \\ \frac{-3n}{-3} &= \frac{3}{-3} \\ n &= -1 \end{aligned}$$

68.
$$\begin{aligned} 12 &= 3j-4 \\ 12+4 &= 3j-4+4 \\ 16 &= 3j \\ \frac{16}{3} &= \frac{3j}{3} \\ \frac{16}{3} &= j \end{aligned}$$

70.
$$\begin{aligned} 12x+30+8x-6 &= 10 \\ 20x+24 &= 10 \\ 20x+24-24 &= 10-24 \\ 20x &= -14 \\ \frac{20x}{20} &= \frac{-14}{20} \\ x &= -\frac{7}{10} \end{aligned}$$

72.
$$\begin{aligned} t-6t &= -13+t-3t \\ -5t &= -2t-13 \\ -5t+2t &= -2t+2t-13 \\ -3t &= -13 \\ \frac{-3t}{-3} &= \frac{-13}{-3} \\ t &= \frac{13}{3} \end{aligned}$$

74.
$$\begin{aligned} x+\frac{3}{7} &= -x+\frac{1}{3}+\frac{4}{7} \\ x+\frac{3}{7} &= -x+\frac{19}{21} \\ x+\frac{3}{7}+x &= -x+\frac{19}{21}+x \\ 2x+\frac{3}{7} &= \frac{19}{21} \\ 2x+\frac{3}{7}-\frac{3}{7} &= \frac{19}{21}-\frac{3}{7} \\ 2x &= \frac{10}{21} \\ \frac{1}{2}\cdot 2x &= \frac{1}{2}\cdot\frac{10}{21} \\ x &= \frac{5}{21} \end{aligned}$$

76.
$$\begin{aligned} -19+74 &= -5(x+3) \\ 55 &= -5x-15 \\ 55+15 &= -5x-15+15 \\ 70 &= -5x \\ \frac{70}{-5} &= \frac{-5x}{-5} \\ -14 &= x \end{aligned}$$

78. Sum = first integer + second integer + third integer + fourth integer.
$$\begin{aligned} \text{Sum} &= x+(x+2)+(x+4)+(x+6) \\ &= x+x+2+x+4+x+6 \\ &= 4x+12 \end{aligned}$$

80. Sum = 20 + second integer.
$$\begin{aligned} \text{Sum} &= 20+(x+1) \\ &= 20+x+1 \\ &= x+21 \end{aligned}$$

82. Let x be an odd integer.
Then $x + 2$ is the next odd integer.
$x + (x + 2) + x + (x + 2) = 4x + 4$

84.
$$\begin{aligned} -7y+2y-3(y+1) &= -7y+2y-3\cdot y-3\cdot 1 \\ &= -7y+2y-3y-3 \\ &= -8y-3 \end{aligned}$$

86.
$$\begin{aligned} 8(z-6)+7z-1 &= 8\cdot z+8\cdot(-6)+7z-1 \\ &= 8z-48+7z-1 \\ &= 15z-49 \end{aligned}$$

88. $-(x-1)+x = -x+1+x = -x+x+1 = 1$

90.
$$\begin{aligned} &(-2)^4 = (-2)(-2)(-2)(-2) = 16 \\ &-2^4 = -2\cdot 2\cdot 2\cdot 2 = -16 \\ &(-2)^4 > -2^4 \end{aligned}$$

92.
$$\begin{aligned} &(-4)^3 = (-4)(-4)(-4) = -64 \\ &-4^3 = -4\cdot 4\cdot 4 = -64 \\ &(-4)^3 = -4^3 \end{aligned}$$

94.
$$\begin{aligned} \underline{\quad}\, x &= 10 \\ \underline{\quad}\cdot\frac{1}{2} &= 10 \\ \underline{\quad}\cdot\frac{1}{2}\cdot 2 &= 10\cdot 2 \\ \underline{\quad} &= 20 \end{aligned}$$

96. answers may vary

98. answers may vary

100.
$$\begin{aligned} 9x &= 13.5 \\ \frac{9x}{9} &= \frac{13.5}{9} \\ x &= 1.5 \end{aligned}$$
Each dose should be 1.5 milliliters.

102.
$$\begin{aligned} 4.95y &= -31.185 \\ \frac{4.95y}{4.95} &= \frac{-31.185}{4.95} \\ y &= -6.3 \end{aligned}$$

104.
$$\begin{aligned} 0.06y+2.63 &= 2.5562 \\ 0.06y+2.63-2.63 &= 2.5562-2.63 \\ 0.06y &= -0.0738 \\ \frac{0.06y}{0.06} &= \frac{-0.0738}{0.06} \\ y &= -1.23 \end{aligned}$$

Section 2.4 Practice Exercises

1.
$$\begin{aligned} 2(4a-9)+3 &= 5a-6 \\ 8a-18+3 &= 5a-6 \\ 8a-15 &= 5a-6 \\ 8a-15-5a &= 5a-6-5a \\ 3a-15 &= -6 \\ 3a-15+15 &= -6+15 \\ 3a &= 9 \\ \frac{3a}{3} &= \frac{9}{3} \\ a &= 3 \end{aligned}$$

$$\begin{aligned}
\text{Check:}\quad 2(4a-9)+3 &= 5a-6\\
2[4(3)-9]+3 &\stackrel{?}{=} 5(3)-6\\
2(12-9)+3 &\stackrel{?}{=} 15-6\\
2(3)+3 &\stackrel{?}{=} 9\\
6+3 &\stackrel{?}{=} 9\\
9 &= 1
\end{aligned}$$

The solution is 3 or the solution set is {3}.

2.
$$\begin{aligned}
7(x-3) &= -6x\\
7x-21 &= -6x\\
7x-21-7x &= -6x-7x\\
-21 &= -13x\\
\frac{-21}{-13} &= \frac{-13x}{-13}\\
\frac{21}{13} &= x
\end{aligned}$$

$$\begin{aligned}
\text{Check:}\quad 7(x-3) &= -6x\\
7\left(\frac{21}{13}-3\right) &\stackrel{?}{=} -6\left(\frac{21}{13}\right)\\
7\left(\frac{21}{13}-\frac{39}{13}\right) &\stackrel{?}{=} -\frac{126}{13}\\
7\left(-\frac{18}{13}\right) &\stackrel{?}{=} -\frac{126}{13}\\
-\frac{126}{13} &= -\frac{126}{13}
\end{aligned}$$

The solution is $\frac{21}{13}$.

3.
$$\begin{aligned}
\frac{3}{5}x-2 &= \frac{2}{3}x-1\\
15\left(\frac{3}{5}x-2\right) &= 15\left(\frac{2}{3}x-1\right)\\
15\left(\frac{3}{5}x\right)-15(2) &= 15\left(\frac{2}{3}x\right)-15(1)\\
9x-30 &= 10x-15\\
9x-30-9x &= 10x-15-9x\\
-30 &= x-15\\
-30+15 &= x-15+15\\
-15 &= x
\end{aligned}$$

$$\begin{aligned}
\text{Check:}\quad \frac{3}{5}x-2 &= \frac{2}{3}x-1\\
\frac{3}{5}\cdot -15-2 &\stackrel{?}{=} \frac{2}{3}\cdot -15-1\\
-9-2 &\stackrel{?}{=} -10-1\\
-11 &= -11
\end{aligned}$$

The solution is –15.

4.
$$\begin{aligned}
\frac{4(y+3)}{3} &= 5y-7\\
3\cdot\frac{4(y+3)}{3} &= 3\cdot(5y-7)\\
4(y+3) &= 3(5y-7)\\
4y+12 &= 15y-21\\
4y+12-4y &= 15y-21-4y\\
12 &= 11y-21\\
12+21 &= 11y-21+21\\
33 &= 11y\\
\frac{33}{11} &= \frac{11y}{11}\\
3 &= y
\end{aligned}$$

To check, replace *y* with 3 in the original equation. The solution is 3.

5.
$$\begin{aligned}
0.35x+0.09(x+4) &= 0.30(12)\\
100[0.35x+0.09(x+4)] &= 100[0.03(12)]\\
35x+9(x+4) &= 3(12)\\
35x+9x+36 &= 36\\
44x+36 &= 36\\
44x+36-36 &= 36-36\\
44x &= 0\\
\frac{44x}{44} &= \frac{0}{44}\\
x &= 0
\end{aligned}$$

To check, replace *x* with 0 in the original equation. The solution is 0.

6.
$$\begin{aligned}
4(x+4)-x &= 2(x+11)+x\\
4x+16-x &= 2x+22+x\\
3x+16 &= 3x+22\\
3x+16-3x &= 3x+22-3x\\
16 &= 22
\end{aligned}$$

There is no solution.

7.
$$\begin{aligned}
12x-18 &= 9(x-2)+3x\\
12x-18 &= 9x-18+3x\\
12x-18 &= 12x-18\\
12x-18+18 &= 12x-18+18\\
12x &= 12x\\
12x-12x &= 12x-12x\\
0 &= 0
\end{aligned}$$

The solution is all real numbers.

Calculator Explorations

1. Solution (–24 = –24)

2. Solution (–4 = –4)

3. Not a solution ($19.4 \neq 10.4$)

4. Not a solution ($-11.9 \neq -60.1$)

5. Solution (17,061 = 17,061)

6. Solution ($-316 = -316$)

Vocabulary, Readiness & Video Check 2.4

1. $x = -7$ is an equation.

2. $x - 7$ is an expression.

3. $4y - 6 + 9y + 1$ is an expression.

4. $4y - 6 = 9y + 1$ is an equation.

5. $\frac{1}{x} - \frac{x-1}{8}$ is an expression.

6. $\frac{1}{x} - \frac{x-1}{8} = 6$ is an equation.

7. $0.1x + 9 = 0.2x$ is an equation.

8. $0.1x^2 + 9y - 0.2x^2$ is an expression.

9. 3; distributive property, addition property of equality, multiplication property of equality

10. Because both sides have more than one term, you need to apply the distributive property to make sure you multiply every single term in the equation by the LCD.

11. The number of decimal places in each number helps you determine what power of 10 you can multiply through by so you are no longer dealing with decimals.

12. When solving a linear equation and all variable terms, subtract out:

a. If you have a true statement, then the equation has <u>all real numbers as a</u> solution.

b. If you have a false statement, then the equation has <u>no</u> solution.

Exercise Set 2.4

2.
$$\begin{aligned}
-3x+1 &= -2(4x+2)\\
-3x+1 &= -8x-4\\
-3x+1-1 &= -8x-4-1\\
-3x &= -8x-5\\
-3x+8x &= -8x-5+8x\\
5x &= -5\\
\frac{5x}{5} &= \frac{-5}{5}\\
x &= -1
\end{aligned}$$

4.
$$\begin{aligned}
15x-5 &= 7+12x\\
15x-5+5 &= 7+12x+5\\
15x &= 12+12x\\
15x-12x &= 12+12x-12x\\
3x &= 12\\
\frac{3x}{3} &= \frac{12}{3}\\
x &= 4
\end{aligned}$$

6.
$$\begin{aligned}
-(5x-10) &= 5x\\
-5x+10 &= 5x\\
-5x+10+5x &= 5x+5x\\
10 &= 10x\\
\frac{10}{10} &= \frac{10x}{10}\\
1 &= x
\end{aligned}$$

8.
$$\begin{aligned}
3(2-5x)+4(6x) &= 12\\
6-15x+24x &= 12\\
6+9x &= 12\\
6-6+9x &= 12-6\\
9x &= 6\\
\frac{9x}{9} &= \frac{6}{9}\\
x &= \frac{2}{3}
\end{aligned}$$

10.
$$\begin{aligned}
-4(n-4)-23 &= -7\\
-4n+16-23 &= -7\\
-4n-7 &= -7\\
-4n-7+7 &= -7+7\\
-4n &= 0\\
\frac{-4n}{-4} &= \frac{0}{-4}\\
n &= 0
\end{aligned}$$

12.
$$\begin{aligned}
5-6(2+b) &= b-14\\
5-12-6b &= b-14\\
-7-6b &= b-14\\
-7-6b-b &= b-b-14\\
-7-7b &= -14\\
-7+7-7b &= -14+7\\
-7b &= -7\\
\frac{-7b}{-7} &= \frac{-7}{-7}\\
b &= 1
\end{aligned}$$

14.
$$\begin{aligned}
6y-8 &= -6+3y+13\\
6y-8 &= 3y+7\\
6y-3y-8 &= 3y-3y+7\\
3y-8 &= 7\\
3y-8+8 &= 7+8\\
3y &= 15\\
\frac{3y}{3} &= \frac{15}{3}\\
y &= 5
\end{aligned}$$

16.
$$\begin{aligned}
-7n+5 &= 8n-10\\
-7n+5-5 &= 8n-10-5\\
-7n &= 8n-15\\
-7n-8n &= 8n-15-8n\\
-15n &= -15\\
\frac{-15n}{-15} &= \frac{-15}{-15}\\
n &= 1
\end{aligned}$$

18.
$$\begin{aligned}
\frac{4}{5}x-\frac{8}{5} &= -\frac{16}{5}\\
5\left(\frac{4}{5}x-\frac{8}{5}\right) &= 5\left(-\frac{16}{5}\right)\\
4x-8 &= -16\\
4x-8+8 &= -16+8\\
4x &= -8\\
\frac{4x}{4} &= \frac{-8}{4}\\
x &= -2
\end{aligned}$$

20.
$$\begin{aligned}
\frac{2}{9}x-\frac{1}{3} &= 1\\
9\left(\frac{2}{9}x-\frac{1}{3}\right) &= 9(1)\\
2x-3 &= 9\\
2x-3+3 &= 9+3\\
2x &= 12\\
\frac{2x}{2} &= \frac{12}{2}\\
x &= 6
\end{aligned}$$

22.
$$\begin{aligned}
0.40x+0.06(30) &= 9.8\\
100[0.40x+0.06(30)] &= 100(9.8)\\
40x+6(30) &= 980\\
40x+180 &= 980\\
40x+180-180 &= 980-180\\
40x &= 800\\
\frac{40x}{40} &= \frac{800}{40}\\
x &= 20
\end{aligned}$$

24.
$$\begin{aligned}
\frac{3(y+3)}{5} &= 2y+6\\
5\left[\frac{3(y+3)}{5}\right] &= 5[2y+6]\\
3(y+3) &= 10y+30\\
3y+9 &= 10y+30\\
3y-10y+9 &= 10y-10y+30\\
-7y+9 &= 30\\
-7y+9-9 &= 30-9\\
-7y &= 21\\
\frac{-7y}{-7} &= \frac{21}{-7}\\
y &= -3
\end{aligned}$$

26.
$$\begin{aligned}
\frac{5}{2}x-1 &= x+\frac{1}{4}\\
4\left(\frac{5}{2}x-1\right) &= 4\left(x+\frac{1}{4}\right)\\
10x-4 &= 4x+1\\
10x-4x-4 &= 4x-4x+1\\
6x-4 &= 1\\
6x-4+4 &= 1+4\\
6x &= 5\\
\frac{6x}{6} &= \frac{5}{6}\\
x &= \frac{5}{6}
\end{aligned}$$

28.
$$\begin{aligned}
0.60(z-300)+0.05z &= 0.70z-205\\
100[0.60(z-300)+0.05z] &= 100[0.70z-205]\\
60(z-300)+5z &= 70z-20{,}500\\
60z-18{,}000+5z &= 70z-20{,}500\\
65z-18{,}000 &= 70z-20{,}500\\
65z-70z-18{,}000 &= 70z-70z-20{,}500\\
-5z-18{,}000 &= -20{,}500\\
-5z-18{,}000+18{,}000 &= -20{,}500+18{,}000\\
-5z &= -2500\\
\frac{-5z}{-5} &= \frac{-2500}{-5}\\
z &= 500
\end{aligned}$$

30.
$$\begin{aligned}
14x+7 &= 7(2x+1)\\
14x+7 &= 14x+7\\
14x+7-14x &= 14x+7-14x\\
7 &= 7
\end{aligned}$$
All real numbers are solutions.

32.
$$\begin{aligned}
\frac{x}{3}-2 &= \frac{x}{3}\\
3\left(\frac{x}{3}-2\right) &= 3\left(\frac{x}{3}\right)\\
x-6 &= x\\
x-x-6 &= x-x\\
-6 &= 0
\end{aligned}$$
There is no solution.

34.
$$\begin{aligned}
2(x-5) &= 2x+10\\
2x-10 &= 2x+10\\
2x-2x-10 &= 2x-2x+10\\
-10 &= 10
\end{aligned}$$
There is no solution.

36.
$$\begin{aligned}
-5(4y-3)+2 &= -20y+17\\
-20y+15+2 &= -20y+17\\
-20y+17 &= -20y+17\\
-20y+17+20y &= -20y+17+20y\\
17 &= 17
\end{aligned}$$
All real numbers are solutions.

38.
$$\begin{aligned}
\frac{4(5-w)}{3} &= -w\\
3\left[\frac{4(5-w)}{3}\right] &= 3(-w)\\
4(5-w) &= -3w\\
20-4w &= -3w\\
20-4w+4w &= -3w+4w\\
20 &= w
\end{aligned}$$

40.
$$\begin{aligned}
-(4a-7)-5a &= 10+a\\
-4a+7-5a &= 10+a\\
-9a+7 &= 10+a\\
-9a-a+7 &= 10+a-a\\
-10a+7 &= 10\\
-10a+7-7 &= 10-7\\
-10a &= 3\\
\frac{-10a}{-10} &= \frac{3}{-10}\\
a &= -\frac{3}{10}
\end{aligned}$$

42.
$$\begin{aligned}
9x+3(x-4) &= 10(x-5)+7\\
9x+3x-12 &= 10x-50+7\\
12x-12 &= 10x-43\\
12x-12+12 &= 10x-43+12\\
12x &= 10x-31\\
12x-10x &= 10x-31-10x\\
2x &= -31\\
\frac{2x}{2} &= \frac{-31}{2}\\
x &= -\frac{31}{2}
\end{aligned}$$

44.
$$\begin{aligned}
\frac{5(x-1)}{4} &= \frac{3(x+1)}{2}\\
4\left[\frac{5(x-1)}{4}\right] &= 4\left[\frac{3(x+1)}{2}\right]\\
5(x-1) &= 6(x+1)\\
5x-5 &= 6x+6\\
5x-6x-5 &= 6x-6x+6\\
-x-5 &= 6\\
-x-5+5 &= 6+5\\
-x &= 11\\
\frac{-x}{-1} &= \frac{11}{-1}\\
x &= -11
\end{aligned}$$

46.
$$\begin{aligned}
0.9x-4.1 &= 0.4\\
10(0.9x-4.1) &= 10(0.4)\\
9x-41 &= 4\\
9x-41+41 &= 4+41\\
9x &= 45\\
\frac{9x}{9} &= \frac{45}{9}\\
x &= 5
\end{aligned}$$

48. $$\begin{aligned} 3(2x-1)+5 &= 6x+2 \\ 6x-3+5 &= 6x+2 \\ 6x+2 &= 6x+2 \\ 6x-6x+2 &= 6x-6x+2 \\ 2 &= 2 \end{aligned}$$
All real numbers are solutions.

50. $$\begin{aligned} 4(4y+2) &= 2(1+6y)+8 \\ 16y+8 &= 2+12y+8 \\ 16y+8 &= 10+12y \\ 16y+8-8 &= 10+12y-8 \\ 16y &= 2+12y \\ 16y-12y &= 2+12y-12y \\ 4y &= 2 \\ \frac{4y}{4} &= \frac{2}{4} \\ y &= \frac{1}{2} \end{aligned}$$

52. $$\begin{aligned} \frac{7}{8}x+\frac{1}{4} &= \frac{3}{4}x \\ 8\left(\frac{7}{8}x+\frac{1}{4}\right) &= 8\left(\frac{3}{4}x\right) \\ 7x+2 &= 6x \\ 7x+2-7x &= 6x-7x \\ 2 &= -x \\ \frac{2}{-1} &= \frac{-x}{-1} \\ -2 &= x \end{aligned}$$

54. $$\begin{aligned} \frac{x}{5}-7 &= \frac{x}{3}-5 \\ 15\left(\frac{x}{5}-7\right) &= 15\left(\frac{x}{3}-5\right) \\ 3x-105 &= 5x-75 \\ 3x-105-3x &= 5x-75-3x \\ -105 &= 2x-75 \\ -105+75 &= 2x-75+75 \\ -30 &= 2x \\ \frac{-30}{2} &= \frac{2x}{2} \\ -15 &= x \end{aligned}$$

56. $$\begin{aligned} 4(2+x)+1 &= 7x-3(x-2) \\ 8+4x+1 &= 7x-3x+6 \\ 9+4x &= 4x+6 \\ 9+4x-4x &= 4x-4x+6 \\ 9 &= 6 \end{aligned}$$
There is no solution.

58. $$\begin{aligned} -0.01(5x+4) &= 0.04-0.01(x+4) \\ 100[-0.01(5x+4)] &= 100[0.04-0.01(x+4)] \\ -(5x+4) &= 4-1(x+4) \\ -5x-4 &= 4-x-4 \\ -5x-4 &= -x \\ -5x+x-4 &= -x+x \\ -4x-4 &= 0 \\ -4x-4+4 &= 0+4 \\ -4x &= 4 \\ \frac{-4x}{-4} &= \frac{4}{-4} \\ x &= -1 \end{aligned}$$

60. $$\begin{aligned} 3-\frac{1}{2}x &= 5x-8 \\ 2\left(3-\frac{1}{2}x\right) &= 2(5x-8) \\ 6-x &= 10x-16 \\ 6-x+x &= 10x-16+x \\ 6 &= 11x-16 \\ 6+16 &= 11x-16+16 \\ 22 &= 11x \\ \frac{22}{11} &= \frac{11x}{11} \\ 2 &= x \end{aligned}$$

62. $$\begin{aligned} 7n+5 &= 10n-10 \\ 7n+5-5 &= 10n-10-5 \\ 7n &= 10n-15 \\ 7n-10n &= 10n-15-10n \\ -3n &= -15 \\ \frac{-3n}{-3} &= \frac{-15}{-3} \\ n &= 5 \end{aligned}$$

64. $$\begin{aligned} 0.2x-0.1 &= 0.6x-2.1 \\ 10(0.2x-0.1) &= 10(0.6x-2.1) \\ 2x-1 &= 6x-21 \\ 2x-6x-1 &= 6x-6x-21 \\ -4x-1 &= -21 \\ -4x-1+1 &= -21+1 \\ -4x &= -20 \\ \frac{-4x}{-4} &= \frac{-20}{-4} \\ x &= 5 \end{aligned}$$

66.
$$\begin{aligned} 0.03(2m+7) &= 0.06(5+m)-0.09 \\ 100[0.03(2m+7)] &= 100[0.06(5+m)-0.09] \\ 3(2m+7) &= 6(5+m)-9 \\ 6m+21 &= 30+6m-9 \\ 6m+21 &= 21+6m \\ 6m-6m+21 &= 21+6m-6m \\ 21 &= 21 \end{aligned}$$
All real numbers are solutions.

68.
$$\begin{array}{cccc} 3 & \text{times} & \text{a number} & \\ \downarrow & \downarrow & \downarrow & \\ 3 & \cdot & x & =3x \end{array}$$

70.
$$\begin{array}{ccc} 8 & \text{minus} & \text{twice a number} \\ \downarrow & \downarrow & \downarrow \\ 8 & - & 2x \end{array}$$

72.
$$\begin{array}{cccc} \text{the quotient of } -12 & \text{and} & \text{the difference of a number and 3} & \\ \downarrow & \downarrow & \downarrow & \\ -12 & \div & (x-3) & =\dfrac{-12}{x-3} \end{array}$$

74. $x + (7x - 9) = x + 7x - 9 = 8x - 9$
The total length is $(8x - 9)$ feet.

76. **a.**
$$\begin{aligned} x+3 &= x+5 \\ x+3-x &= x+5-x \\ 3 &= 5 \end{aligned}$$
There is no solution.

b. answers may vary

c. answers may vary

78.
$$\begin{aligned} 3x+1 &= 3x+2 \\ 3x+1-3x &= 3x+2-3x \\ 1 &= 2 \end{aligned}$$
There is no solution. The answer is B.

80.
$$\begin{aligned} x-11x-3 &= -10x-1-2 \\ -10x-3 &= -10x-3 \\ -10x-3+10x &= -10x-3+10x \\ -3 &= -3 \end{aligned}$$
All real numbers are solutions. The answer is A.

82.
$$\begin{aligned} -x+15 &= x+15 \\ -x+15+x &= x+15+x \\ 15 &= 2x+15 \\ 15-15 &= 2x+15-15 \\ 0 &= 2x \\ \frac{0}{2} &= \frac{2x}{2} \\ 0 &= x \end{aligned}$$
The answer is C.

84. answers may vary

86. **a.** Since the perimeter is the sum of the lengths of the sides, $x + (2x + 1) + (3x - 2) = 35$.

b.
$$\begin{aligned} x+2x+1+3x-2 &= 35 \\ 6x-1 &= 35 \\ 6x-1+1 &= 35+1 \\ 6x &= 36 \\ \frac{6x}{6} &= \frac{36}{6} \\ x &= 6 \end{aligned}$$

c. $2x + 1 = 2(6) + 1 = 13$
$3x - 2 = 3(6) - 2 = 16$
The lengths are $x = 6$ meters,
$2x + 1 = 13$ meters and $3x - 2 = 16$ meters.

88. answers may vary

90.
$$\begin{aligned} 1000(x+40) &= 100(16+7x) \\ 1000x+40,000 &= 1600+700x \\ 1000x+40,000-700x &= 1600+700x-700x \\ 300x+40,000 &= 1600 \\ 300x+40,000-40,000 &= 1600-40,000 \\ 300x &= -38,400 \\ \frac{300x}{300} &= \frac{-38,400}{300} \\ x &= -128 \end{aligned}$$

92.
$$\begin{aligned} 0.127x-2.685 &= 0.027x-2.38 \\ 1000(0.127x-2.685) &= 1000(0.027x-2.38) \\ 127x-2685 &= 27x-2380 \\ 127x-27x-2685 &= 27x-27x-2380 \\ 100x-2685 &= -2380 \\ 100x-2685+2685 &= -2380+2685 \\ 100x &= 305 \\ \frac{100x}{100} &= \frac{305}{100} \\ x &= 3.05 \end{aligned}$$

94.
$$\begin{aligned} t^2-6t &= t(8+t) \\ t^2-6t &= 8t+t^2 \\ t^2-t^2-6t &= 8t+t^2-t^2 \\ -6t &= 8t \\ -6t+6t &= 8t+6t \\ 0 &= 14t \\ \frac{0}{14} &= \frac{14t}{14} \\ 0 &= t \end{aligned}$$

96.
$$\begin{aligned} y^2-4y+10 &= y(y-5) \\ y^2-4y+10 &= y^2-5y \\ y^2-y^2-4y+10 &= y^2-y^2-5y \\ -4y+10 &= -5y \\ -4y+5y+10 &= -5y+5y \\ y+10 &= 0 \\ y+10-10 &= -10 \\ y &= -10 \end{aligned}$$

Integrated Review

1.
$$\begin{aligned} x-10 &= -4 \\ x-10+10 &= -4+10 \\ x &= 6 \end{aligned}$$

2.
$$\begin{aligned} y+14 &= -3 \\ y+14-14 &= -3-14 \\ y &= -17 \end{aligned}$$

3.
$$\begin{aligned} 9y &= 108 \\ \frac{9y}{9} &= \frac{108}{9} \\ y &= 12 \end{aligned}$$

4.
$$\begin{aligned} -3x &= 78 \\ \frac{-3x}{-3} &= \frac{78}{-3} \\ x &= -26 \end{aligned}$$

5.
$$\begin{aligned} -6x+7 &= 25 \\ -6x+7-7 &= 25-7 \\ -6x &= 18 \\ \frac{-6x}{-6} &= \frac{18}{-6} \\ x &= -3 \end{aligned}$$

6.
$$\begin{aligned} 5y-42 &= -47 \\ 5y-42+42 &= -47+42 \\ 5y &= -5 \\ \frac{5y}{5} &= \frac{-5}{5} \\ y &= -1 \end{aligned}$$

7.
$$\begin{aligned} \frac{2}{3}x &= 9 \\ \frac{3}{2}\left(\frac{2}{3}x\right) &= \frac{3}{2}(9) \\ x &= \frac{27}{2} \end{aligned}$$

8.
$$\begin{aligned} \frac{4}{5}z &= 10 \\ \frac{5}{4}\left(\frac{4}{5}z\right) &= \frac{5}{4}(10) \\ z &= \frac{25}{2} \end{aligned}$$

9.
$$\begin{aligned} \frac{r}{-4} &= -2 \\ -4\left(\frac{r}{-4}\right) &= -4(-2) \\ r &= 8 \end{aligned}$$

10.
$$\begin{aligned} \frac{y}{-8} &= 8 \\ -8\left(\frac{y}{-8}\right) &= -8(8) \\ y &= -64 \end{aligned}$$

11.
$$\begin{aligned} 6-2x+8 &= 10 \\ -2x+14 &= 10 \\ -2x+14-14 &= 10-14 \\ -2x &= -4 \\ \frac{-2x}{-2} &= \frac{-4}{-2} \\ x &= 2 \end{aligned}$$

12.
$$\begin{aligned} -5-6y+6 &= 19 \\ -6y+1 &= 19 \\ -6y+1-1 &= 19-1 \\ -6y &= 18 \\ \frac{-6y}{-6} &= \frac{18}{-6} \\ y &= -3 \end{aligned}$$

13.
$$\begin{aligned} 2x-7&=2x-27\\ 2x-2x-7&=2x-2x-27\\ -7&=-27 \end{aligned}$$
There is no solution.

14.
$$\begin{aligned} 3+8y&=8y-2\\ 3+8y-8y&=8y-8y-2\\ 3&=-2 \end{aligned}$$
There is no solution.

15.
$$\begin{aligned} -3a+6+5a&=7a-8a\\ 2a+6&=-a\\ 2a-2a+6&=-a-2a\\ 6&=-3a\\ \frac{6}{-3}&=\frac{-3a}{-3}\\ -2&=a \end{aligned}$$

16.
$$\begin{aligned} 4b-8-b&=10b-3b\\ 3b-8&=7b\\ 3b-3b-8&=7b-3b\\ -8&=4b\\ \frac{-8}{4}&=\frac{4b}{4}\\ -2&=b \end{aligned}$$

17.
$$\begin{aligned} -\frac{2}{3}x&=\frac{5}{9}\\ -\frac{3}{2}\left(-\frac{2}{3}x\right)&=-\frac{3}{2}\left(\frac{5}{9}\right)\\ x&=-\frac{5}{6} \end{aligned}$$

18.
$$\begin{aligned} -\frac{3}{8}y&=-\frac{1}{16}\\ -\frac{8}{3}\left(-\frac{3}{8}y\right)&=-\frac{8}{3}\left(-\frac{1}{16}\right)\\ y&=\frac{1}{6} \end{aligned}$$

19.
$$\begin{aligned} 10&=-6n+16\\ 10-16&=-6n+16-16\\ -6&=-6n\\ \frac{-6}{-6}&=\frac{-6n}{-6}\\ 1&=n \end{aligned}$$

20.
$$\begin{aligned} -5&=-2m+7\\ -5-7&=-2m+7-7\\ -12&=-2m\\ \frac{-12}{-2}&=\frac{-2m}{-2}\\ 6&=m \end{aligned}$$

21.
$$\begin{aligned} 3(5c-1)-2&=13c+3\\ 15c-3-2&=13c+3\\ 15c-5&=13c+3\\ 15c-13c-5&=13c-13c+3\\ 2c-5&=3\\ 2c-5+5&=3+5\\ 2c&=8\\ \frac{2c}{2}&=\frac{8}{2}\\ c&=4 \end{aligned}$$

22.
$$\begin{aligned} 4(3t+4)-20&=3+5t\\ 12t+16-20&=3+5t\\ 12t-4&=3+5t\\ 12t-5t-4&=3+5t-5t\\ 7t-4&=3\\ 7t-4+4&=3+4\\ 7t&=7\\ \frac{7t}{7}&=\frac{7}{7}\\ t&=1 \end{aligned}$$

23.
$$\begin{aligned} \frac{2(z+3)}{3}&=5-z\\ 3\left[\frac{2(z+3)}{3}\right]&=3(5-z)\\ 2z+6&=15-3z\\ 2z+3z+6&=15-3z+3z\\ 5z+6&=15\\ 5z+6-6&=15-6\\ 5z&=9\\ \frac{5z}{5}&=\frac{9}{5}\\ z&=\frac{9}{5} \end{aligned}$$

24.
$$\begin{aligned}
\frac{3(w+2)}{4} &= 2w+3\\
4\left[\frac{3(w+2)}{4}\right] &= 4(2w+3)\\
3w+6 &= 8w+12\\
3w-8w+6 &= 8w-8w+12\\
-5w+6 &= 12\\
-5w+6-6 &= 12-6\\
-5w &= 6\\
\frac{-5w}{-5} &= \frac{6}{-5}\\
w &= -\frac{6}{5}
\end{aligned}$$

25.
$$\begin{aligned}
-2(2x-5) &= -3x+7-x+3\\
-4x+10 &= -4x+10\\
-4x+4x+10 &= -4x+4x+10\\
10 &= 10
\end{aligned}$$
All real numbers are solutions.

26.
$$\begin{aligned}
-4(5x-2) &= -12x+4-8x+4\\
-20x+8 &= -20x+8\\
-20x+20x+8 &= -20x+20x+8\\
8 &= 8
\end{aligned}$$
All real numbers are solutions.

27.
$$\begin{aligned}
0.02(6t-3) &= 0.04(t-2)+0.02\\
100[0.02(6t-3)] &= 100[0.04(t-2)+0.02]\\
2(6t-3) &= 4(t-2)+2\\
12t-6 &= 4t-8+2\\
12t-6 &= 4t-6\\
12t-4t-6 &= 4t-4t-6\\
8t-6 &= -6\\
8t-6+6 &= -6+6\\
8t &= 0\\
\frac{8t}{8} &= \frac{0}{8}\\
t &= 0
\end{aligned}$$

28.
$$\begin{aligned}
0.03(m+7) &= 0.02(5-m)+0.03\\
100[0.03(m+7)] &= 100[0.02(5-m)+0.03]\\
3(m+7) &= 2(5-m)+3\\
3m+21 &= 10-2m+3\\
3m+21 &= 13-2m\\
3m+2m+21 &= 13-2m+2m\\
5m+21 &= 13\\
5m+21-21 &= 13-21\\
5m &= -8\\
\frac{5m}{5} &= \frac{-8}{5}\\
m &= -\frac{8}{5} = -1.6
\end{aligned}$$

29.
$$\begin{aligned}
-3y &= \frac{4(y-1)}{5}\\
5(-3y) &= 5\left[\frac{4(y-1)}{5}\right]\\
-15y &= 4y-4\\
-15y-4y &= 4y-4y-4\\
-19y &= -4\\
\frac{-19y}{-19} &= \frac{-4}{-19}\\
y &= \frac{4}{19}
\end{aligned}$$

30.
$$\begin{aligned}
-4x &= \frac{5(1-x)}{6}\\
6(-4x) &= 6\left[\frac{5(1-x)}{6}\right]\\
-24x &= 5-5x\\
-24x+5x &= 5-5x+5x\\
-19x &= 5\\
\frac{-19x}{-19} &= \frac{5}{-19}\\
x &= -\frac{5}{19}
\end{aligned}$$

31.
$$\begin{aligned}
\frac{5}{3}x-\frac{7}{3} &= x\\
3\left(\frac{5}{3}x-\frac{7}{3}\right) &= 3(x)\\
5x-7 &= 3x\\
5x-5x-7 &= 3x-5x\\
-7 &= -2x\\
\frac{-7}{-2} &= \frac{-2x}{-2}\\
\frac{7}{2} &= x
\end{aligned}$$

32. $$\begin{aligned}\frac{7}{5}n+\frac{3}{5}&=-n\\5\left(\frac{7}{5}n+\frac{3}{5}\right)&=5(-n)\\7n+3&=-5n\\7n-7n+3&=-5n-7n\\3&=-12n\\\frac{3}{-12}&=\frac{-12n}{-12}\\-\frac{1}{4}&=n\end{aligned}$$

33. $$\begin{aligned}9(3x-1)&=-4+49\\27x-9&=45\\27x-9+9&=45+9\\27x&=54\\\frac{27x}{27}&=\frac{54}{27}\\x&=2\end{aligned}$$

34. $$\begin{aligned}12(2x+1)&=-6+66\\24x+12&=60\\24x+12-12&=60-12\\24x&=48\\\frac{24x}{24}&=\frac{48}{24}\\x&=2\end{aligned}$$

35. $$\begin{aligned}\frac{1}{10}(3x-7)&=\frac{3}{10}x+5\\10\left[\frac{1}{10}(3x-7)\right]&=10\left(\frac{3}{10}x+5\right)\\3x-7&=3x+50\\3x-7-3x&=3x+50-3x\\-7&=50\end{aligned}$$

There is no solution.

36. $$\begin{aligned}\frac{1}{7}(2x-5)&=\frac{2}{7}x+1\\7\left[\frac{1}{7}(2x-5)\right]&=7\left(\frac{2}{7}x+1\right)\\2x-5&=2x+7\\2x-5-2x&=2x+7-2x\\-5&=7\end{aligned}$$

There is no solution.

37. $$\begin{aligned}5+2(3x-6)&=-4(6x-7)\\5+6x-12&=-24x+28\\6x-7&=-24x+28\\6x-7+24x&=-24x+28+24x\\30x-7&=28\\30x-7+7&=28+7\\30x&=35\\\frac{30x}{30}&=\frac{35}{30}\\x&=\frac{7}{6}\end{aligned}$$

38. $$\begin{aligned}3+5(2x-4)&=-7(5x+2)\\3+10x-20&=-35x-14\\10x-17&=-35x-14\\10x-17+35x&=-35x-14+35x\\45x-17&=-14\\45x-17+17&=-14+17\\45x&=3\\\frac{45x}{45}&=\frac{3}{45}\\x&=\frac{1}{15}\end{aligned}$$

Section 2.5 Practice Exercises

1. Let x = the number.

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

The number is 9.

2. Let x = the number.

$$\begin{aligned}3x-4&=2(x-1)\\3x-4&=2x-2\\3x-4-2x&=2x-2-2x\\x-4&=-2\\x-4+4&=-2+4\\x&=2\end{aligned}$$

The number is 2.

3. Let x = the length of short piece, then $4x$ = the length of long piece.

$$\begin{aligned} x+4x &= 45 \\ 5x &= 45 \\ \frac{5x}{5} &= \frac{45}{5} \\ x &= 9 \end{aligned}$$

$4x = 4(9) = 36$

The short piece is 9 inches and the long piece is 36 inches.

4. Let x = number of Republican governors, then $x - 7$ = number of Democratic governors.

$$\begin{aligned} x+x-7 &= 49 \\ 2x-7 &= 49 \\ 2x-7+7 &= 49+7 \\ 2x &= 56 \\ \frac{2x}{2} &= \frac{56}{2} \\ x &= 28 \end{aligned}$$

$x - 7 = 28 - 7 = 21$

There were 28 Republican and 21 Democratic governors.

5. x = degree measure of first angle
$3x$ = degree measure of second angle
$x + 55$ = degree measure of third angle

$$\begin{aligned} x+3x+(x+55) &= 180 \\ 5x+55 &= 180 \\ 5x+55-55 &= 180-55 \\ 5x &= 125 \\ \frac{5x}{5} &= \frac{125}{5} \\ x &= 25 \end{aligned}$$

$3x = 3(25) = 75$
$x + 55 = 25 + 55 = 80$

The measures of the angles are 25°, 75°, and 80°.

6. Let x = the first even integer, then $x + 2$ = the second even integer, and $x + 4$ = the third even integer.

$$\begin{aligned} x+(x+2)+(x+4) &= 144 \\ 3x+6 &= 144 \\ 3x+6-6 &= 144-6 \\ 3x &= 138 \\ \frac{3x}{3} &= \frac{138}{3} \\ x &= 46 \end{aligned}$$

$x + 2 = 46 + 2 = 48$
$x + 4 = 46 + 4 = 50$

The integers are 46, 48, and 50.

Vocabulary, Readiness & Video Check 2.5

1. $2x$; $2x - 31$

2. $3x$; $3x + 17$

3. $x + 5$; $2(x + 5)$

4. $x - 11$; $7(x - 11)$

5. $20 - y$; $\frac{20-y}{3}$ or $(20 - y) \div 3$

6. $-10 + y$; $\frac{-10+y}{9}$ or $(-10 + y) \div 9$

7. in the statement of the application

8. The original application asks for the measure of two supplementary angles. The solution of $x = 43$ only gives us the measure of one of the angles.

9. That the 3 angle measures are consecutive even integers and that they sum to 180°.

Exercise Set 2.5

2. Let x = the number.

$$\begin{aligned} 3x-1 &= 2x \\ 3x-1-3x &= 2x-3x \\ 3x-1-3x &= 2x-3x \\ -1 &= -x \\ \frac{-1}{-1} &= \frac{-x}{-1} \\ 1 &= x \end{aligned}$$

The number is 1.

4. Let x = the number.

$$\begin{aligned} 4x+(-2) &= 5x+(-2) \\ 4x-2 &= 5x-2 \\ 4x-2+2 &= 5x-2+2 \\ 4x &= 5x \\ 4x-4x &= 5x-4x \\ 0 &= x \end{aligned}$$

The number is 0.

6. Let x = the number.

$$\begin{aligned} 5[x+(-1)] &= 6(x-5) \\ 5x+5(-1) &= 6x+6(-5) \\ 5x-5 &= 6x-30 \\ 5x-5x-5 &= 6x-5x-30 \\ -5 &= x-30 \\ -5+30 &= x-30+30 \\ 25 &= x \end{aligned}$$

The number is 25.

8. Let x = the number.

$$\begin{aligned} 2(x-4) &= x-\frac{1}{4} \\ 2x-8 &= x-\frac{1}{4} \\ 4(2x-8) &= 4\left(x-\frac{1}{4}\right) \\ 8x-32 &= 4x-1 \\ 8x-4x-32 &= 4x-4x-1 \\ 4x-32 &= -1 \\ 4x-32+32 &= -1+32 \\ 4x &= 31 \\ \frac{4x}{4} &= \frac{31}{4} \end{aligned}$$

The number is $\frac{31}{4}$.

10. The sum of the three lengths is 46 feet.

$$\begin{aligned} x+3x+2+7x &= 46 \\ 11x+2 &= 46 \\ 11x+2-2 &= 46-2 \\ 11x &= 44 \\ \frac{11x}{11} &= \frac{44}{11} \\ x &= 4 \end{aligned}$$

$3x = 3(4) = 12$

$2 + 7x = 2 + 7(4) = 2 + 28 = 30$

The lengths are 4 feet, 12 feet, and 30 feet.

12. Let x be the length of the shorter piece. Then $3x$ is the length of the 2nd piece and the 3rd piece. The sum of the lengths is 21 feet.

$$\begin{aligned} x+3x+3x &= 21 \\ 7x &= 21 \\ \frac{7x}{7} &= \frac{21}{7} \\ x &= 3 \end{aligned}$$

$3x = 3(3) = 9$

The shorter piece is 3 feet and the longer pieces are each 9 feet.

14.

$$\begin{aligned} x+x+39,771 &= 43,265 \\ 2x+39,771 &= 43,265 \\ 2x+39,771-39,771 &= 43,265-39,771 \\ 2x &= 3494 \\ \frac{2x}{2} &= \frac{3494}{2} \\ x &= 1747 \end{aligned}$$

In 2014, 1747 screens were analog.

16. Let x be the measure of the smaller angle. Then $2x - 15$ is the measure of the larger angle. The sum of the four angles is 360°.

$$\begin{aligned} 2x+2(2x-15) &= 360 \\ 2x+4x-30 &= 360 \\ 6x-30 &= 360 \\ 6x-30+30 &= 360+30 \\ 6x &= 390 \\ \frac{6x}{6} &= \frac{390}{6} \\ x &= 65 \end{aligned}$$

$2x - 15 = 2(65) - 15 = 130 - 15 = 115$

Two angles measure 65° and two angles measure 115°.

18. Three consecutive integers:
Integer: x
Next integers: $x + 1$, $x + 2$
Sum of the second and third consecutive integers, simplified: $(x + 1) + (x + 2) = 2x + 3$

20. Three consecutive odd integers:
Odd integer: x
Next integers: $x + 2$, $x + 4$
Sum of the three consecutive odd integers, simplified: $x + (x + 2) + (x + 4) = 3x + 6$

22. Four consecutive integers:
Integer: x
Next integers: $x + 1$, $x + 2$, $x + 3$
Sum of the first and fourth consecutive integers, simplified: $x + (x + 3) = 2x + 3$

24. Three consecutive even integers:
Even integer: x
Next integers: $x + 2$, $x + 4$
Sum of the three consecutive even integers, simplified: $x + (x + 2) + (x + 4) = 3x + 6$

26. Let x = the number of one room and $x + 2$ = the number of the other.

$$x+x+2=654$$
$$2x+2=654$$
$$2x+2-2=654-2$$
$$2x=652$$
$$\frac{2x}{2}=\frac{652}{2}$$
$$x=326$$

$x + 2 = 326 + 2 = 328$

The room numbers are 326 and 328.

28. Let x = code for Mali Republic, $x + 2$ = code for Cote d'Ivoire, and $x + 4$ = code for Niger.

$$x+x+2+x+4=675$$
$$3x+6=675$$
$$3x+6-6=675-6$$
$$3x=669$$
$$\frac{3x}{3}=\frac{669}{3}$$
$$x=223$$

$x + 2 = 223 + 2 = 225$

$x + 4 = 223 + 4 = 227$

The codes are: 223 for Mali, 225 for Cote d'Ivoire, 227 for Niger.

30. Let x represent the weight of the Armanty meteorite. Then $3x$ represents the weight of the Hoba West meteorite.

$$x+3x=88$$
$$4x=88$$
$$\frac{4x}{4}=\frac{88}{4}$$
$$x=22$$

$3x = 3(22) = 66$

The Armanty meteorite weighs 22 tons and the Hoba West meteorite weighs 66 tons.

32. Let x be the measure of the shorter piece. Then $5x + 1$ is the measure of the longer piece. The measures sum to 25 feet.

$$x+5x+1=25$$
$$6x+1=25$$
$$6x+1-1=25-1$$
$$6x=24$$
$$\frac{6x}{6}=\frac{24}{6}$$
$$x=4$$

$5x + 1 = 5(4) + 1 = 20 + 1 = 21$

The pieces measure 4 feet and 21 feet.

34. Let x = the number.

$$9=2x-10$$
$$9+10=2x-10+10$$
$$19=2x$$
$$\frac{19}{2}=\frac{2x}{2}$$
$$\frac{19}{2}=x$$

The number is $\frac{19}{2}$.

36. Let x = species of grasshoppers, then $20x$ = species of beetles.

$$x+20x=420,000$$
$$21x=420,000$$
$$\frac{21x}{21}=\frac{420,000}{21}$$
$$x=20,000$$

$20x = 20(20,000) = 400,000$

There are 400,000 species of beetles and 20,000 species of grasshoppers.

38. Let x = the measure of the smallest angle, $x + 2$ = the measure of the second, $x + 4$ = the measure of the third, and $x + 6$ = the measure of the fourth.

$$x+x+2+x+4+x+6=360$$
$$4x+12=360$$
$$4x+12-12=360-12$$
$$4x=348$$
$$\frac{4x}{4}=\frac{348}{4}$$
$$x=87$$

$x + 2 = 87 + 2 = 89$

$x + 4 = 87 + 4 = 91$

$x + 6 = 87 + 6 = 93$

The angles are 87°, 89°, 91°, and 93°.

40. Let x = first odd integer, then $x + 2$ = next odd integer, and $x + 4$ = third consecutive odd integer.

$$x+(x+2)+(x+4)=51$$
$$3x+6=51$$
$$3x+6-6=51-6$$
$$3x=45$$
$$\frac{3x}{3}=\frac{45}{3}$$
$$x=15$$

$x + 2 = 15 + 2 = 17$

$x + 4 = 15 + 4 = 19$

The code is 15, 17, 19.

42. Let x = the number.

$$\begin{aligned} 2(x+6) &= 3(x+4) \\ 2x+12 &= 3x+12 \\ 2x+12-12 &= 3x+12-12 \\ 2x &= 3x \\ 2x-2x &= 3x-2x \\ 0 &= x \end{aligned}$$

The number is 0.

44. Let x = the measure of the first angle then $2x - 3$ = the measure of the other.

$$\begin{aligned} x+2x-3 &= 90 \\ 3x-3 &= 90 \\ 3x-3+3 &= 90+3 \\ 3x &= 93 \\ \frac{3x}{3} &= \frac{93}{3} \\ x &= 31 \end{aligned}$$

$2x - 3 = 2(31) - 3 = 59$

The angles are 31° and 59°.

46.

$$\begin{aligned} \frac{1}{5}+2x &= 3x-\frac{4}{5} \\ \frac{1}{5}+2x-2x &= 3x-\frac{4}{5}-2x \\ \frac{1}{5} &= x-\frac{4}{5} \\ \frac{1}{5}+\frac{4}{5} &= x-\frac{4}{5}+\frac{4}{5} \\ \frac{5}{5} &= x \\ 1 &= x \end{aligned}$$

The number is 1.

48. Let x = the number.

$$\begin{aligned} \frac{3}{4}+3x &= 2x-\frac{1}{2} \\ 4\left(\frac{3}{4}+3x\right) &= 4\left(2x-\frac{1}{2}\right) \\ 3+12x &= 8x-2 \\ 3+12x-8x &= 8x-2-8x \\ 3+4x &= -2 \\ 3+4x-3 &= -2-3 \\ 4x &= -5 \\ \frac{4x}{4} &= \frac{-5}{4} \\ x &= -\frac{5}{4} \end{aligned}$$

The number is $-\frac{5}{4}$.

50. Let x = floor space of Empire State Building, then $3x$ = floor space of the Pentagon.

$$\begin{aligned} x+3x &= 8700 \\ 4x &= 8700 \\ \frac{4x}{4} &= \frac{8700}{4} \\ x &= 2175 \end{aligned}$$

$3x = 3(2175) = 6525$

The Empire State Building has 2175 thousand square feet and the Pentagon has 6525 thousand square feet.

52. Let x = the number.

$$\begin{aligned} \frac{7}{8}\cdot x &= \frac{1}{2} \\ \frac{8}{7}\cdot\frac{7}{8}x &= \frac{8}{7}\cdot\frac{1}{2} \\ x &= \frac{4}{7} \end{aligned}$$

The number is $\frac{4}{7}$.

54. Let x = first integer (smallest piece) then $x + 2$ = second integer (middle piece) and $x + 4$ = third integer (longest piece)

$$\begin{aligned} x+(x+2)+(x+4) &= 48 \\ 3x+6 &= 48 \\ 3x+6-6 &= 48-6 \\ 3x &= 42 \\ \frac{3x}{3} &= \frac{42}{3} \\ x &= 14 \end{aligned}$$

$x + 2 = 14 + 2 = 16$

$x + 4 = 14 + 4 = 18$

The pieces measure 14 inches, 16 inches, and 18 inches.

56. Let x = smallest angle, then $4x$ = largest angles.

$$\begin{aligned} x+4x+4x &= 180 \\ 9x &= 180 \\ \frac{9x}{9} &= \frac{180}{9} \\ x &= 20 \end{aligned}$$

$4x = 4(20) = 80$

The angles measure 20°, 80°, and 80°.

58. Let x = length of first piece,
then $5x$ = length of second piece,
and $6x$ = length of third piece.
$$x+5x+6x=48$$
$$12x=48$$
$$\frac{12x}{12}=\frac{48}{12}$$
$$x=4$$
$5x = 5(4) = 20$
$6x = 6(4) =24$
The first piece is 4 feet, the second piece is 20 feet, and the third piece is 24 feet.

60. The bars ending between 3 and 5 represent the games Destiny and Grand Theft Auto V, so those games sold between 3 and 5 million copies in 2014.

62. Let x represent the sales of Minecraft, in millions. Then $x + 0.6$ represents the sales of Grand Theft Auto V.
$$x+x+0.6=6$$
$$2x+0.6=6$$
$$2x+0.6-0.6=6-0.6$$
$$2x=5.4$$
$$\frac{2x}{2}=\frac{5.4}{2}$$
$$x=2.7$$
$x + 0.6 = 2.7 + 0.6 = 3.3$
Minecraft sold 2.7 million copies and Grand Theft Auto V sold 3.3 million copies.

64. answers may vary

66. Replace B by 14 and h by 22.
$$\frac{1}{2}Bh=\frac{1}{2}(14)(22)=7(22)=154$$

68. Replace r by 15 and t by 2.
$r \cdot t = 15 \cdot 2 = 30$

70. Let x be the measure of the first angle. Then $2x$ is the measure of the second angle and $5x$ is the measure of the third angle. The measures sum to 180°.
$$x+2x+5x=180$$
$$8x=180$$
$$\frac{8x}{8}=\frac{180}{8}$$
$$x=22.5$$
$2x = 2(22.5) = 45$
$5x = 5(22.5) = 112.5$
Yes, the triangle exists and has angles that measure 22.5°, 45°, and 112.5°.

72. One blink every 5 seconds is $\frac{1\text{ blink}}{5\text{ sec}}$.
There are $60 \cdot 60 = 3600$ seconds in one hour.
$$\frac{1\text{ blink}}{5\text{ sec}}\cdot 3600\text{ sec}=720\text{ blinks}$$
The average eye blinks 720 times each hour.
$16 \cdot 720 = 11{,}520$
The average eye blinks 11,520 times while awake for a 16-hour day.
$11{,}520 \cdot 365 = 4{,}204{,}800$
The average eye blinks 4,204,800 times in one year.

74. answers may vary

76. answers may vary

78. Measurements may vary. Rectangle (b) best approximates the shape of a golden rectangle.

Section 2.6 Practice Exercises

1. Let d = 580 and r = 5.
$$d=r\cdot t$$
$$580=5t$$
$$\frac{580}{5}=\frac{5t}{5}$$
$$116=t$$
It takes 116 seconds or 1 minute 56 seconds.

2. Let l = 40 and P = 98.
$$P=2l+2w$$
$$98=2\cdot 40+2w$$
$$98=80+2w$$
$$98-80=80+2w-80$$
$$18=2w$$
$$\frac{18}{2}=\frac{2w}{2}$$
$$9=w$$
The dog run is 9 feet wide.

3. Let C = 8.
$$F=\frac{9}{5}C+32$$
$$F=\frac{9}{5}\cdot 8+32$$
$$F=\frac{72}{5}+\frac{160}{5}$$
$$F=\frac{232}{5}=46.4$$
The equivalent temperature is 46.4°F.

4. Let w = width of sign, then
$5w + 3$ = length of sign.

$$\begin{aligned} P &= 2l + 2w \\ 66 &= 2(5w+3) + 2w \\ 66 &= 10w + 6 + 2w \\ 66 &= 12w + 6 \\ 66 - 6 &= 12w + 6 - 6 \\ 60 &= 12w \\ \frac{60}{12} &= \frac{12w}{12} \\ 5 &= w \end{aligned}$$

$5w + 3 = 5(5) + 3 = 28$
The sign has length 28 inches and width 5 inches.

5.
$$\begin{aligned} I &= PRT \\ \frac{I}{PT} &= \frac{PRT}{PT} \\ \frac{I}{PT} &= R \text{ or } R = \frac{I}{PT} \end{aligned}$$

6.
$$\begin{aligned} H &= 5as + 10a \\ H - 10a &= 5as + 10a - 10a \\ H - 10a &= 5as \\ \frac{H-10a}{5a} &= \frac{5as}{5a} \\ \frac{H-10a}{5a} &= s \text{ or } s = \frac{H-10a}{5a} \end{aligned}$$

7.
$$\begin{aligned} N &= F + d(n-1) \\ N - F &= F + d(n-1) - F \\ N - F &= d(n-1) \\ \frac{N-F}{n-1} &= \frac{d(n-1)}{n-1} \\ \frac{N-F}{n-1} &= d \text{ or } d = \frac{N-F}{n-1} \end{aligned}$$

8.
$$\begin{aligned} A &= \frac{1}{2}a(b+B) \\ 2 \cdot A &= 2 \cdot \frac{1}{2}a(b+B) \\ 2A &= a(b+B) \\ 2A &= ab + aB \\ 2A - ab &= ab + aB - ab \\ 2A - ab &= aB \\ \frac{2A-ab}{a} &= \frac{aB}{a} \\ \frac{2A-ab}{a} &= B \text{ or } B = \frac{2A-ab}{a} \end{aligned}$$

Vocabulary, Readiness & Video Check 2.6

1. A formula is an equation that describes known relationships among quantities.

2. This is a distance, rate, and time problem. The distance is given in miles and the time is given in hours, so the rate that we are finding must be in miles per hour (mph).

3. To show that the process of solving this equation for x—dividing both sides by 5, the coefficient of x—is the same process used to solve a formula for a specific variable. Treat whatever is multiplied by that specific variable as the coefficient—the coefficient is all the factors except that specific variable.

Exercise Set 2.6

2. Let $d = 195$ and $t = 3$.
$$\begin{aligned} d &= rt \\ 195 &= r(3) \\ \frac{195}{3} &= \frac{3r}{3} \\ 65 &= r \end{aligned}$$

4. Let $l = 14$, $w = 8$, and $h = 3$.
$$\begin{aligned} V &= lwh \\ V &= 14(8)(3) \\ V &= 336 \end{aligned}$$

6. Let $A = 60$, $B = 7$, and $b = 3$.
$$\begin{aligned} A &= \frac{1}{2}h(B+b) \\ 60 &= \frac{1}{2}h(7+3) \\ 2(60) &= 2\left[\frac{1}{2}h(10)\right] \\ 120 &= 10h \\ \frac{120}{10} &= \frac{10h}{10} \\ 12 &= h \end{aligned}$$

8. Let $V = 45$, and $h = 5$.
$$V = \frac{1}{3}Ah$$
$$45 = \frac{1}{3}A(5)$$
$$3(45) = 3\left[\frac{1}{3}(5A)\right]$$
$$135 = 5A$$
$$\frac{135}{5} = \frac{5A}{5}$$
$$27 = A$$

10. Let $r = 4.5$, and $\pi \approx 3.14$.
$$A = \pi r^2$$
$$A \approx 3.14(4.5)^2$$
$$A \approx 3.14(20.25)$$
$$A \approx 63.6$$

12. Let $I = 1{,}056{,}000$, $R = 0.055$, and $T = 6$.
$$I = PRT$$
$$1{,}056{,}000 = P(0.055)(6)$$
$$1{,}056{,}000 = 0.33P$$
$$\frac{1{,}056{,}000}{0.33} = \frac{0.33P}{0.33}$$
$$3{,}200{,}000 = P$$

14. Let $r = 3$ and $\pi \approx 3.14$.
$$V = \frac{4}{3}\pi r^3$$
$$V \approx \frac{4}{3}(3.14)(3)^3$$
$$V \approx \frac{4}{3}(3.14)(27)$$
$$V \approx \frac{4}{3}(84.78)$$
$$V \approx 113.0$$
($V \approx 113.1$ using a calculator.)

16.
$$A = \pi ab$$
$$\frac{A}{\pi a} = \frac{\pi ab}{\pi a}$$
$$\frac{A}{\pi a} = b$$

18.
$$T = mnr$$
$$\frac{T}{mr} = \frac{mnr}{mr}$$
$$\frac{T}{mr} = n$$

20.
$$-x + y = 13$$
$$-x + x + y = 13 + x$$
$$y = 13 + x$$

22.
$$A = P + PRT$$
$$A - P = P - P + PRT$$
$$A - P = PRT$$
$$\frac{A-P}{PR} = \frac{PRT}{PR}$$
$$\frac{A-P}{PR} = T$$

24.
$$D = \frac{1}{4}fk$$
$$4D = 4\left(\frac{1}{4}fk\right)$$
$$4D = fk$$
$$\frac{4D}{f} = \frac{fk}{f}$$
$$\frac{4D}{f} = k$$

26.
$$PR = x + y + z + w$$
$$PR - (x + y + w) = x + y + z + w - (x + y + w)$$
$$PR - x - y - w = x + y + z + w - x - y - w$$
$$PR - x - y - w = z$$

28.
$$S = 4lw + 2wh$$
$$S - 4lw = 4lw - 4lw + 2wh$$
$$S - 4lw = 2wh$$
$$\frac{S - 4lw}{2w} = \frac{2wh}{2w}$$
$$\frac{S - 4lw}{2w} = h$$

30. Use $A = lw$ when $A = 52{,}400$ and $l = 400$.
$$A = lw$$
$$52{,}400 = 400 \cdot w$$
$$\frac{52{,}400}{400} = \frac{400w}{400}$$
$$131 = w$$
The width of the sign is 131 feet.

32. a.
$$A = \frac{1}{2}bh$$
$$A = \frac{1}{2} \cdot 36 \cdot 27$$
$$A = 486$$
$$P = l_1 + l_2 + l_3$$
$$P = 27 + 36 + 45$$
$$P = 108$$
The area is 486 square feet and the perimeter is 108 feet.

b. The fence has to do with perimeter because it is located around the edge of the property. The grass seed has to do with area because it is located in the middle of the property.

34. a.

$$A = bh \qquad P = 2l_1 + 2l_2$$
$$A = 9.3(7) \qquad P = 2(11.7) + 2(9.3)$$
$$A = 65.1 \qquad P = 23.4 + 18.6$$
$$P = 42$$

The area is 65.1 square feet and the perimeter is 42 feet.

b. The border has to do with the perimeter because it surrounds the edge. The paint has to do with the area because it covers the wall.

36. Let $C = -5$.

$$F = \frac{9}{5}(-5) + 32 = -9 + 32 = 23$$

The equivalent temperature is 23°F.

38. Let $P = 400$ and $l = 2w - 10$.

$$\begin{aligned} P &= 2l + 2w \\ 400 &= 2(2w - 10) + 2w \\ 400 &= 4w - 20 + 2w \\ 400 &= 6w - 20 \\ 400 + 20 &= 6w - 20 + 20 \\ 420 &= 6w \\ \frac{420}{6} &= \frac{6w}{6} \\ 70 &= w \end{aligned}$$

$$l = 2w - 10 = 2(70) - 10 = 140 - 10 = 130$$

The length is 130 meters.

40. Let x = the measure of each of the two equal sides, and $x - 2$ = the measure of the third.

$$\begin{aligned} x + x + x - 2 &= 22 \\ 3x - 2 &= 22 \\ 3x - 2 + 2 &= 22 + 2 \\ 3x &= 24 \\ \frac{3x}{3} &= \frac{24}{3} \\ x &= 8 \end{aligned}$$

$x - 2 = 8 - 2 = 6$

The shortest side is 6 feet.

42. Let $d = 700$ and $r = 55$.

$$\begin{aligned} d &= rt \\ 700 &= 55t \\ \frac{700}{55} &= \frac{55t}{55} \\ \frac{700}{55} &= t \end{aligned}$$

$$t = \frac{700}{55} = \frac{140}{11} = 12\frac{8}{11}$$

The trip will take $12\frac{8}{11}$ hours.

44. Let $r = 4$ and $h = 3$. Use $\pi \approx 3.14$.

$$\begin{aligned} V &= \pi r^2 h \\ V &\approx (3.14)(4)^2(3) \\ &\approx (3.14)(16)(3) \\ &\approx 150.72 \end{aligned}$$

Let x = number of goldfish and volume per fish = 2.

$$\begin{aligned} 150.72 &= 2x \\ \frac{150.72}{2} &= \frac{2x}{2} \\ 75.36 &= x \end{aligned}$$

75 goldfish can be placed in the tank.

46. Use $N = 94$.

$$\begin{aligned} T &= 50 + \frac{N - 40}{4} \\ T &= 50 + \frac{94 - 40}{4} \\ T &= 50 + \frac{54}{4} \\ T &= 50 + 13.5 \\ T &= 63.5 \end{aligned}$$

The temperature is 63.5° Fahrenheit.

48. Use $T = 65$.

$$\begin{aligned} T &= 50 + \frac{N - 40}{4} \\ 65 &= 50 + \frac{N - 40}{4} \\ 65 - 50 &= 50 + \frac{N - 40}{4} - 50 \\ 15 &= \frac{N - 40}{4} \\ 4 \cdot 15 &= 4 \cdot \frac{N - 40}{4} \\ 60 &= N - 40 \\ 60 + 40 &= N - 40 + 40 \\ 100 &= N \end{aligned}$$

There are 100 chirps per minute.

50. As the air temperature of their environment decreases, the number of cricket chirps per minute <u>decreases</u>.

52. Let $A = 20$, and $b = 5$.

$$A = \frac{1}{2}bh$$
$$20 = \frac{1}{2}(5)h$$
$$2(20) = 2\left(\frac{5}{2}h\right)$$
$$40 = 5h$$
$$\frac{40}{5} = \frac{5h}{5}$$
$$8 = h$$

The height is 8 feet.

54. Let $r = 4000$. Use $\pi \approx 3.14$.

$$C = 2\pi r \approx 2(3.14)(4000)$$
$$C \approx 25{,}120$$

The length of rope is 25,120 miles.

56.
$$x + (2x - 8) + (3x - 12) = 82$$
$$6x - 20 = 82$$
$$6x - 20 + 20 = 82 + 20$$
$$6x = 102$$
$$\frac{6x}{6} = \frac{102}{6}$$
$$x = 17$$

$2x - 8 = 2(17) - 8 = 26$

$3x - 12 = 3(17) - 12 = 39$

The lengths are 17 feet, 26 feet, and 39 feet.

58. $A = 3990$ and $w = 57$.

$$A = lw$$
$$3990 = l \cdot 57$$
$$\frac{3990}{57} = \frac{57l}{57}$$
$$70 = l$$

The length is 70 feet.

60. Let x = the length of a side of the square and $2x - 15$ = the length of a side of the triangle.

$$P(\text{triangle}) = P(\text{square})$$
$$3(2x - 15) = 4x$$
$$6x - 45 = 4x$$
$$6x - 4x - 45 = 4x - 4x$$
$$2x - 45 = 0$$
$$2x - 45 + 45 = 45$$
$$2x = 45$$
$$\frac{2x}{2} = \frac{45}{2}$$
$$x = 22.5$$

$2x - 15 = 2(22.5) - 15 = 45 - 15 = 30$

The side of the triangle is 30 units and the side of the square is 22.5 units.

62. Let $d = 150$ and $r = 45$.

$$d = rt$$
$$150 = 45t$$
$$\frac{150}{45} = \frac{45t}{45}$$
$$\frac{150}{45} = t$$
$$t = \frac{150}{45} = \frac{10}{3}$$

The trip will take $\frac{10}{3} = 3\frac{1}{3}$ hours or 3 hours 20 minutes.

He should arrive at 7:20 A.M.

64. Let $F = 78$.

$$F = \frac{9}{5}C + 32$$
$$78 = \frac{9}{5}C + 32$$
$$5(78) = 5\left(\frac{9}{5}C + 32\right)$$
$$390 = 9C + 160$$
$$390 - 160 = 9C + 160 - 160$$
$$230 = 9C$$
$$\frac{230}{9} = \frac{9C}{9}$$
$$\frac{230}{9} = C$$
$$C = \frac{230}{9} = 25\frac{5}{9}$$

The equivalent temperature is $25\frac{5}{9}$°C.

66. Let $C = -10$.

$$\begin{aligned} F &= \frac{9}{5}C + 32 \\ &= \frac{9}{5}(-10) + 32 \\ &= -18 + 32 \\ &= 14 \end{aligned}$$

The equivalent temperature is 14°F

68. Let $F = -227$.

$$C = \frac{5}{9}(F - 32)$$

$$C = \frac{5}{9}(-227 - 32) \approx -144$$

The equivalent temperature is −144°C.

70. Use $V = \frac{4}{3}\pi r^3$ when $r = \frac{30}{2} = 15$ and $\pi = 3.14$.

$$V = \frac{4}{3}\pi r^3 = \frac{4}{3}(3.14)(15)^3 = 14{,}130$$

The volume of the sphere is 14,130 cubic inches.

72. 8% = 0.08

74. 0.5% = 0.005

76. 0.03 = 0.03(100%) = 3%

78. 5 = 5(100%) = 500%

80. Use $A = bh$. If the base is doubled, the new base is $2b$. If the height is doubled, the new height is $2h$.
$A = (2b)(2h) = 2 \cdot 2 \cdot b \cdot h = 4bh$
The area is multiplied by 4.

82. Let x be the temperature. Use $F = \frac{9}{5}C + 32$ when $F = C = x$.

$$\begin{aligned} F &= \frac{9}{5}C + 32 \\ x &= \frac{9}{5}x + 32 \\ x - \frac{9}{5}x &= \frac{9}{5}x + 32 - \frac{9}{5}x \\ \frac{5}{5}x - \frac{9}{5}x &= 32 \\ -\frac{4}{5}x &= 32 \\ -\frac{5}{4}\cdot\left(-\frac{4}{5}x\right) &= -\frac{5}{4}\cdot 32 \\ x &= -40 \end{aligned}$$

They are the same when the temperature is −40°.

84.

$$\begin{aligned} B &= \frac{F}{P-V} \\ B(P-V) &= \frac{F}{P-V}(P-V) \\ B(P-V) &= F \\ BP - BV &= F \\ BP - BV - BP &= F - BP \\ -BV &= F - BP \\ \frac{-BV}{-B} &= \frac{F - BP}{-B} \\ V &= \frac{BP - F}{B} \\ V &= \frac{BP}{B} - \frac{F}{B} \\ V &= P - \frac{F}{B} \end{aligned}$$

86.

Title:
f3.eps
Creator:
Adobe Illustrator(R) 11
Preview:

88. Let $d = 238{,}860$ and $r = 186{,}000$.

$$\begin{aligned} d &= rt \\ 238{,}860 &= 186{,}000t \\ \frac{238{,}860}{186{,}000} &= \frac{186{,}000t}{186{,}000} \\ 1.3 &\approx t \end{aligned}$$

It will take 1.3 seconds.

90. $20\ \dfrac{\text{miles}}{\text{hour}}$

$= 20\ \dfrac{\text{miles}}{\text{hour}}\left(\dfrac{5280 \text{ feet}}{1 \text{ mile}}\right)\left(\dfrac{1 \text{ hour}}{3600 \text{ seconds}}\right)$

$= \dfrac{88}{3}$ feet/second

Let $d = 1300$ and $r = \dfrac{88}{3}$.

$$d = rt$$
$$1300 = \frac{88}{3}t$$
$$\frac{3}{88}(1300) = \frac{3}{88}\left(\frac{88}{3}\right)t$$
$$44.3 \approx t$$

It will take about 44.3 seconds.

92. Use $d = rt$ when $d = 25{,}000$ and $r = 3800$.

$$d = rt$$
$$25{,}000 = 3800 \cdot t$$
$$\frac{25{,}000}{3800} = \frac{3800t}{3800}$$
$$6.58 \approx t$$

6 hr and $0.58(60) \approx 35$ min

It would take the Boeing X-51 6 hours 35 minutes to travel around Earth.

94. Let $d = 2$ then $r = 1$.

$15 \text{ feet} = \dfrac{15 \text{ feet}}{1} \cdot \dfrac{12 \text{ inches}}{1 \text{ foot}} = 180$ inches, so $h = 180$.

$$V = \pi r^2 h$$
$$V = (\pi)(1)^2(180) = 180\pi \approx 565.5$$

The volume of the column is 565.5 cubic inches.

Section 2.7 Practice Exercises

1. Let x = the unknown percent.

$$35 = x \cdot 56$$
$$\frac{35}{56} = \frac{56x}{56}$$
$$0.625 = x$$

The number 35 is 62.5% of 56.

2. Let x = the unknown number.

$$198 = 55\% \cdot x$$
$$198 = 0.55x$$
$$\frac{198}{0.55} = \frac{0.55x}{0.55}$$
$$360 = x$$

The number 198 is 55% of 360.

3. **a.** From the circle graph, we see that 41% of pets owned are freshwater fish and 3% are saltwater fish; thus 41% + 3% = 44% of pets owned are freshwater fish or saltwater fish.

b. The circle graph percents have a sum of 100%; thus the percent of pets that are not equines is 100% – 3% = 97%.

c. To find the number of dogs owned, we find 19% of 396.12
= (0.19)(396.12)
= 75.2628
≈ 75.3
Thus, about 75.3 million dogs are owned in the United States.

4. Let x = discount.

$x = 85\% \cdot 480$
$x = 0.85 \cdot 480$
$x = 408$

The discount is \$408.

New price = \$480 – \$408 = \$72

5. Increase = 2710 – 1900 = 810

Let x = percent of increase.

$$810 = x \cdot 1900$$
$$\frac{810}{1900} = \frac{1900x}{1900}$$
$$0.426 \approx x$$

The percent of increase is 42.6%.

6. Let x = number of digital 3D screens in 2012.

$$x + 0.07x = 15{,}782$$
$$1.07x = 15{,}782$$
$$\frac{1.07x}{1.07} = \frac{15{,}782}{1.07}$$
$$x \approx 14{,}750$$

There were 14,750 digital 3D screens in 2012.

7. Let x = number of liters of 2% solution.

Eyewash	No. of gallons ·	Acid Strength =	Amt. of Acid
2%	x	2%	$0.02x$
5%	$6 - x$	5%	$0.05(6 - x)$
Mix: 3%	6	3%	$0.03(6)$

$$\begin{aligned} 0.02x + 0.05(6 - x) &= 0.03(6) \\ 0.02x + 0.3 - 0.05x &= 0.18 \\ -0.03x + 0.3 &= 0.18 \\ -0.03x + 0.3 - 0.3 &= 0.18 - 0.3 \\ -0.03x &= -0.12 \\ \frac{-0.03x}{-0.03} &= \frac{-0.12}{-0.03} \\ x &= 4 \end{aligned}$$

$6 - x = 6 - 4 = 2$

She should mix 4 liters of 2% eyewash with 2 liters of 5% eyewash.

Vocabulary, Readiness & Video Check 2.7

1. No, 25% + 25% + 40% = 90% ≠ 100%.

2. No, 30% + 30% + 30% = 90% ≠ 100%.

3. Yes, 25% + 25% + 25% + 25% = 100%.

4. Yes, 40% + 50% + 10% = 100%.

5. **a.** equals; =

b. multiplication; ·

c. Drop the percent symbol and move the decimal point two places to the left.

6. **a.** You also find a discount amount by multiplying the (discount) percent by the original price.

b. For discount, the new price is the original price minus the discount amount, so you *subtract* from the original price rather than *add* as with mark-up.

7. You must first find the actual amount of increase in price by subtracting the original price from the new price.

8.

Alloy	Ounces	Copper Strength	Amount of Copper
10%	x	0.10	$0.10x$
30%	400	0.30	0.30(400)
20%	$x + 400$	0.20	$0.20(x + 400)$

$0.10x + 0.30(400) = 0.20(x + 400)$

Exercise Set 2.7

2. Let x be the unknown number.
$x = 88\% \cdot 1000$
$x = 0.88 \cdot 1000$
$x = 880$
880 is 88% of 1000.

4. Let x be the unknown percent.
$$87.2 = x \cdot 436$$
$$\frac{87.2}{436} = \frac{436x}{436}$$
$$0.2 = x$$
$$20\% = x$$
The number 87.2 is 20% of 436.

6. Let x be the unknown number.
$$126 = 35\% \cdot x$$
$$126 = 0.35 \cdot x$$
$$\frac{126}{0.35} = \frac{0.35x}{0.35}$$
$$360 = x$$
126 is 35% of 360.

8. 21% + 10% + 20% = 51%
51% of Earth's land area is in Asia, Antarctica, or Africa.

10. The land area of Africa is 20% of Earth's land area.
$20\% \text{ of } 56.4 = 20\% \cdot 56.4 = 0.20 \cdot 56.4 = 11.28$
The land area of Africa is 11.28 million square areas.

12. Let x = amount of discount.
$x = 25\% \cdot 12.50$
$x = 0.25 \cdot 12.50$
$x = 3.125 \approx 3.13$
New price = 12.50 – 3.13 = 9.37
The discount was \$3.13 and the new price is \$9.37.

14. Let x = tip.
$x = 20\% \cdot 65.40$
$x = 0.2 \cdot 65.4$
$x = 13.08$
Total = 65.40 + 13.08 = 78.48
The total cost is \$78.48.

16. Decrease = 314 – 290 = 24
Let x = percent.
$$24 = x \cdot 314$$
$$\frac{24}{314} = \frac{314x}{314}$$
$$0.076 \approx x$$
The percent of decrease is 7.6%.

18. Decrease = 100 – 81 = 11
Let x = percent.
$$11 = x \cdot 100$$
$$\frac{11}{100} = \frac{100x}{100}$$
$$0.11 = x$$
The percent of decrease is 11%.

20. Let x = original price and $0.25x$ = increase.
$$x + 0.25x = 80$$
$$1.25x = 80$$
$$\frac{1.25x}{1.25} = \frac{80}{1.25}$$
$$x = 64$$
The original price was \$64.

22. Let x = last year's salary, and $0.03x$ = increase.
$$x + 0.03x = 55,620$$
$$1.03x = 55,620$$
$$\frac{1.03x}{1.03} = \frac{55,620}{1.03}$$
$$x = 54,000$$
Last year's salary was \$54,000.

24. Let x = the amount of 25% solution.

	No. of cu cm	· Strength =	Amt. of Antibiotic
25%	x	0.25	$0.25x$
60%	10	0.6	10(0.6)
30%	$x + 10$	0.3	$0.3(x + 10)$

$$0.25x + 10(0.6) = 0.3(x + 10)$$
$$0.25x + 6 = 0.3x + 3$$
$$0.25x - 0.25x + 6 = 0.3x - 0.25x + 3$$
$$6 = 0.05x + 3$$
$$6 - 3 = 0.05x + 3 - 3$$
$$3 = 0.05x$$
$$\frac{3}{0.05} = \frac{0.05x}{0.05}$$
$$60 = x$$
Add 60 cc of 25% solution.

26. Let x = the pounds of cashew nuts.

	No. of lb	· Cost/lb	= Value
Peanuts	20	3	3(20)
Cashews	x	5	$5x$
Mix	$x + 20$	3.50	$3.50(x + 20)$

$$\begin{aligned} 3(20)+5x &= 3.50(x+20) \\ 60+5x &= 3.5x+70 \\ 60+5x-3.5x &= 3.5x-3.5x+70 \\ 60+1.5x &= 70 \\ 60-60+1.5x &= 70-60 \\ 1.5x &= 10 \\ \frac{1.5x}{1.5} &= \frac{10}{1.5} \\ x &= 6\frac{2}{3} \end{aligned}$$

Add $6\frac{2}{3}$ pounds of cashews.

28. Let x = the number.
$x = 140\% \cdot 86$
$x = 1.4 \cdot 86$
$x = 120.4$
140% of 86 is 120.4.

30. Let x = the number.

$$\begin{aligned} 56.25 &= 45\% \cdot x \\ 56.25 &= 0.45x \\ \frac{56.25}{0.45} &= \frac{0.45x}{0.45} \\ 125 &= x \end{aligned}$$

56.25 is 45% of 125.

32. Let x = the percent.

$$\begin{aligned} 42 &= x \cdot 35 \\ \frac{42}{35} &= \frac{35x}{35} \\ 1.2 &= x \end{aligned}$$

42 is 120% of 35.

34. From the graph, the height of the bar is about 23. Therefore, the average American spends about 23 minutes on Internet browsers.

36. 17 is what percent of 162?

$$\begin{aligned} 17 &= x \cdot 162 \\ \frac{17}{162} &= \frac{162x}{162} \\ 0.105 &\approx x \end{aligned}$$

10.5% of online time is spent following news.

38.

Unit Case Volume for Coca-Cola (in billions of cases)		
World Region	*Case Volume*	*Percent of Total (rounded to nearest percent)*
North America	5.9	$\frac{5.9}{28.2} \approx 21\%$
Latin America	8.2	$\frac{8.2}{28.2} \approx 29\%$
Europe	3.9	$\frac{3.9}{28.2} \approx 14\%$
Eurasia and Africa	4.3	$\frac{4.3}{28.2} \approx 15\%$
Pacific	5.9	$\frac{5.9}{28.2} \approx 21\%$
Total	28.2	100%

40. Let x = the decrease in price.
$x = 0.15(0.95) = 0.1425 \approx 0.14$
The decrease in price is \$0.14.
The new price is 0.95 – 0.14 = \$0.81.

42. Increase = 1.49 – 1.19 = 0.30
Let x = the percent.

$$0.3 = x \cdot 1.19$$
$$\frac{0.3}{1.19} = \frac{1.19x}{1.19}$$
$$0.252 \approx x$$

The percent of increase was 25.2%.

44. Let x represent the amount Charles paid for the car.

$$x + 20\% \cdot x = 4680$$
$$x + 0.20x = 4680$$
$$1.2x = 4680$$
$$\frac{1.2x}{1.2} = \frac{4680}{1.2}$$
$$x = 3900$$

Charles paid \$3900 for the car.

46.
$$\text{percent of increase} = \frac{\text{amount of increase}}{\text{original amount}} = \frac{24-6}{6} = \frac{18}{6} = 3$$

The area increased by 300%.

48. Let x be the gallons of water.

	gallons	concentration	amount
water	x	0%	$0x = 0$
70% antifreeze	30	70%	0.7(30)
60% antifreeze	$x + 30$	60%	$0.6(x + 30)$

The amount of antifreeze being combined must be the same as that in the mixture.

$$\begin{aligned} 0 + 0.7(30) &= 0.6(x + 30) \\ 21 &= 0.6x + 18 \\ 21 - 18 &= 0.6x + 18 - 18 \\ 3 &= 0.6x \\ \frac{3}{0.6} &= \frac{0.6x}{0.6} \\ 5 &= x \end{aligned}$$

Thus, 5 gallons of water should be used.

50. $$\begin{aligned} \text{percent of increase} &= \frac{\text{amount of increase}}{\text{original amount}} \\ &= \frac{88 - 72}{72} \\ &= \frac{16}{72} \\ &\approx 0.222 \end{aligned}$$

The number of decisions by the Supreme Court increased 22.2%.

52. Let x be the average number of children per woman in 1920.

$$\begin{aligned} x - 0.44x &= 1.9 \\ 0.56x &= 1.9 \\ \frac{0.56x}{0.56} &= \frac{1.9}{0.56} \\ x &\approx 3.4 \end{aligned}$$

There were 3.4 children per woman in 1920.

54. $64\% \cdot 9800 = 0.64 \cdot 9800 = 6272$

You would expect 6272 post-secondary institutions to have Internet access in their classrooms.

56. Let x be the pounds of chocolate-covered peanuts.

	pounds	cost ($)	value
chocolate-covered	x	5	$5x$
granola bites	10	2	2(10)
trail mix	$x + 10$	3	$3(x + 10)$

The value of those being combined must be the same as the value as the mixture.

$$\begin{aligned}5x+2(10)&=3(x+10)\\5x+20&=3x+30\\5x+20-3x&=3x+30-3x\\2x+20&=30\\2x+20-20&=30-20\\2x&=10\\\frac{2x}{2}&=\frac{10}{2}\\x&=5\end{aligned}$$

Therefore, 5 pounds of chocolate-covered peanuts should be used.

58. Let x be the length of Christian's throw.

$$\begin{aligned}x&=148.00+0.689(148.00)\\&=148.00+101.972\\&=249.972\\&\approx 250\end{aligned}$$

Christian Sandstrom's world record throw was 250 meters.

60. $\frac{12}{3}=2^2$

62. $-3^3=(-3)^3$

64. $|-2| = 2;\ -|-2| = -2$

$|-2| > -|-2|$

66. answers may vary

68. **a.** yes; answers may vary

b. no; answers may vary

70. 23 g is what percent of 300 g? Let y represent the unknown percent.

$$\begin{aligned}y\cdot 300&=23\\\frac{300y}{300}&=\frac{23}{300}\\y&=0.07\overline{6}\end{aligned}$$

This food contains 7.7% of the daily value of total carbohydrate in one serving.

72. 6g · 9 calories/gram = 54 calories

54 of the 280 calories come from fat.

$\frac{54}{280}\approx 0.193$

19.3% of the calories in this food come from fat.

74. answers may vary

Section 2.8 Practice Exercises

1. Let x = time down, then $x + 1$ = time up.

	Rate ·	Time =	Distance
Up	1.5	$x + 1$	$1.5(x + 1)$
Down	4	x	$4x$

$$\begin{aligned} d &= d \\ 1.5(x+1) &= 4x \\ 1.5x+1.5 &= 4x \\ 1.5 &= 2.5x \\ \frac{1.5}{2.5} &= \frac{2.5x}{2.5} \\ 0.6 &= x \end{aligned}$$

Total Time = $x + 1 + x = 0.6 + 1 + 0.6 = 2.2$
The entire hike took 2.2 hours.

2. Let x = speed of eastbound train, then $x - 10$ = speed of westbound train.

	r ·	t =	d
East	x	1.5	$1.5x$
West	$x - 10$	1.5	$1.5(x - 10)$

$$\begin{aligned} 1.5x+1.5(x-10) &= 171 \\ 1.5x+1.5x-15 &= 171 \\ 3x-15 &= 171 \\ 3x &= 186 \\ \frac{3x}{3} &= \frac{186}{3} \\ x &= 62 \end{aligned}$$

$x - 10 = 62 - 10 = 52$
The eastbound train is traveling at 62 mph and the westbound train is traveling at 52 mph.

3. Let x = the number of \$20 bills, then $x + 47$ = number of \$5 bills.

Denomination	Number	Value
\$5 bills	$x + 47$	$5(x + 47)$
\$20 bills	x	$20x$

$$\begin{aligned} 5(x+47)+20x &= 1710 \\ 5x+235+20x &= 1710 \\ 235+25x &= 1710 \\ 25x &= 1475 \\ x &= 59 \end{aligned}$$

$x + 47 = 59 + 47 = 106$
There are 106 \$5 bills and 59 \$20 bills.

4. Let x = amount invested at 11.5%, then
30,000 – x = amount invested at 6%.

	Principal ·	Rate ·	Time =	Interest
11.5%	x	0.115	1	$x(0.115)(1)$
6%	30,000 – x	0.06	1	$0.06(30,000 - x)(1)$
Total	30,000			2790

$$\begin{aligned} 0.115x + 0.06(30,000 - x) &= 2790 \\ 0.115x + 1800 - 0.06x &= 2790 \\ 1800 + 0.055x &= 2790 \\ 0.055x &= 990 \\ \frac{0.055x}{0.055} &= \frac{990}{0.055} \\ x &= 18,000 \end{aligned}$$

30,000 – x = 30,000 – 18,000 = 12,000
She invested $18,000 at 11.5% and $12,000 at 6%.

Vocabulary, Readiness & Video Check 2.8

1.

	r ·	t =	d
bus	55	x	$55x$
car	50	$x + 3$	$50(x + 3)$

$55x = 50(x + 3)$

2. The important thing is to remember the difference between the *number* of bills you have and the *value* of the bills.

3.

P ·	R ·	T =	I
x	0.06	1	$0.06x$
36,000 – x	0.04	1	$0.04(36,000 - x)$

$0.06x = 0.04(36,000 - x)$

Exercise Set 2.8

2. Let x = the time traveled by the bus.

	Rate ·	Time =	Distance
Bus	60	x	$60x$
Car	40	$x + 1.5$	$40(x + 1.5)$

$$\begin{aligned} d &= d \\ 60x &= 40(x+1.5) \\ 60x &= 40x+60 \\ 20x &= 60 \\ \frac{20x}{20} &= \frac{60}{20} \\ x &= 3 \end{aligned}$$

It will take the bus 3 hours to overtake the car.

4. Let x = the time to get to Disneyland and $7.2 - x$ = the time to return

	Rate ·	Time =	Distance
Going	50	x	$50x$
Returning	40	$7.2 - x$	$40(7.2 - x)$

$$\begin{aligned} d &= d \\ 50x &= 40(7.2-x) \\ 50x &= 288-40x \\ 90x &= 288 \\ \frac{90x}{90} &= \frac{288}{90} \\ x &= 3.2 \end{aligned}$$

It took 3.2 hours to get to Disneyland.
$d = rt$
$d = 50(3.2) = 160$
The distance to Disneyland is 160 miles.

6. The value of z quarters is $0.25z$.

8. The value of $(20 - z)$ half-dollars is $0.50(20 - z)$.

10. The value of $97z$ \$100 bills is $100(97z)$ or $9700z$.

12. The value of $(15 - y)$ \$10 bills is $10(15 - y)$.

14. Let x = number of \$50 bills, then $6x$ = number of \$20 bills.

	Number of Bills	Value of Bills
\$20 bills	$6x$	$20(6x)$
\$50 bills	x	$50x$
Total		3910

$$\begin{aligned} 20(6x)+50x &= 3910 \\ 120x+50x &= 3910 \\ 170x &= 3910 \\ x &= 23 \end{aligned}$$

$6x = 6(23) = 138$
There are 138 \$20 bills and 23 \$50 bills.

16. Let x = the amount invested at 9% for one year.

	Principal ·	Rate =	Interest
9%	x	0.09	$0.09x$
10%	$x + 250$	0.10	$0.10(x + 250)$
Total			101

$$\begin{aligned} 0.09x+0.10(x+250) &= 101 \\ 0.09x+0.10x+25 &= 101 \\ 0.19x+25 &= 101 \\ 0.19x &= 76 \\ \frac{0.19x}{0.19} &= \frac{76}{0.19} \\ x &= 400 \end{aligned}$$

$x + 250 = 400 + 250 = 650$
She invested \$650 at 10% and \$400 at 9%.

18. Let x = the amount invested at 10% for one year.

	Principal ·	Rate =	Interest
10%	x	0.10	$0.10x$
12%	$2x$	0.12	$0.12(2x)$
Total			2890

$$\begin{aligned} 0.10x+0.12(2x) &= 2890 \\ 0.10x+0.24x &= 2890 \\ 0.34x &= 2890 \\ \frac{0.34x}{0.34} &= \frac{2890}{0.34} \\ x &= 8500 \end{aligned}$$

$2x = 2(8500) = 17{,}000$
He invested \$17,000 at 12% and \$8500 at 10%.

20. Let x = number of adult tickets, then $732 - x$ = number of child tickets.

	Number ·	Rate =	Cost
Adult	x	22	$22x$
Child	$732 - x$	15	$15(732 - x)$
Total	732		12,912

$$\begin{aligned}22x+15(732-x)&=12,912\\22x+10,980-15x&=12,912\\10,980+7x&=12,912\\7x&=1932\\x&=276\end{aligned}$$

$732 - x = 732 - 276 = 456$

Sales included 276 adult tickets and 456 child tickets.

22. Let x = the time traveled

	Rate	· Time	= Distance
Car A	65	x	$65x$
Car B	41	x	$41x$

The total distance is 530 miles.

$$\begin{aligned}65x+41x&=530\\106x&=530\\\frac{106x}{106}&=\frac{530}{106}\\x&=5\end{aligned}$$

The two cars will be 530 miles apart in 5 hours.

24. Let x = the amount invested at 12% for one year.

	Principal	· Rate	= Interest
12%	x	0.12	$0.12x$
4%	$20,000 - x$	-0.04	$-0.04(20,000 - x)$

$$\begin{aligned}0.12x-0.04(20,000-x)&=0\\0.12x-800+0.04x&=0\\0.16x-800&=0\\0.16x&=800\\\frac{0.16x}{0.16}&=\frac{800}{0.16}\\x&=5000\end{aligned}$$

$20,000 - x = 20,000 - 5000 = 15,000$

She invested \$15,000 at 4% and \$5000 at 12%.

26. Let x = the time they are able to talk.

	Rate	· Time	= Distance
Cade	5	x	$5x$
Kathleen	4	x	$4x$
Total			20

$$\begin{aligned} 5x+4x &= 2 \\ 9x &= 20 \\ \frac{9x}{9} &= \frac{20}{9} \\ x &= 2\frac{2}{9} \end{aligned}$$

They can talk for $2\frac{2}{9}$ hours.

28. Let x = the speed of the slower train.

	Rate	· Time	= Distance
Train A	x	1.5	$1.5x$
Train B	$x + 8$	1.5	$1.5(x + 8)$

The total distance is 162 miles.

$$\begin{aligned} 1.5x+1.5(x+8) &= 162 \\ 1.5x+1.5x+12 &= 162 \\ 3x+12 &= 162 \\ 3x &= 150 \\ \frac{3x}{3} &= \frac{150}{3} \\ x &= 50 \end{aligned}$$

$x + 8 = 58$

The speeds of the trains are 50 mph and 58 mph.

30. Let x = number of quarters, then
$5x$ = number of dimes.

	Number	Value
Quarters	x	$0.25x$
Dimes	$5x$	$0.10(5x)$
Total		27.75

$$\begin{aligned} 0.25x+0.10(5x) &= 27.75 \\ 0.25x+0.5x &= 27.75 \\ 0.75x &= 27.75 \\ x &= 37 \end{aligned}$$

$5x = 5(37) = 185$

The collection has 37 quarters and 185 dimes.

32. Let x = the time traveled.

	Rate	· Time	= Distance
Car A	65	x	$65x$
Car B	45	x	$45x$

The total distance is 330.

$$\begin{aligned} 65x+45x &= 330 \\ 110x &= 330 \\ \frac{110x}{110} &= \frac{330}{110} \\ x &= 3 \end{aligned}$$

They will be 330 miles apart in 3 hours.

34. Let x = the time traveled.

	Rate ·	Time =	Distance
Car A	40	x	$40x$
Car B	50	x	$50x$

If two cars are traveling in the same direction, so find the difference in their distances traveled.

$$\begin{aligned} 50x-40x &= 20 \\ 10x &= 20 \\ \frac{10x}{10} &= \frac{20}{10} \\ x &= 2 \end{aligned}$$

They will be 20 miles apart in 2 hours.

36. Let x = the amount invested at 9% for one year.

	Principal ·	Rate =	Interest
9%	x	0.09	$0.09x$
10%	$2x$	0.10	$0.1(2x)$
11%	$3x$	0.11	$0.11(3x)$
Total			2790

$$\begin{aligned} 0.09x+0.1(2x)+0.11(3x) &= 2790 \\ 0.09x+0.2x+0.33x &= 2790 \\ 0.62x &= 2790 \\ \frac{0.62x}{0.62} &= \frac{2790}{0.62} \\ x &= 4500 \end{aligned}$$

$2x = 2(4500) = 9000$
$3x = 3(4500) = 13,500$

She invested \$4500 at 9%, \$9000 at 10% and \$13,500 at 11%.

38. Let x = the time it takes them to meet.

	Rate ·	Time =	Distance
Nedra	3	x	$3x$
Latonya	4	x	$4x$
Total			12

$$\begin{aligned}3x+4x&=12\\7x&=12\\\frac{7x}{7}&=\frac{12}{7}\\x&=1\frac{5}{7}\end{aligned}$$

They meet in $1\frac{5}{7}$ hours.

40. Let x = the time before getting stopped.

	Rate ·	Time =	Distance
Before	70	x	$70x$
After	60	$4-x$	$60(4-x)$
Total			255

$$\begin{aligned}70x+60(4-x)&=255\\70x+240-60x&=255\\10x+240&=255\\10x&=15\\\frac{10x}{10}&=\frac{15}{10}\\x&=1.5\end{aligned}$$

He drove 1.5 hours before getting stopped.

42. $(-2)+(-8)=-10$

44. $-11+2.9=-8.1$

46. $-12-3=-12+(-3)=-15$

48. Let x = number of quarters, then
$136+x$ = number of dimes,
$8x$ = number of nickels,
$16x+32$ = number of pennies.

	Number	Value
Quarters	x	$0.25x$
Dimes	$136+x$	$0.10(136+x)$
Nickels	$8x$	$0.05(8x)$
Pennies	$16x+32$	$0.01(16x+32)$
Total		44.86

$$\begin{aligned}0.25x+0.10(136+x)+0.05(8x)+0.01(16x+32)&=44.86\\0.25x+13.6+0.1x+0.4x+0.16x+0.32&=44.86\\0.91x+13.92&=44.86\\0.91x&=30.94\\x&=34\end{aligned}$$

$136 + x = 136 + 34 = 170$
$8x = 8(34) = 272$
$16x + 32 = 16(34) + 32 = 576$
There were 34 quarters, 170 dimes, 272 nickels, and 576 pennies.

50.
$$\begin{aligned} R &= C \\ 60x &= 50x + 5000 \\ 10x &= 5000 \\ \frac{10x}{10} &= \frac{5000}{10} \\ x &= 500 \end{aligned}$$
Should sell 500 boards to break even.
$C = R = 60x = 60(500) = 30,000$
It costs $30,000 to produce the break-even number of boards.

52.
$$\begin{aligned} R &= C \\ 105x &= 875 + 70x \\ 105x - 70x &= 875 + 70x - 70x \\ 35x &= 875 \\ \frac{35x}{35} &= \frac{875}{35} \\ x &= 25 \end{aligned}$$
They should sell 25 monitors to break even.

Section 2.9 Practice Exercises

1. $x < 5$
Place a parenthesis at 5 since the inequality symbol is <. Shade to the left of 5. The solution set is $(-\infty, 5)$.

Title:

2.
$$\begin{aligned} x + 11 &\ge 6 \\ x + 11 - 11 &\ge 6 - 11 \\ x &\ge -5 \end{aligned}$$
The solution set is $[-5, \infty)$.

Title:

3.
$$\begin{aligned} -5x &\ge -15 \\ \frac{-5x}{-5} &\le \frac{-15}{-5} \\ x &\le 3 \end{aligned}$$
The solution set is $(-\infty, 3]$.

Title:

4.
$$\begin{aligned} 3x &> -9 \\ \frac{3x}{3} &> \frac{-9}{3} \\ x &> -3 \end{aligned}$$
The solution set is $(-3, \infty)$.

Title:

5.
$$\begin{aligned} 45 - 7x &\le -4 \\ 45 - 7x - 45 &\le -4 - 45 \\ -7x &\le -49 \\ \frac{-7x}{-7} &\ge \frac{-49}{-7} \\ x &\ge 7 \end{aligned}$$
The solution set is $[7, \infty)$.

Title:

6.
$$\begin{aligned} 3x + 20 &\le 2x + 13 \\ 3x + 20 - 2x &\le 2x + 13 - 2x \\ x + 20 &\le 13 \\ x + 20 - 20 &\le 13 - 20 \\ x &\le -7 \end{aligned}$$
The solution set is $(-\infty, -7]$.

Title:

7.
$$\begin{aligned} 6 - 5x &> 3(x - 4) \\ 6 - 5x &> 3x - 12 \\ 6 - 5x - 3x &> 3x - 12 - 3x \\ 6 - 8x &> -12 \\ 6 - 8x - 6 &> -12 - 6 \\ -8x &> -18 \\ \frac{-8x}{-8} &< \frac{-18}{-8} \\ x &< \frac{9}{4} \end{aligned}$$
The solution set is $\left(-\infty, \frac{9}{4}\right)$.

Title:
EMG-BA5-HC-02-09-P
Creator:

8.
$$\begin{aligned}3(x-4)-5 &\le 5(x-1)-12\\ 3x-12-5 &\le 5x-5-12\\ 3x-17 &\le 5x-17\\ 3x-17-5x &\le 5x-17-5x\\ -2x-17 &\le -17\\ -2x-17+17 &\le -17+17\\ -2x &\le 0\\ \frac{-2x}{-2} &\ge \frac{0}{-2}\\ x &\ge 0\end{aligned}$$
The solution set is $[0, \infty)$.

Title:
EMG-BA5-HC-02-09-P

9. $-3 \le x < 1$
Graph all numbers greater than or equal to –3 and less than 1. Place a bracket at –3 and a parenthesis at 1.
The solution set is $[-3, 1)$.

Title:
EMG-BA5-HC-02-09-P

10.
$$\begin{aligned}-4 < 3x+2 &\le 8\\ -4-2 < 3x+2-2 &\le 8-2\\ -6 < 3x &\le 6\\ \frac{-6}{3} < \frac{3x}{3} &\le \frac{6}{3}\\ -2 < x &\le 2\end{aligned}$$
The solution set is $(-2, 2]$.

Title:
EMG-BA5-HC-02-09-P

11.
$$\begin{aligned}1 < \frac{3}{4}x+5 &< 6\\ 4(1) < 4\left(\frac{3}{4}x+5\right) &< 4(6)\\ 4 < 3x+20 &< 24\\ 4-20 < 3x+20-20 &< 24-20\\ -16 < 3x &< 4\\ \frac{-16}{3} < \frac{3x}{3} &< \frac{4}{3}\\ -\frac{16}{3} < x &< \frac{4}{3}\end{aligned}$$
The solution set is $\left(-\frac{16}{3}, \frac{4}{3}\right)$.

Title:
EMG-BA5-HC-02-09-P
Creator:
Adobe Illustrator(R) 11

12. Let x = the number.
$$\begin{aligned}35-2x &> 15\\ 35-2x-35 &> 15-35\\ -2x &> -20\\ \frac{-2x}{-2} &< \frac{-20}{-2}\\ x &< 10\end{aligned}$$
All numbers less than 10.

13. Let x = number of classes.
$$\begin{aligned}300+375x &\le 1500\\ 300+375x-300 &\le 1500-300\\ 375x &\le 1200\\ \frac{375x}{375} &\le \frac{1200}{375}\\ x &\le 3.2\end{aligned}$$
Kasonga can afford at most 3 community college classes this semester.

Vocabulary, Readiness & Video Check 2.9

1. $6x - 7(x + 9)$ is an expression.
2. $6x = 7(x + 9)$ is an equation.
3. $6x < 7(x + 9)$ is an inequality.
4. $5y - 2 \ge -38$ is an inequality.
5. –5 is not a solution to $x \ge -3$.
6. $|-6| = 6$ is not a solution to $x < 6$.
7. The graph of Example 1 is shaded from $-\infty$ to and including –1, as indicated by a bracket. To write interval notation, you write down what is shaded for the inequality from left to right. A parenthesis is always used with $-\infty$, so from the graph, the interval notation is $(-\infty, -1]$.
8. Step 5 is where you apply the multiplication property of inequality. If a negative number is multiplied or divided when applying this property, you need to make sure you remember to reverse the direction of the inequality symbol.
9. You would divide the left, middle, and right by –3 instead of 3, which would reverse the directions of both inequality symbols.
10. no greater than; $\le$

Exercise Set 2.9

2. $(-3, \infty)$, $x > -3$

Title:

4. $(-\infty, 4]$, $x \le 4$

Title:

6. $y < 0$, $(-\infty, 0)$

Title:

8. $z < -\frac{2}{3}$, $\left(-\infty, -\frac{2}{3}\right)$

Title:
EMG-BA5-HC-02-09-0
Creator:

10. $x > 3$, $(3, \infty)$

Title:

12.
$$\begin{aligned} 3x &> -9 \\ x &> -3,\ (-3, \infty) \end{aligned}$$

Title:

14.
$$\begin{aligned} x + 4 &\le 1 \\ x &\le -3,\ (-\infty, -3] \end{aligned}$$

Title:

16.
$$\begin{aligned} -5x &< 20 \\ \frac{-5x}{-5} &> \frac{20}{-5} \\ x &> -4,\ (-4, \infty) \end{aligned}$$

Title:

18.
$$\begin{aligned} 3 - 7x &\ge 10 - 8x \\ 3 + x &\ge 10 \\ x &\ge 7,\ [7, \infty) \end{aligned}$$

Title:

20.
$$\begin{aligned} 7x + 3 &< 9x - 3x \\ 7x + 3 &< 6x \\ x + 3 &< 0 \\ x &< -3,\ (-\infty, -3) \end{aligned}$$

Title:

22.
$$\begin{aligned} 3x + 9 &\le 5(x - 1) \\ 3x + 9 &\le 5x - 5 \\ -2x + 9 &\le -5 \\ -2x &\le -14 \\ \frac{-2x}{-2} &\ge \frac{-14}{-2} \\ x &\ge 7,\ [7, \infty) \end{aligned}$$

Title:

24.
$$\begin{aligned} -7x + 4 &> 3(4 - x) \\ -7x + 4 &> 12 - 3x \\ -4x + 4 &> 12 \\ -4x &> 8 \\ \frac{-4x}{-4} &< \frac{8}{-4} \\ x &< -2,\ (-\infty, -2) \end{aligned}$$

Title:

26.
$$\begin{aligned} 3(5x - 4) &\le 4(3x - 2) \\ 15x - 12 &\le 12x - 8 \\ 3x - 12 &\le -8 \\ 3x &\le 4 \\ x &\le \frac{4}{3},\ \left(-\infty, \frac{4}{3}\right] \end{aligned}$$

Title:
EMG-BA5-HC-02-09-2
Creator:

28.
$$\begin{aligned} 7(x - 2) + x &\le -4(5 - x) - 12 \\ 7x - 14 + x &\le -20 + 4x - 12 \\ 8x - 14 &\le -32 + 4x \\ 4x - 14 &\le -32 \\ 4x &\le -18 \\ x &\le -\frac{9}{2},\ \left(-\infty, -\frac{9}{2}\right] \end{aligned}$$

Title:
EMG-BA5-HC-02-09-2
Creator:

30.
$$\begin{aligned} -7x &> 21 \\ \frac{-7x}{-7} &< \frac{21}{-7} \\ x &< -3,\ (-\infty, -3) \end{aligned}$$

Title:

32.
$$\begin{aligned} y - 4 &\le 1 \\ y &\le 5,\ (-\infty, 5] \end{aligned}$$

Title:

34.
$$\begin{aligned} 2x-1 &\ge 4x-5 \\ -2x-1 &\ge -5 \\ -2x &\ge -4 \\ \frac{-2x}{-2} &\le \frac{-4}{-2} \\ x &\le 2,\ (-\infty,\ 2] \end{aligned}$$

Title:

36.
$$\begin{aligned} 4-x &< 8x+2x \\ 4-x &< 10x \\ 4-11x &< 0 \\ -11x &< -4 \\ \frac{-11x}{-11} &> \frac{-4}{-11} \\ x &> \frac{4}{11},\ \left(\frac{4}{11},\ \infty\right) \end{aligned}$$

Title:
EMG-BA5-HC-02-09-3
Creator:

38.
$$\begin{aligned} \frac{5}{6}x &\ge -8 \\ x &\ge -\frac{48}{5},\ \left[-\frac{48}{5},\ \infty\right) \end{aligned}$$

Title:
EMG-BA5-HC-02-09-2
Creator:

40.
$$\begin{aligned} 5(x+4) &< 4(2x+3) \\ 5x+20 &< 8x+12 \\ -3x+20 &< 12 \\ -3x &< -8 \\ \frac{-3x}{-3} &> \frac{-8}{-3} \\ x &> \frac{8}{3},\ \left(\frac{8}{3},\ \infty\right) \end{aligned}$$

Title:
EMG-BA5-HC-02-09-3
Creator:

42.
$$\begin{aligned} 6(2-x) &\ge 12 \\ 12-6x &\ge 12 \\ -6x &\ge 0 \\ \frac{-6x}{-6} &\le \frac{0}{-6} \\ x &\le 0,\ (\infty,\ 0] \end{aligned}$$

Title:

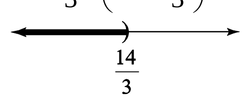
44.
$$\begin{aligned} -6x+2 &< -3(x+4) \\ -6x+2 &< -3x-12 \\ -3x+2 &< -12 \\ -3x &< -14 \\ \frac{-3x}{-3} &> \frac{-14}{-3} \\ x &> \frac{14}{3},\ \left(\frac{14}{3},\ \infty\right) \end{aligned}$$

Title:
EMG-BA5-HC-02-09-4
Creator:

46.
$$\begin{aligned} -5(1-x)+x &\le -(6-2x)+6 \\ -5+5x+x &\le -6+2x+6 \\ -5+6x &\le 2x \\ -5+4x &\le 0 \\ 4x &\le 5 \\ x &\le \frac{5}{4},\ \left(-\infty,\ \frac{5}{4}\right] \end{aligned}$$

Title:
EMG-BA5-HC-02-09-4
Creator:

48.
$$\begin{aligned} \frac{1}{3}(3x-1) &< \frac{1}{2}(x+4) \\ 6\left[\frac{1}{3}(3x-1)\right] &< 6\left[\frac{1}{2}(x+4)\right] \\ 2(3x-1) &< 3(x+4) \\ 6x-2 &< 3x+12 \\ 6x-2+2 &< 3x+12+2 \\ 6x &< 3x+14 \\ 6x-3x &< 3x-3x+14 \\ 3x &< 14 \\ \frac{3x}{3} &< \frac{14}{3} \\ x &< \frac{14}{3},\ \left(-\infty,\ \frac{14}{3}\right) \end{aligned}$$



50. $2 \le y \le 3$, [2, 3]

Title:

52. $-1 \le x \le 4$, [−1, 4]

Title:

54. $-5 < 2x < -2$

$-\frac{5}{2} < x < -1, \left(-\frac{5}{2}, -1\right)$

Title:
EMG-BA5-HC-02-09-5
Creator:

56. $4 \le 5x - 6 \le 19$

$10 \le 5x \le 25$

$2 \le x \le 5, [2, 5]$

Title:
EMG-BA5-HC-02-09-5

58. $0 < 4(x+5) \le 8$

$0 < 4x + 20 \le 8$

$-20 < 4x \le -12$

$-5 < x \le -3, (-5, -3]$

Title:
EMG-BA5-HC-02-09-6

60. $1 < 4 + 2x \le 7$

$-3 < 2x \le 3$

$-\frac{3}{2} < x \le \frac{3}{2}, \left(-\frac{3}{2}, \frac{3}{2}\right]$

Title:
EMG-BA5-HC-02-09-6
Creator:

62. $-5 \le 2(x+4) < 8$

$-5 \le 2x + 8 < 8$

$-13 \le 2x < 0$

$-\frac{13}{2} \le x < 0, \left[-\frac{13}{2}, 0\right)$

Title:
EMG-BA5-HC-02-09-6
Creator:

64. Let x be the number.

$$5x + 1 \le 10$$
$$5x + 1 - 1 \le 10 - 1$$
$$5x \le 9$$
$$\frac{5x}{5} \le \frac{9}{5}$$
$$x \le \frac{9}{5}$$

All numbers less than or equal to $\frac{9}{5}$ make this statement true.

66. Use $P = a + b + c$ when $a = x$, $b = 3x$, $c = 12$, and $P \le 32$.

$$x + 3x + 12 \le 32$$
$$4x + 12 \le 32$$
$$4x + 12 - 12 \le 32 - 12$$
$$4x \le 20$$
$$\frac{4x}{4} \le \frac{20}{4}$$
$$x \le 5$$

$3x \le 3(5) = 15$

The maximum lengths of the other two sides are 5 inches and 15 inches.

68. Convert heights to inches.

$6'8'' = 6 \cdot 12 + 8 = 80$

$6'6'' = 6 \cdot 12 + 6 = 78$

$6'0'' = 6 \cdot 12 + 0 = 72$

$5'9'' = 5 \cdot 12 + 9 = 69$

$6'5'' = 6 \cdot 12 + 5 = 77$

Let x be the height of the center.

$$\frac{x + 80 + 78 + 72 + 69}{5} \ge 77$$
$$\frac{x + 299}{5} \ge 77$$
$$5 \cdot \frac{x + 299}{5} \ge 5 \cdot 77$$
$$x + 299 \ge 385$$
$$x + 299 - 299 \ge 385 - 299$$
$$x \ge 86$$

$86'' = 7'2''$

The center should be at least $7'2''$.

70. Let x represent the number of people. Then the cost is $40 + 15x$.

$$40 + 15x \le 860$$
$$40 + 15x - 40 \le 860 - 40$$
$$15x \le 820$$
$$\frac{15x}{15} \le \frac{820}{15}$$
$$x \le \frac{820}{15} \approx 54.7$$

They can invite at most 54 people.

72. Let x represent the number of minutes.

$$5.3x \ge 200$$
$$\frac{5.3x}{5.3} \ge \frac{200}{5.3}$$
$$x \ge \frac{200}{5.3} \approx 38$$

The person must bicycle at least 38 minutes.

74. Let x = the unknown number.

$$2 < \frac{1}{2}x - 4 < 3$$
$$6 < \frac{1}{2}x < 7$$
$$12 < x < 14$$

All numbers between 12 and 14

76. $(3)^3 = (3)(3)(3) = 27$

78. $0^5 = (0)(0)(0)(0)(0) = 0$

80. $\left(\frac{2}{3}\right)^3 = \left(\frac{2}{3}\right)\left(\frac{2}{3}\right)\left(\frac{2}{3}\right) = \frac{8}{27}$

82. Since $m \le n$, then $2m \le 2n$.

84. If $-x < y$, then $x > -y$.

86. Yes; answers may vary

88. Let x be the score on her final exam. Since the final counts as two tests, her final course average is $\frac{85+95+92+3x}{6}$.

$$\frac{85+95+92+3x}{6} \ge 90$$
$$\frac{272+3x}{6} \ge 90$$
$$6\left(\frac{272+3x}{6}\right) \ge 6(90)$$
$$272+3x \ge 540$$
$$272+2x-272 \ge 540-272$$
$$3x \ge 268$$
$$\frac{3x}{3} \ge \frac{268}{3}$$
$$x \ge 89.\overline{3}$$

Her final exam score must be at least 89.3 for her to get an A.

90. answers may vary

92. answers may vary

94. $C = 3.14d$

$$118 \le 3.14d \le 122$$
$$37.58 \le d \le 38.85$$

The diameter must be between 37.58 mm and 38.85 mm.

96. $x(x-3) \ge x^2 - 5x - 8$

$$x^2 - 3x \ge x^2 - 5x - 8$$
$$-3x \ge -5x - 8$$
$$2x \ge -8$$
$$x \ge -4,\ [-4, \infty)$$

Title:
EMG-BA5-HC-02-09-3

98. $x^2 - 4x + 8 < x(x+8)$

$$x^2 - 4x + 8 < x^2 + 8x$$
$$-4x + 8 < 8x$$
$$-12x + 8 < 0$$
$$-12x < -8$$
$$\frac{-12x}{-12} > \frac{-8}{-12}$$
$$x > \frac{2}{3},\ \left(\frac{2}{3}, \infty\right)$$

Title:
EMG-BA5-HC-02-09-4
Creator:

Chapter 2 Vocabulary Check

1. Terms with the same variables raised to exactly the same powers are called <u>like terms</u>.
2. If terms are not like terms, they are <u>unlike terms</u>.
3. A <u>linear equation in one variable</u> can be written in the form $ax + b = c$.
4. A <u>linear inequality in one variable</u> can be written in the form $ax + b < c$, (or $>$, $\le$, $\ge$).
5. Inequalities containing two inequality symbols are called <u>compound inequalities</u>.
6. An equation that describes a known relationship among quantities is called a <u>formula</u>.
7. The <u>numerical coefficient</u> of a term is its numerical factor.
8. Equations that have the same solution are called <u>equivalent equations</u>.
9. The solutions to the equation $x + 5 = x + 5$ are <u>all real numbers</u>.
10. The solution to the equation $x + 5 = x + 4$ is <u>no solution</u>.

11. If both sides of an inequality are multiplied or divided by the same positive number, the direction of the inequality symbol is the same.

12. If both sides of an inequality are multiplied by the same negative number, the direction of the inequality symbol is reversed.

Chapter 2 Review

1. $5x - x + 2x = 6x$

2. $0.2z - 4.6x - 7.4z = -4.6x - 7.2z$

3. $\frac{1}{2}x + 3 + \frac{7}{2}x - 5 = \frac{8}{2}x - 2 = 4x - 2$

4. $\frac{4}{5}y + 1 + \frac{6}{5}y + 2 = \frac{10}{5}y + 3 = 2y + 3$

5. $2(n - 4) + n - 10 = 2n - 8 + n - 10 = 3n - 18$

6. $3(w+2) - (12 - w) = 3w + 6 - 12 + w = 4w - 6$

7. $(x + 5) - (7x - 2) = x + 5 - 7x + 2 = -6x + 7$

8. $$\begin{aligned}(y - 0.7) - (1.4y - 3) &= y - 0.7 - 1.4y + 3\\ &= -0.4y + 2.3\end{aligned}$$

9. Three times a number decreased by 7 is $3x - 7$.

10. Twice the sum of a number and 2.8 added to 3 times the number is $2(x + 2.8) + 3x$.

11. $$\begin{aligned}8x + 4 &= 9x\\ 8x + 4 - 8x &= 9x - 8x\\ 4 &= x\end{aligned}$$

12. $$\begin{aligned}5y - 3 &= 6y\\ 5y - 3 - 5y &= 6y - 5y\\ -3 &= y\end{aligned}$$

13. $$\begin{aligned}\frac{2}{7}x + \frac{5}{7}x &= 6\\ \frac{7}{7}x &= 6\\ x &= 6\end{aligned}$$

14. $$\begin{aligned}3x - 5 &= 4x + 1\\ -5 &= x + 1\\ -6 &= x\end{aligned}$$

15. $$\begin{aligned}2x - 6 &= x - 6\\ x - 6 &= -6\\ x &= 0\end{aligned}$$

16. $$\begin{aligned}4(x + 3) &= 3(1 + x)\\ 4x + 12 &= 3 + 3x\\ x + 12 &= 3\\ x &= -9\end{aligned}$$

17. $$\begin{aligned}6(3 + n) &= 5(n - 1)\\ 18 + 6n &= 5n - 5\\ 18 + n &= -5\\ n &= -23\end{aligned}$$

18. $$\begin{aligned}5(2 + x) - 3(3x + 2) &= -5(x - 6) + 2\\ 10 + 5x - 9x - 6 &= -5x + 30 + 2\\ -4x + 4 &= -5x + 32\\ x + 4 &= 32\\ x &= 28\end{aligned}$$

19. $$\begin{aligned}x - 5 &= 3\\ x - 5 + \underline{5} &= 3 + \underline{5}\\ x &= 8\end{aligned}$$

20. $$\begin{aligned}x + 9 &= -2\\ x + 9 - \underline{9} &= -2 - \underline{9}\\ x &= -11\end{aligned}$$

21. $10 - x$; choice b.

22. $x - 5$; choice a.

23. Complementary angles sum to 90°.
$(90 - x)°$; choice b.

24. Supplementary angles sum to 180°.
$180 - (x + 5) = 180 - x - 5 = 175 - x$
$(175 - x)°$; choice c.

25. $$\begin{aligned}\frac{3}{4}x &= -9\\ \frac{4}{3}\left(\frac{3}{4}x\right) &= \frac{4}{3}(-9)\\ x &= -12\end{aligned}$$

26. $$\begin{aligned}\frac{x}{6} &= \frac{2}{3}\\ 6 \cdot \frac{x}{6} &= 6 \cdot \frac{2}{3}\\ x &= 4\end{aligned}$$

27. $-5x = 0$
$$\frac{-5x}{-5} = \frac{0}{-5}$$
$$x = 0$$

28. $-y = 7$
$$\frac{-y}{-1} = \frac{7}{-1}$$
$$y = -7$$

29. $0.2x = 0.15$
$$\frac{0.2x}{0.2} = \frac{0.15}{0.2}$$
$$x = 0.75$$

30. $\frac{-x}{3} = 1$
$$-3 \cdot \frac{-x}{3} = -3 \cdot 1$$
$$x = -3$$

31. $-3x + 1 = 19$
$$-3x = 18$$
$$\frac{-3x}{-3} = \frac{18}{-3}$$
$$x = -6$$

32. $5x + 25 = 20$
$$5x = -5$$
$$\frac{5x}{5} = \frac{-5}{5}$$
$$x = -1$$

33. $7(x-1) + 9 = 5x$
$$7x - 7 + 9 = 5x$$
$$7x + 2 = 5x$$
$$2 = -2x$$
$$\frac{2}{-2} = \frac{-2x}{-2}$$
$$-1 = x$$

34. $7x - 6 = 5x - 3$
$$2x - 6 = -3$$
$$2x = 3$$
$$\frac{2x}{2} = \frac{3}{2}$$
$$x = \frac{3}{2}$$

35. $-5x + \frac{3}{7} = \frac{10}{7}$
$$7\left(-5x + \frac{3}{7}\right) = 7 \cdot \frac{10}{7}$$
$$-35x + 3 = 10$$
$$-35x = 7$$
$$x = -\frac{7}{35}$$
$$x = -\frac{1}{5}$$

36. $5x + x = 9 + 4x - 1 + 6$
$$6x = 4x + 14$$
$$2x = 14$$
$$x = 7$$

37. Let x = the first integer, then
$x + 1$ = the second integer, and
$x + 2$ = the third integer.
sum = $x + (x + 1) + (x + 2) = 3x + 3$

38. Let x = the first integer, then
$x + 2$ = the second integer
$x + 4$ = the third integer
$x + 6$ = the fourth integer.
sum = $x + (x + 6) = 2x + 6$

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

40. $\frac{7}{8}x + 1 = \frac{5}{8}x$
$$8\left(\frac{7}{8}x + 1\right) = 8\left(\frac{5}{8}x\right)$$
$$7x + 8 = 5x$$
$$8 = -2x$$
$$-4 = x$$

41. $-(5x + 1) = -7x + 3$
$$-5x - 1 = -7x + 3$$
$$2x - 1 = 3$$
$$2x = 4$$
$$x = 2$$

42. $$\begin{aligned} -4(2x+1) &= -5x+5 \\ -8x-4 &= -5x+5 \\ -3x-4 &= 5 \\ -3x &= 9 \\ x &= -3 \end{aligned}$$

43. $$\begin{aligned} -6(2x-5) &= -3(9+4x) \\ -12x+30 &= -27-12x \\ 30 &= -27 \end{aligned}$$
There is no solution.

44. $$\begin{aligned} 3(8y-1) &= 6(5+4y) \\ 24y-3 &= 30+24y \\ -3 &= 30 \end{aligned}$$
There is no solution.

45. $$\begin{aligned} \frac{3(2-z)}{5} &= z \\ 3(2-z) &= 5z \\ 6-3z &= 5z \\ 6 &= 8z \\ \frac{6}{8} &= z \\ \frac{3}{4} &= z \end{aligned}$$

46. $$\begin{aligned} \frac{4(n+2)}{5} &= -n \\ 4(n+2) &= -5n \\ 4n+8 &= -5n \\ 8 &= -9n \\ -\frac{8}{9} &= n \end{aligned}$$

47. $$\begin{aligned} 0.5(2n-3)-0.1 &= 0.4(6+2n) \\ 10[0.5(2n-3)-0.1] &= 10[0.4(6+2n)] \\ 5(2n-3)-1 &= 4(6+2n) \\ 10n-15-1 &= 24+8n \\ 10n-16 &= 24+8n \\ 2n-16 &= 24 \\ 2n &= 40 \\ n &= 20 \end{aligned}$$

48. $$\begin{aligned} -9-5a &= 3(6a-1) \\ -9-5a &= 18a-3 \\ -9 &= 23a-3 \\ -6 &= 23a \\ -\frac{6}{23} &= a \end{aligned}$$

49. $$\begin{aligned} \frac{5(c+1)}{6} &= 2c-3 \\ 5(c+1) &= 6(2c-3) \\ 5c+5 &= 12c-18 \\ -7c+5 &= -18 \\ -7c &= -23 \\ c &= \frac{23}{7} \end{aligned}$$

50. $$\begin{aligned} \frac{2(8-a)}{3} &= 4-4a \\ 2(8-a) &= 3(4-4a) \\ 16-2a &= 12-12a \\ 10a+16 &= 12 \\ 10a &= -4 \\ a &= \frac{-4}{10} \\ a &= -\frac{2}{5} \end{aligned}$$

51. $$\begin{aligned} 200(70x-3560) &= -179(150x-19,300) \\ 14,000x-712,000 &= -26,850x+3,454,700 \\ 40,850x-712,000 &= 3,454,700 \\ 40,850x &= 4,166,700 \\ x &= 102 \end{aligned}$$

52. $$\begin{aligned} 1.72y-0.04y &= 0.42 \\ 1.68y &= 0.42 \\ y &= 0.25 \end{aligned}$$

53. Let x = length of a side of the square, then
50.5 + 10x = the height.
$$\begin{aligned} x+(50.5+10x) &= 7327 \\ 11x+50.5 &= 7327 \\ 11x &= 7276.5 \\ x &= 661.5 \end{aligned}$$
50.5 + 10x = 50.5 + 10(661.5) = 6665.5
The height is 6665.5 inches.

54. Let x = the length of the shorter piece and
2x = the length of the other.
$$\begin{aligned} x+2x &= 12 \\ 3x &= 12 \\ x &= 4 \end{aligned}$$
2x = 2(4) = 8
The lengths are 4 feet and 8 feet.

55. Let x = the number of Target Canada stores, then $14x - 69$ = the number of Target US stores.
$$x+(14x-69)=1926$$
$$15x-69=1926$$
$$15x=1995$$
$$x=133$$
$14x - 69 = 14(133) - 69 = 1862 - 69 = 1793$
There were 133 Target Canada stores and 1793 Target US stores.

56. Let x = first integer, then
$x + 1$ = second integer, and
$x + 2$ = third integer.
$$x+(x+1)+(x+2)=-114$$
$$3x+3=-114$$
$$3x=-117$$
$$x=-39$$
$x + 1 = -39 + 1 = -38$
$x + 2 = -39 + 2 = -37$
The integers are -39, -38, -37.

57. Let x = the unknown number.
$$\frac{x}{3}=x-2$$
$$3\cdot\frac{x}{3}=3(x-2)$$
$$x=3x-6$$
$$-2x=-6$$
$$x=3$$
The number is 3.

58. Let x = the unknown number.
$$2(x+6)=-x$$
$$2x+12=-x$$
$$12=-3x$$
$$-4=x$$
The number is -4.

59. Let $P = 46$ and $l = 14$.
$$P=2l+2w$$
$$46=2(14)+2w$$
$$46=28+2w$$
$$18=2w$$
$$9=w$$

60. Let $V = 192$, $l = 8$, and $w = 6$.
$$V=lwh$$
$$192=8(6)h$$
$$192=48h$$
$$4=h$$

61.
$$y=mx+b$$
$$y-b=mx$$
$$\frac{y-b}{x}=m$$

62.
$$r=vst-5$$
$$r+5=vst$$
$$\frac{r+5}{vt}=s$$

63.
$$2y-5x=7$$
$$-5x=-2y+7$$
$$x=\frac{-2y+7}{-5}$$
$$x=\frac{2y-7}{5}$$

64.
$$3x-6y=-2$$
$$-6y=-3x-2$$
$$y=\frac{-3x-2}{-6}$$
$$y=\frac{3x+2}{6}$$

65.
$$C=\pi D$$
$$\frac{C}{D}=\pi$$

66.
$$C=2\pi r$$
$$\frac{C}{2r}=\pi$$

67. Let $V = 900$, $l = 20$, and $h = 3$.
$$V=lwh$$
$$900=20w(3)$$
$$900=60w$$
$$15=w$$
The width is 15 meters.

68. Let x = width, then $x + 6$ = length.
$$60=2x+2(x+6)$$
$$60=2x+2x+12$$
$$60=4x+12$$
$$48=4x$$
$$12=x$$
$x + 6 = 12 + 6 = 18$
The dimensions are 18 feet by 12 feet.

69. Let d = 10,000 and r = 125.

$$\begin{aligned} d &= rt \\ 10{,}000 &= 125t \\ 80 &= t \end{aligned}$$

It will take 80 minutes or 1 hour and 20 minutes.

70. Let F = 104.

$$\begin{aligned} C &= \frac{5}{9}(F-32) \\ &= \frac{5}{9}(104-32) \\ &= \frac{5}{9}(72) \\ &= 40 \end{aligned}$$

The temperature was 40°C.

71. Let x = the percent.

$$\begin{aligned} 9 &= x \cdot 45 \\ \frac{9}{45} &= \frac{45x}{45} \\ 0.2 &= x \end{aligned}$$

9 is 20% of 45.

72. Let x = the percent.

$$\begin{aligned} 59.5 &= x \cdot 85 \\ \frac{59.5}{85} &= \frac{85x}{85} \\ 0.7 &= x \end{aligned}$$

59.5 is 70% of 85.

73. Let x = the number.

$$\begin{aligned} 137.5 &= 125\% \cdot x \\ 137.5 &= 1.25x \\ \frac{137.5}{1.25} &= \frac{1.25x}{1.25} \\ 110 &= x \end{aligned}$$

137.5 is 125% of 110.

74. Let x = the number.

$$\begin{aligned} 768 &= 60\% \cdot x \\ 768 &= 0.6x \\ \frac{768}{0.6} &= \frac{0.6x}{0.6} \\ 1280 &= x \end{aligned}$$

768 is 60% of 1280.

75. Let x = mark-up.

$x = 11\% \cdot 1900$

$x = 0.11 \cdot 1900$

$x = 209$

New price = 1900 + 209 = 2109

The mark-up is \$209 and the new price is \$2109.

76. Find 79% of 76,000.
$0.79 \cdot 76,000 = 60,040$
We would expect 60,040 people in that city to use the Internet.

77. Let x = gallons of 40% solution.

Strength	gallons	Concentration	
40%	x	0.4	$0.4x$
10%	$30 - x$	0.1	$0.1(30 - x)$
20%	30	0.2	$0.2(30)$

$$\begin{aligned} 0.4x + 0.1(30 - x) &= 0.2(30) \\ 0.4x + 3 - 0.1x &= 6 \\ 0.3x + 3 &= 6 \\ 0.3x &= 3 \\ x &= 10 \end{aligned}$$

$30 - x = 30 - 10 = 20$
Mix 10 gallons of 40% acid solution with 20 gallons of 10% acid solution.

78. Increase = 21.0 – 20.7 = 0.3
Let x = percent.

$$\begin{aligned} 0.3 &= x \cdot 20.7 \\ \frac{0.3}{20.7} &= \frac{20.7x}{20.7} \\ 0.0145 &\approx x \end{aligned}$$

The percent of increase is 1.45%.

79. From the graph, the height of ‘Almost hit a car’ is 18%.

80. Choose the tallest bar. The most common effect is swerving into another lane.

81. Find 21% of 4600.
$0.21 \cdot 4600 = 966$
We would expect 966 customers to have cut someone off.

82. Find 41% of 4600.
$0.41 \cdot 4600 = 1886$
We would expect 1886 customers to have sped up.

83.
$$\begin{aligned} \text{percent of decrease} &= \frac{\text{amount of decrease}}{\text{original amount}} \\ &= \frac{250 - 170}{250} \\ &= \frac{80}{250} \\ &= 0.32 \end{aligned}$$

The percent of decrease is 32%.

84. Let x = original price.

$$x - 0.20x = 19.20$$
$$0.80x = 19.20$$
$$\frac{0.80x}{0.80} = \frac{19.20}{0.80}$$
$$x = 24$$

The original price was \$24.

85. Let x = time up, then $3 - x$ = time down.

	Rate	· Time =	Distance
Up	10	x	$10x$
Down	50	$3 - x$	$50(3 - x)$

$$d = d$$
$$10x = 50(3 - x)$$
$$10x = 150 - 50x$$
$$60x = 150$$
$$x = 2.5$$

$$\begin{aligned}\text{Total distance} &= 10x + 50(3 - x)\\ &= 10(2.5) + 50(3 - 2.5)\\ &= 25 + 50(0.5)\\ &= 25 + 25\\ &= 50\end{aligned}$$

The distance traveled was 50 km.

86. Let x = the amount invested at 10.5% for one year.

	Principal	· Rate =	Interest
10.5%	x	0.105	0.105
8.5%	$50{,}000 - x$	0.085	$0.085(50{,}000 - x)$
Total	50,000		4550

$$\begin{aligned}0.105x + 0.085(50{,}000 - x) &= 4550\\ 0.105x + 4250 - 0.085x &= 4550\\ 0.02x + 4250 &= 4550\\ 0.02x &= 300\\ x &= 15{,}000\end{aligned}$$

$50{,}000 - x = 50{,}000 - 15{,}000 = 35{,}000$

Invest \$35,000 at 8.5% and \$15,000 at 10.5%.

87. Let x = the number of dimes,
$2x$ = the number of quarters, and
$500 - x - 2x$ the number of nickels.

	No. of Coins ·	Value =	Amt. of Money
Dimes	x	0.1	$0.1x$
Quarters	$2x$	0.25	$0.25(2x)$
Nickels	$500 - 3x$	0.05	$0.05(500 - 3x)$
Total	500		88

$$\begin{aligned} 0.1x + 0.25(2x) + 0.05(500 - 3x) &= 88 \\ 0.1x + 0.5x + 25 - 0.15x &= 88 \\ 0.45x + 25 &= 88 \\ 0.45x &= 63 \\ x &= 140 \end{aligned}$$

$500 - 3x = 500 - 3(140) = 500 - 420 = 80$
There were 80 nickels in the pay phone.

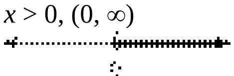
88. Let x = the time traveled by the Amtrak train.

	Rate ·	Time =	Distance
Amtrak	60	x	$60x$
Freight	45	$x + 1.5$	$45(x + 1.5)$

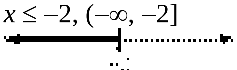
$$\begin{aligned} d &= d \\ 60x &= 45(x + 1.5) \\ 60x &= 45x + 67.5 \\ 15x &= 67.5 \\ x &= 4.5 \end{aligned}$$

It will take 4.5 hours.

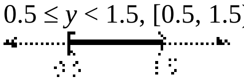
89. $x > 0$, $(0, \infty)$



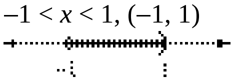
90. $x \le -2$, $(-\infty, -2]$



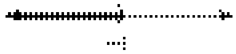
91. $0.5 \le y < 1.5$, $[0.5, 1.5)$



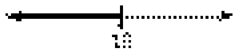
92. $-1 < x < 1$, $(-1, 1)$



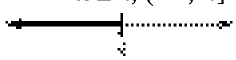
93. $-3x > 12$
$\frac{-3x}{-3} < \frac{12}{-3}$
$x < -4,\ (-\infty, -4)$



94. $-2x \ge -20$
$\frac{-2x}{-2} \le \frac{-20}{-2}$
$x \le 10,\ (-\infty, 10]$

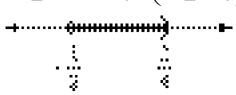


95. $x + 4 \ge 6x - 16$
$-5x + 4 \ge -16$
$-5x \ge -20$
$\frac{-5x}{-5} \le \frac{-20}{-5}$
$x \le 4,\ (-\infty, 4]$

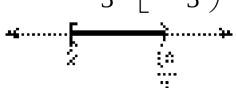


96. $5x - 7 > 8x + 5$
$-3x - 7 > 5$
$-3x > 12$
$\frac{-3x}{-3} < \frac{12}{-3}$
$x < -4,\ (-\infty, -4)$

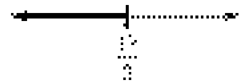
97. $-3 < 4x - 1 < 2$
$-2 < 4x < 3$
$-\frac{1}{2} < x < \frac{3}{4},\ \left(-\frac{1}{2}, \frac{3}{4}\right)$



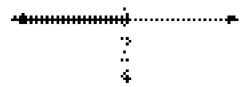
98. $2 \le 3x - 4 < 6$
$6 \le 3x < 10$
$2 \le x < \frac{10}{3},\ \left[2, \frac{10}{3}\right)$



99. $4(2x - 5) \le 5x - 1$
$8x - 20 \le 5x - 1$
$3x - 20 \le -1$
$3x \le 19$
$x \le \frac{19}{3},\ \left(-\infty, \frac{19}{3}\right]$



100. $-2(x - 5) > 2(3x - 2)$
$-2x + 10 > 6x - 4$
$-8x + 10 > -4$
$-8x > -14$
$\frac{-8x}{-8} < \frac{-14}{-8}$
$x < \frac{7}{4},\ \left(-\infty, \frac{7}{4}\right)$



101. Let x = the amount of sales then
$0.05x$ = her commission.
$175 + 0.05x \ge 300$
$0.05x \ge 125$
$x \ge 2500$
Sales must be at least \$2500.

102. Let x = her score on the fourth round.
$\frac{76 + 82 + 79 + x}{4} < 80$
$237 + x < 320$
$x < 83$
Her score must be less than 83.

103. $6x + 2x - 1 = 5x + 11$
$8x - 1 = 5x + 11$
$3x - 1 = 11$
$3x = 12$
$x = 4$

104. $2(3y - 4) = 6 + 7y$
$6y - 8 = 6 + 7y$
$-8 = 6 + y$
$-14 = y$

105.
$$\begin{aligned} 4(3-a)-(6a+9) &= -12a \\ 12-4a-6a-9 &= -12a \\ 3-10a &= -12a \\ 3 &= -2a \\ -\frac{3}{2} &= a \end{aligned}$$

106.
$$\begin{aligned} \frac{x}{3}-2 &= 5 \\ \frac{x}{3} &= 7 \\ 3\cdot\frac{x}{3} &= 3\cdot 7 \\ x &= 21 \end{aligned}$$

107.
$$\begin{aligned} 2(y+5) &= 2y+10 \\ 2y+10 &= 2y+10 \\ 10 &= 10 \end{aligned}$$
All real numbers are solutions.

108.
$$\begin{aligned} 7x-3x+2 &= 2(2x-1) \\ 4x+2 &= 4x-2 \\ 2 &= -2 \end{aligned}$$
There is no solution.

109. Let x = the number.
$$\begin{aligned} 6+2x &= x-7 \\ 6+x &= -7 \\ x &= -13 \end{aligned}$$
The number is −13.

110. Let x = length of shorter piece, then
$4x + 3$ = length of longer piece.
$$\begin{aligned} x+(4x+3) &= 23 \\ 5x+3 &= 23 \\ 5x &= 20 \\ x &= 4 \end{aligned}$$
$4x + 3 = 4(4) + 3 = 19$
The shorter piece is 4 inches and the longer piece is 19 inches.

111.
$$\begin{aligned} V &= \frac{1}{3}Ah \\ 3\cdot V &= 3\cdot\frac{1}{3}Ah \\ 3V &= Ah \\ \frac{3V}{A} &= \frac{Ah}{A} \\ \frac{3V}{A} &= h \end{aligned}$$

112. Let x = the number.
$x = 26\% \cdot 85$
$x = 0.26 \cdot 85$
$x = 22.1$
22.1 is 26% of 85.

113. Let x = the number.
$$\begin{aligned} 72 &= 45\%\cdot x \\ 72 &= 0.45x \\ \frac{72}{0.45} &= \frac{0.45x}{0.45} \\ 160 &= x \end{aligned}$$
72 is 45% of 160.

114. Increase = 282 − 235 = 47
Let x = percent.
$$\begin{aligned} 47 &= x\cdot 235 \\ \frac{47}{235} &= \frac{235x}{235} \\ 0.2 &= x \end{aligned}$$
The percent of increase is 20%.

115.
$$\begin{aligned} 4x-7 &> 3x+2 \\ x-7 &> 2 \\ x &> 9,\ (9,\ \infty) \end{aligned}$$

Title:
EMG-BA5-HC-02-09-1

116.
$$\begin{aligned} -5x &< 20 \\ \frac{-5x}{-5} &> \frac{20}{-5} \\ x &> -4,\ (-4,\ \infty) \end{aligned}$$

Title:
EMG-BA5-HC-02-REV

117.
$$\begin{aligned} -3(1+2x)+x &\ge -(3-x) \\ -3-6x+x &\ge -3+x \\ -3-5x &\ge -3+x \\ -5x &\ge x \\ -6x &\ge 0 \\ \frac{-6x}{-6} &\le \frac{0}{-6} \\ x &\le 0,\ (-\infty,\ 0] \end{aligned}$$

Title:
EMG-BA5-HC-02-REV

Chapter 2 Getting Ready for the Test

1. There is no equal sign, so this is not an equation that can be solved. Also, there is only one term that cannot be further simplified. Thus the best direction is to identify the numerical coefficient; C.

2. This is an equation that can be solved; A.

3. Two terms are given, so the best direction is to determine whether the given terms are like or unlike terms; D.

4. There is no equal sign, so this is not an equation that can be solved—it is an expression that can be simplified; B.

5. Subtracting $100z$ from $8m$ translates to $8m - 100z$; B.

6. Subtracting $7x - 1$ from $9y$ translates to $9y - (7x - 1)$; C.

7.
$$\begin{aligned} 7x+6 &= 7x+9 \\ 7x-7x+6 &= 7x-7x+9 \\ 6 &= 9 \quad \text{False} \end{aligned}$$
The equation has no solution; B.

8.
$$\begin{aligned} 2y-5 &= 2y-5 \\ 2y-2y-5 &= 2y-2y-5 \\ -5 &= -5 \quad \text{True} \end{aligned}$$
The equation has all real numbers as solutions; A.

9.
$$\begin{aligned} 11x-13 &= 10x-13 \\ 11x-10x-13 &= 10x-10x-13 \\ x-13 &= -13 \\ x-13+13 &= -13+13 \\ x &= 0 \end{aligned}$$
The solution is 0; C.

10.
$$\begin{aligned} x+15 &= -x+15 \\ x+x+15 &= -x+x+15 \\ 2x+15 &= 15 \\ 2x+15-15 &= 15-15 \\ 2x &= 0 \\ \frac{2x}{2} &= \frac{0}{2} \\ x &= 0 \end{aligned}$$
The solution is 0; C.

11. $5(3x - 2) = 5 \cdot 3x - 5 \cdot 2 = 15x - 10$
$$\begin{aligned} -(x+20) &= -1(x+20) \\ &= -1\cdot x+(-1)\cdot 20 \\ &= -x-20 \end{aligned}$$
The resulting equation is $15x - 10 = -x - 20$; B.

12.
$$\begin{aligned} 30\left(\frac{8x}{3}+1\right) &= 30\cdot\frac{8x}{3}+30\cdot 1 \\ &= 10\cdot 8x+30 \\ &= 80x+30 \end{aligned}$$
$$30\left(\frac{x-2}{10}\right) = 3(x-2) = 3\cdot x-3\cdot 2 = 3x-6$$
The simplified equation is $80x + 30 = 3x - 6$; D.

Chapter 2 Test

1. $2y - 6 - y - 4 = y - 10$

2. $2.7x + 6.1 + 3.2x - 4.9 = 5.9x + 1.2$

3.
$$\begin{aligned} 4(x-2)-3(2x-6) &= 4x-8-6x+18 \\ &= -2x+10 \end{aligned}$$

4. $7 + 2(5y - 3) = 7 + 10y - 6 = 10y + 1$

5.
$$\begin{aligned} -\frac{4}{5}x &= 4 \\ -\frac{5}{4}\cdot\left(-\frac{4}{5}x\right) &= -\frac{5}{4}\cdot 4 \\ x &= -5 \end{aligned}$$

6.
$$\begin{aligned} 4(n-5) &= -(4-2n) \\ 4n-20 &= -4+2n \\ 2n-20 &= -4 \\ 2n &= 16 \\ n &= 8 \end{aligned}$$

7.
$$\begin{aligned} 5y-7+y &= -(y+3y) \\ 6y-7 &= -4y \\ -7 &= -10y \\ \frac{7}{10} &= y \end{aligned}$$

8.
$$\begin{aligned} 4z+1-z &= 1+z \\ 3z+1 &= 1+z \\ 2z+1 &= 1 \\ 2z &= 0 \\ z &= 0 \end{aligned}$$

9.
$$\begin{aligned} \frac{2(x+6)}{3} &= x-5 \\ 2(x+6) &= 3(x-5) \\ 2x+12 &= 3x-15 \\ 12 &= x-15 \\ 27 &= x \end{aligned}$$

10. $$\begin{aligned} \frac{1}{2}-x+\frac{3}{2} &= x-4 \\ 2\left(\frac{1}{2}-x+\frac{3}{2}\right) &= 2(x-4) \\ 1-2x+3 &= 2x-8 \\ -2x+4 &= 2x-8 \\ -4x+4 &= -8 \\ -4x &= -12 \\ x &= 3 \end{aligned}$$

11. $$\begin{aligned} -0.3(x-4)+x &= 0.5(3-x) \\ 10[-0.3(x-4)+x] &= 10[0.5(3-x)] \\ -3(x-4)+10x &= 5(3-x) \\ -3x+12+10x &= 15-5x \\ 7x+12 &= 15-5x \\ 12x+12 &= 15 \\ 12x &= 3 \\ x &= \frac{3}{12}=\frac{1}{4}=0.25 \end{aligned}$$

12. $$\begin{aligned} -4(a+1)-3a &= -7(2a-3) \\ -4a-4-3a &= -14a+21 \\ -7a-4 &= -14a+21 \\ 7a-4 &= 21 \\ 7a &= 25 \\ a &= \frac{25}{7} \end{aligned}$$

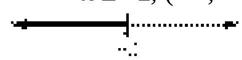
13. $$\begin{aligned} -2(x-3) &= x+5-3x \\ -2x+6 &= -2x+5 \\ 6 &= 5 \end{aligned}$$
There is no solution.

14. Let $y = -14$, $m = -2$, and $b = -2$.
$$\begin{aligned} y &= mx+b \\ -14 &= -2x-2 \\ -12 &= -2x \\ 6 &= x \end{aligned}$$

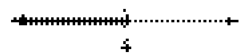
15. $$\begin{aligned} V &= \pi r^2 h \\ \frac{V}{\pi r^2} &= \frac{\pi r^2 h}{\pi r^2} \\ \frac{V}{\pi r^2} &= h \end{aligned}$$

16. $$\begin{aligned} 3x-4y &= 10 \\ -4y &= -3x+10 \\ y &= \frac{-3x+10}{-4} \\ y &= \frac{3x-10}{4} \end{aligned}$$

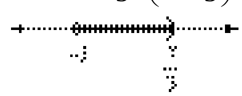
17. $$\begin{aligned} 3x-5 &\ge 7x+3 \\ -4x-5 &\ge 3 \\ -4x &\ge 8 \\ \frac{-4x}{-4} &\le \frac{8}{-4} \\ x &\le -2,\ (-\infty, -2] \end{aligned}$$



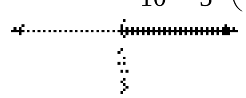
18. $$\begin{aligned} x+6 &> 4x-6 \\ -3x+6 &> -6 \\ -3x &> -12 \\ \frac{-3x}{-3} &< \frac{-12}{-3} \\ x &< 4,\ (-\infty, 4) \end{aligned}$$



19. $$\begin{aligned} &-2 < 3x+1 < 8 \\ &-3 < 3x < 7 \\ &-1 < x < \frac{7}{3},\ \left(-1, \frac{7}{3}\right) \end{aligned}$$



20. $$\begin{aligned} \frac{2(5x+1)}{3} &> 2 \\ 2(5x+1) &> 6 \\ 10x+2 &> 6 \\ 10x &> 4 \\ x &> \frac{4}{10}=\frac{2}{5},\ \left(\frac{2}{5}, \infty\right) \end{aligned}$$



21. Let x = the number.

$$x+\frac{2}{3}x=35$$
$$3\left(x+\frac{2}{3}x\right)=3(35)$$
$$3x+2x=105$$
$$5x=105$$
$$x=21$$

The number is 21.

22. Let x = width, then $x + 2$ = length.

$$P=2w+2l$$
$$252=2x+2(x+2)$$
$$252=2x+2x+4$$
$$252=4x+4$$
$$252-4=4x+4-4$$
$$248=4x$$
$$\frac{248}{4}=\frac{4x}{4}$$
$$62=x$$

$64 = x + 2$

The dimensions of the deck are 62 feet by 64 feet.

23. Let x = one area code, then $2x$ = other area code.

$$x+2x=1203$$
$$3x=1203$$
$$\frac{3x}{3}=\frac{1203}{3}$$
$$x=401$$

$2x = 2(401) = 802$

The area codes are 401 and 802.

24. Let x = the amount invested at 10% for one year.

	Principal	· Rate	= Interest
10%	x	0.10	$0.1x$
12%	$2x$	0.12	$0.12(2x)$
Total			2890

$$0.1x+0.12(2x)=2890$$
$$0.1x+0.24x=2890$$
$$0.34x=2890$$
$$x=8500$$

$2x = 2(8500) = 17,000$

He invested \$8500 at 10% and \$17,000 at 12%.

25. Let x = the time they travel.

	Rate	· Time	= Distance
Train 1	50	x	$50x$
Train 2	64	x	$64x$
Total			285

$$50x+64x=285$$
$$114x=285$$
$$x=2\frac{1}{2}$$

They must travel for $2\frac{1}{2}$ hours.

26. From the graph, 69% are classified as weak. Find 69% of 800.

69% · 800 = 0.69 · 800 = 552

You would expect 552 of the 800 to be classified as weak.

27. Let x be the unknown percent.

$$72=x\cdot 180$$
$$\frac{72}{180}=\frac{180x}{180}$$
$$0.4=x$$

72 is 40% of 180.

28.
$$\text{percent of decrease}=\frac{\text{amount of decrease}}{\text{original amount}}=\frac{225-189}{225}=\frac{36}{225}=0.16$$

The percent of decrease is 16%.

Chapter 2 Cumulative Review

1. **a.** The natural numbers are 11 and 112.

b. The whole numbers are 0, 11, and 112.

c. The integers are −3, −2, 0, 11, and 112.

d. The rational numbers are −3, −2, −1.5, 0, $\frac{1}{4}$, 11, and 112.

e. The irrational number is $\sqrt{2}$.

f. All the numbers in the given set are real numbers.

2. a. The natural numbers are 2, 7, and 8.

b. The whole numbers are 0, 2, 7, and 8.

c. The integers are –185, 0, 2, 7, and 8.

d. The rational numbers are –185, $-\frac{1}{5}$, 0, 2, 7, and 8.

e. The irrational number is $\sqrt{3}$.

f. All the numbers in the given set are real numbers.

3. a. $|4| = 4$

b. $|-5| = 5$

c. $|0| = 0$

d. $\left|-\frac{1}{2}\right| = \frac{1}{2}$

e. $|5.6| = 5.6$

4. a. $|5| = 5$

b. $|-8| = 8$

c. $\left|-\frac{2}{3}\right| = \frac{2}{3}$

5. a. $40 = 2 \cdot 2 \cdot 2 \cdot 5$

b. $63 = 3 \cdot 3 \cdot 7$

6. a. $44 = 2 \cdot 2 \cdot 11$

b. $90 = 2 \cdot 3 \cdot 3 \cdot 5$

7. $\frac{2}{5} = \frac{2}{5} \cdot \frac{4}{4} = \frac{8}{20}$

8. $\frac{2}{3} = \frac{2}{3} \cdot \frac{8}{8} = \frac{16}{24}$

9.
$$\begin{aligned} 3[4+2(10-1)] &= 3[4+2(9)] \\ &= 3[4+18] \\ &= 3[22] \\ &= 66 \end{aligned}$$

10.
$$\begin{aligned} 5[16-4(2+1)] &= 5[16-4(3)] \\ &= 5[16-12] \\ &= 5[4] \\ &= 20 \end{aligned}$$

11. Let $x = 2$.
$$\begin{aligned} 3x+10 &= 8x \\ 3(2)+10 &\ 0\ 8(2) \\ 6+10 &\ 0\ 16 \\ 16 &= 16 \end{aligned}$$
2 is a solution of the equation.

12. Let $x = 3$.
$$\begin{aligned} 5x-2 &= 4x \\ 5(3)-2 &\ 0\ 4(3) \\ 15-2 &\ 0\ 12 \\ 13 &\neq 12 \end{aligned}$$
3 is not a solution of the equation.

13. $-1 + (-2) = -3$

14. $(-2) + (-8) = -10$

15. $-4 + 6 = 2$

16. $-3 + 10 = 7$

17. a. $-(-10) = 10$

b. $-\left(-\frac{1}{2}\right) = \frac{1}{2}$

c. $-(-2x) = 2x$

d. $-|-6| = -(6) = -6$

18. a. $-(-5) = 5$

b. $-\left(-\frac{2}{3}\right) = \frac{2}{3}$

c. $-(-a) = a$

d. $-|-3| = -(3) = -3$

19. a. $5.3 - (-4.6) = 5.3 + 4.6 = 9.9$

b. $-\frac{3}{10}-\frac{5}{10}=-\frac{3}{10}+\left(-\frac{5}{10}\right)$
$=\frac{-3-5}{10}$
$=-\frac{8}{10}$
$=-\frac{4}{5}$

c. $-\frac{2}{3}-\left(-\frac{4}{5}\right)=-\frac{2}{3}\cdot\frac{5}{5}+\frac{4}{5}\cdot\frac{3}{3}$
$=-\frac{10}{15}+\frac{12}{15}$
$=\frac{2}{15}$

20. a. $-2.7 - 8.4 = -2.7 + (-8.4) = -11.1$

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

c. $\frac{1}{4}-\left(-\frac{1}{2}\right)=\frac{1}{4}+\frac{1}{2}\cdot\frac{2}{2}=\frac{1}{4}+\frac{2}{4}=\frac{3}{4}$

21. a. $x = 90 - 38 = 90 + (-38) = 52$
The complementary angle is 52°.

b. $y = 180 - 62 = 180 + (-62) = 118$
The supplementary angle is 118°.

22. a. $x = 90 - 72 = 90 + (-72) = 18$
The complementary angle is 18°.

b. $y = 180 - 47 = 180 + (-47) = 133$
The supplementary angle is 133°.

23. a. $(-1.2)(0.05) = -0.06$

b. $\frac{2}{3}\cdot\left(-\frac{7}{10}\right)=-\frac{2\cdot 7}{3\cdot 10}=-\frac{14}{30}=-\frac{7}{15}$

c. $\left(-\frac{4}{5}\right)(-20)=\frac{4\cdot 20}{5}=\frac{80}{5}=16$

24. a. $(4.5)(-0.08) = -0.36$

b. $-\frac{3}{4}\cdot\left(-\frac{8}{17}\right)=\frac{3\cdot 8}{4\cdot 17}=\frac{24}{68}=\frac{6}{17}$

25. a. $\frac{-24}{-4}=6$

b. $\frac{-36}{3}=-12$

c. $\frac{2}{3}\div\left(-\frac{5}{4}\right)=\frac{2}{3}\left(-\frac{4}{5}\right)=-\frac{8}{15}$

d. $-\frac{3}{2}\div 9=-\frac{3}{2}\div\frac{9}{1}=-\frac{3}{2}\cdot\frac{1}{9}=-\frac{3}{18}=-\frac{1}{6}$

26. a. $\frac{-32}{8}=-4$

b. $\frac{-108}{-12}=9$

c. $-\frac{5}{7}\div\left(\frac{-9}{2}\right)=-\frac{5}{7}\left(-\frac{2}{9}\right)=\frac{10}{63}$

27. a. $x + 5 = 5 + x$

b. $3 \cdot x = x \cdot 3$

28. a. $y + 1 = 1 + y$

b. $y \cdot 4 = 4 \cdot y$

29. a. $8 \cdot 2 + 8 \cdot x = 8(2 + x)$

b. $7s + 7t = 7(s + t)$

30. a. $4\cdot y+4\cdot\frac{1}{3}=4\left(y+\frac{1}{3}\right)$

b. $0.10x + 0.10y = 0.10(x + y)$

31. $(2x-3)-(4x-2)=2x-3-4x+2=-2x-1$

32. $(-5x+1)-(10x+3)=-5x+1-10x-3$
$=-15x-2$

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

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

35. $6(2a-1)-(11a+6)=7$
$12a-6-11a-6=7$
$a-12=7$
$a=19$

36. $-3x+1-(-4x-6)=10$
$-3x+1+4x+6=10$
$x+7=10$
$x=3$

37. $\frac{y}{7}=20$
$y=140$

38. $\frac{x}{4}=18$
$x=72$

39. $4(2x-3)+7=3x+5$
$8x-12+7=3x+5$
$8x-5=3x+5$
$5x-5=5$
$5x=10$
$x=2$

40. $6x+5=4(x+4)-1$
$6x+5=4x+16-1$
$6x+5=4x+15$
$2x+5=15$
$2x=10$
$x=5$

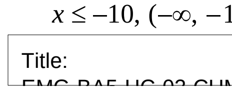
41. Let x = a number.
$2(x+4)=4x-12$
$2x+8=4x-12$
$8=2x-12$
$20=2x$
$10=x$
The number is 10.

42. Let x = a number.
$x+4=3x-8$
$4=2x-8$
$12=2x$
$6=x$
The number is 6.

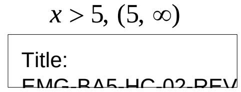
43. $V=lwh$
$\frac{V}{wh}=\frac{lwh}{wh}$
$\frac{V}{wh}=l$

44. $C=2\pi r$
$\frac{C}{2\pi}=\frac{2\pi r}{2\pi}$
$\frac{C}{2\pi}=r$

45. $x+4\le -6$
$x\le -10,\ (-\infty, -10]$



46. $x-3>2$
$x>5,\ (5, \infty)$



Mini-Lecture 2.1

Simplifying Algebraic Expressions

Learning Objectives:

1. Identify terms, like terms, and unlike terms.
2. Combine like terms.
3. Use the distributive property to remove parentheses.
4. Write word phrases as algebraic expressions.

Examples

1. Identify the numerical coefficient of each term.

   a) $9x$ b) $-3y$ c) $-x$ d) $2.7x^2y$

   Indicate whether the terms in each list are like or unlike.

   e) $6x, -3x$ f) $-xy^2, -x^2y$ g) $5ab, -\frac{1}{2}ba$ h) $2x^3yz^2, -x^3yz^3$

2. Simplify each expression by combining any like terms.

   a) $7x - 2x + 4$ b) $-9y + 2 - 1 + 6 + y - 7$ c) $1.6x^5 + 0.9x^2 - 0.3x^5$

3. Simplify each expression. Use the distributive property to remove any parentheses.

   a) $3(x + 6)$ b) $-(-5m + 6n - 2p)$ c) $\frac{1}{3}(6x-9)$

   Remove parentheses and simplify each expression.

   d) $14(2x + 6) - 4$ e) $10a - 5 - 2(a - 3)$ f) $3(2x - 5) - (x + 7)$

4. Write each phrase as an algebraic expression. Simplify if possible.

   a) Add $-4y + 3$ to $6y - 9$ b) Subtract $2x - 1$ from $3x + 7$

   c) Triple a number, decreased by six d) Six times the sum of a number and two

Teaching Notes:

- Students will need repeated practice with identifying terms and like terms.
- Some students do not know that a variable without a numerical coefficient actually has a coefficient of 1.
- Some students will forget to distribute the minus sign in 3b), 3e), and 3f). Some students might need to write a 1 in front of the parentheses in 3b) and 3f).

Answers: *1a) 9; 1b) -3; 1c) -1; 1d) 2.7; 1e) like; 1f) unlike; 1g) like; 1h) unlike; 2a) 5x+4; 2b) -8y; 2c)* $1.3x^5+0.9x^2$*; 3a) 3x+18; 3b) 5m-6n+2p; 3c) 2x-3; 3d) 28x+80; 3e) 8a+1; 3f) 5x-22; 4a) (-4y+3) + (6y-9) = 2y-6; 4b) (3x+7) – (2x-1) = x + 8; 4c) 3x-6; 4d) 6(x + 2)*

Mini-Lecture 2.2

The Addition Property of Equality

Learning Objectives:

1. Define linear equations and use the addition property of equality to solve linear equations.
2. Write word phrases as algebraic expressions.

Examples:

1. Solve each equation. Check each solution.

   a) $y - 6 = 18$ b) $-18 = t - 5$ c) $8.1 + y = 13.9$ d) $a + \frac{2}{3} = -\frac{3}{4}$

Solve each equation. If possible, be sure to first simplify each side of the equation. Check each solution.

   e) $5(y + 2) = 6(y - 3)$ f) $10x = 4x + 9 + 5x$

   g) $-8z + 5 + 6z = -3z + 10$ h) $-5x + 4 + 6x = 15 - 28$

   i) $-\frac{1}{6}x - \frac{1}{3} = \frac{5}{6}x + \frac{1}{2}$ j) $-14.9 + 4a - 2.7 + 2a = 5.1 + 7a + 1.5$

2. Write each algebraic expression described.

   a) Two numbers have a sum of 72. If one number is *z*, express the other number in terms of *z*.

   b) During a recent marathon, Tom ran 8 more miles than Judy ran. If Judy ran *x* miles, how many miles did Tom run?

   c) On a recent car trip, Raymond drove *x* miles on day one. On day two, he drove 170 miles more than he did on day one. How many miles, in terms of *x*, did Raymond drive for both days combined?

Teaching Notes:

- Some students need a quick review of "like terms."
- Advise students to write out each step until they have mastered this concept. Avoid shortcuts!
- Some students need to be taught how to work a problem in sequential order showing each step.
- Encourage students to take their time and organize their work. This will help when the problems become more complex.

Answers: 1a) 24; 1b) -13; 1c) 5.8; 1d) -17/12; 1e) 28; 1f) 9; 1g) 5; 1h) -17; 1i) -5/6; 1j) 11; 2a) 72 – z; 2b) x+8; 2c) 2x+ 170

Mini-Lecture 2.3

The Multiplication Property of Equality

Learning Objectives:

1. Use the multiplication property of equality to solve linear equations.
2. Use both the addition and multiplication properties of equality to solve linear equations.
3. Write word phrases as algebraic expressions.

Examples:

1. Use the multiplication property of equality to solve the following linear equations. Check each solution.

   a) $-8x = -24$ b) $7x = 0$ c) $-z = 19$ d) $3x = -22$

   e) $\frac{2}{5}a = 12$ f) $\frac{y}{-11} = 2.5$ g) $\frac{-3}{8}b = 0$ h) $-10.2 = -3.4c$

2. Use the addition property of equality and the multiplication property of equality to solve the following linear equations. Check each solution.

   a) $5x + 6 = 46$ b) $\frac{a}{9} - 7 = 11$ c) $-24 = -3x - 9$ d) $\frac{1}{3}y - \frac{1}{3} = -6$

   e) $-5.8z + 1.9 = -32.5 - 1.5z$ f) $8y + 7 = 6 - 2y - 10y$ g) $4(4x - 1) = (-8) - (-24)$

3. Write each algebraic expression described. Simplify if possible.

   a) If *z* represents the first of two consecutive even integers, express the sum of the two integers in terms of *z*.

   b) If *x* represents the first of three consecutive even integers, express the sum of the first and third integer in terms of *x*.

   c) Houses on one side of a street are all numbered using consecutive odd integers. If the first house on the street is numbered *x*, write an expression in *x* for the sum of five house numbers in a row.

Teaching Notes:

- Review "like terms" with students.
- Many students do not combine like terms before using one of the properties.
- Encourage students to always take the time to check their solution.

Answers: 1a) 3; 1b) 0; 1c) -19; 1d) -22/3; 1e) 30; 1f) -27.5; 1g) 0; 1h) 3; 2a) 8; 2b) 162; 2c) 5; 2d) -17; 2e) 8; 2f) -1/20; 2g) 5/4; 3a) 2z+2; 3b) 2x+4; 3c) 5x+20

Mini-Lecture 2.4
Solving Linear Equations

Learning Objectives:

1. Apply a general strategy for solving a linear equation.
2. Solve equations containing fractions.
3. Solve equations containing decimals.
4. Recognize identities and equations with no solution.

Examples:

1. Solve the following linear equations.

   a) $6a-(5a-1)=4$ b) $4(3b-1)=16$ c) $4z=8(2z+9)$

   d) $2(x+8)=3(x-5)$ e) $3(2a-3)=5(a+4)$ f) $12(4c-2)=3c-4$

2. Solve each equation containing fractions.

   a) $\frac{y}{6}-4=1$ b) $\frac{1}{4}x-\frac{3}{8}x=5$ c) $\frac{-6x+5}{4}+1=-\frac{5x}{4}$

   Solve each equation containing decimals.

   d) $0.05x+0.06(x-1{,}500)=570$ e) $0.4(x+7)-0.1(3x+6)=-0.8$

3. Solve each equation. Indicate if it is an identity or an equation with no solution.

   a) $6(z+7)=6z+42$ b) $3+12x-1=8x+4x-1$ c) $\frac{x}{3}-3=\frac{2x}{6}+1$

Teaching Notes:

- Refer students to the beginning of this section in the textbook for steps: Solving Linear Equations in One Variable.
- Most students find solving equations with fractions or decimals difficult.
- Common error: When multiplying equations with fractions by the LCD, some students multiply only the terms with fractions instead of all terms.
- Common error: When solving equations with decimals and parentheses (examples 2d and 2e), some students multiply terms both inside parentheses and outside parentheses by a power of 10.

<u>Answers:</u> 1a) 3; 1b) 5/3; 1c) -6; 1d) 31; 1e) 29; 1f) 4/9; 2a) 30; 2b) -40; 2c) 9; 2d) 6,000 2e) -30; 3a) identity; 3b) no solution; 3c) no solution

Mini-Lecture 2.5

An Introduction to Problem Solving

Learning Objectives:

Apply the steps for problem solving as we

1. Solve problems involving direct translations.
2. Solve problems involving relationships among unknown quantities.
3. Solve problems involving consecutive integers.

Examples:

1. Solve.
   a) Eight is added to a number and the sum is doubled, the result is 11 less than the number. Find the number.

   b) Three times the difference of a number and 2 is equal to 8 subtracted from twice a number. Find the integers.

2. Solve.

   a) A college graduating class is made up of 450 students. There are 206 more girls than boys. How many boys are in the class?

   b) A 22-ft pipe is cut into two pieces. The shorter piece is 7 feet shorter than the longer piece. What is the length of the longer piece?

   c) A triangle has three angles, A, B, and C. Angle C is 18° greater than angle B. Angle A is 4 times angle B. What is the measure of each angle?
   (Hint: The sum of the angles of a triangle is 180°).

3. Solve.
   a) The room numbers of two adjacent hotel rooms are two consecutive odd numbers. If their sum is 1380, find the hotel room numbers.

   b) When you open a book, the left and right page numbers are two consecutive natural numbers. The sum of their page numbers is 349. What is the number of the page that comes first?

Teaching Notes:

- Many students find application problems challenging.
- Encourage students, whenever possible, to draw diagrams, charts, etc.
- Encourage students to use algebra to solve a problem even though they may be able to solve without it.
- Refer students to ***General Strategy for Problem Solving*** section 2.5, page 111.

Answers: 1a) -27; 1b) 21, 63; 2a) 122 boys; 2b) 14.5 feet; 2c) A=108°, B=27°, C=45°; 3a) 689, 691; 3b) 174

Mini-Lecture 2.6
Formulas and Problem Solving

Learning Objectives:

1. Use formulas to solve problems.
2. Solve a formula or equation for one of its variables.

Examples:

1. Substitute the given values into each given formula and solve for the unknown variable. If necessary, round to one decimal place.

   a) Distance Formula
   $d = rt;\; t = 9, d = 63$

   b) Perimeter of a rectangle
   $P = 2l + 2w;\; P = 32, w = 7$

   c) Volume of a pyramid
   $V = \frac{1}{3}Bh;\; V = 40, h = 8$

   d) Simple interest
   $I = prt;\; I = 23, p = 230, r = 0.02$

   e) Convert the record high temperature of 102°F to Celsius. ($F = \frac{9}{5}C + 32$)

   f) You have decided to fence an area of your backyard for your dog. The length of the area is 1 meter less than twice the width. If the perimeter of the area is 70 meters, find the length and width of the rectangular area.

   g) For the holidays, Chris and Alicia drove 476 miles. They left their house at 7 a.m. and arrived at their destination at 4 p.m. They stopped for 1 hour to rest and re-fuel. What was their average rate of speed?

2. Solve each formula for the specified variable.

   a) Area of a triangle
   $A = \frac{1}{2}bh$ for b

   b) Perimeter of a triangle
   $P = s_1 + s_2 + s_3$ for s_3

   c) Surface area of a special rectangular box
   $S = 4lw + 2wh$ for l

   d) Circumference of a circle
   $C = 2\pi r$ for r

Teaching Notes:

- Most students will only need algebra reminders when working with a formula given values.
- Refer students to ***Solving Equations for a Specified Variable*** chart in the textbook, page 127.
- Most students have problems with applications. Refer them back to section 2.5 and the ***General Strategy for Problem Solving*** in the textbook, page 111.

Answers: 1a) 7; 1b) 9; 1c) 15; 1d) 5; 1e) 38.9°C; 1f) l=23, w=12; 1g) 59.5 mph; 2a) $b = \frac{2A}{h}$;

2b) $s_3 = P - s_1 - s_2$; 2c) $\frac{S - 2wh}{4w}$; 2d) $r = \frac{C}{2\pi}$

Mini-Lecture 2.7

Percent and Mixture Problem Solving

Learning Objectives:

1. Solve percent equations.
2. Solve discount and mark-up problems.
3. Solve percent of increase and percent of decrease problems.
4. Solve mixture problems.

Examples:

1. Find each number described.

   a) 5% of 300 is what number?
   b) 207 is 90% of what number?
   c) 15 is 1% of what number?
   d) What percent of 350 is 420?

2. Solve the following discount and mark-up problems. If needed, round answers to the nearest cent.

   a) A "Going-Out-Of-Business" sale advertised a 75% discount on all merchandise. Find the discount and the sale price of an item originally priced at $130.

   b) Recently, an anniversary dinner cost $145.23 excluding tax. Find the total cost if a 15% tip is added to the cost.

3. Solve the following percent increase and decrease problems.

   a) The number of minutes on a cell phone bill went from 1200 minutes in March to1600 minutes in April. Find the percent increase. Round to the nearest whole percent.

   b) In 2004, a college campus had 8,900 students enrolled. In 2005, the same college campus had 7,600 students enrolled. Find the percent decrease. Round to the nearest whole percent.

   c) Find the original price of a pair of boots if the sale price is $120 after a 20% discount.

4. How much pure acid should be mixed with 4 gallons of a 30% acid solution in order to get a 80% acid solution? Use the following table to model the situation.

	Number of Gallons · Acid Strength = Amount of Acid		
Pure Acid			
30% Acid Solution			
80% Acid Solution Needed			

Teaching Notes:

- Most students find problem solving challenging. Encourage students to make a list of all appropriate formulas.

Answers: *1a) 15; 1b) 230; 1c) 1500; 1d) 120%; 2a) discount - $97.50, sale price - $32.50; 2b) $167.01; 3a) 33%; 3b) 15%; 3c) $150; 4) 10 gallons*

Mini-Lecture 2.8
Further Problem Solving

Learning Objectives:

1. Solve problems involving distance.
2. Solve problems involving money.
3. Solve problems involving interest.

Examples:

1. How long will it take a car traveling 60 miles per hour to overtake an activity bus traveling 45-miles per hour if the activity bus left 2 hours before the car?

	r	***D***	***t***
Car	60 mph	$60x$	x
Activity Bus	45 mph	$45(x + 2)$	$x + 2$

2. A collection of dimes and quarters and nickels are emptied from a drink machine. There were four times as many dimes as quarters, and there were ten less nickels than there were quarters. If the value of the coins was $19.50, find the number of quarters, the number of dimes, and the number of nickels.

	Number	**Value of each**	**Total value**	
Quarters	x	0.25	$0.25x$	40 @ 0.25=$10.00
Dimes	$2x$	0.10	$0.10(2x)$	80 @ 0.10=$$8.00
Nickels	x **- 10**	0.05	$0.05(x – 10)$	30 @ 0.05=$1.50
Entire Collection			$19.50	$19.50

3. Jeff received a year end bonus of $80,000. He invested some of this money at 8% and the rest at 10%. If his yearly earned income was $7,300, how much did Jeff invest at 10%? Use the following table to model the situation.

	Principal ·	Rate ·	Time =	Interest
8% Fund	x	0.08	1	$0.08x$
10% Fund	$80,000 - x$	0.1	1	$0.01(50,000 – x)$
Total	80,000			7,300

Teaching Notes:

- Most students find problem solving challenging. Encourage students to make a list of all appropriate formulas.

Answers: *1) 6 hours; 2) Number of Quarters = 40, Number of dimes = 80, number of nickels = 303; 3) $45,000*

Mini-Lecture 2.9

Solving Linear Inequalities

Learning Objectives:

1. Define linear inequality in one variable, graph solution sets on a number line, and use interval notation.
2. Solve linear inequalities.
3. Solve compound inequalities.
4. Solve inequality applications.

Examples:

1. Graph each inequality on a number line and write it in interval notation.

   a) $x \geq -5$ b) $y < 7$ c) $-\frac{3}{2} \geq m$ d) $x > -\frac{2}{5}$

2. Using the addition property of inequality, solve each inequality. Graph the solution set and write it in interval notation.

   a) $x + 7 \leq 12$ b) $x - 10 > -3$ c) $-4z - 2 > -5z + 1$ d) $18 - 2x \leq -3x + 24$

   Using the multiplication property of inequality, solve each inequality. Graph the solution set and write it in interval notation.

   e) $-8 \geq \frac{x}{3}$ f) $3x < 73$ g) $0 < \frac{y}{8}$ h) $-\frac{3}{5}z \leq 9$

   Using both properties, solve each inequality.

   i) $3(3x - 16) < 12(x - 2)$ j) $-18(z - 2) \geq -21z + 24$ k) $\frac{8}{21}(x+2) > \frac{1}{7}(x+3)$

3. Solve each inequality. Graph the solution set and write it in interval notation.

   a) $-5 < t \leq 0$ b) $-12 \leq 2x < -8$ c) $3 \leq 4x - 9 \leq 7$

4. Solve the following.

   a) Eight more than twice a number is less than negative twelve. Find all numbers that make this statement true.

   b) One side of a triangle is six times as long as another side and the third side is 8 inches long. If the perimeter can be no more than 106 inches, find the maximum lengths of the other two sides.

Teaching Notes:

- Remind students to reverse the direction of the inequality symbol when multiplying or dividing by a negative number.
- Suggest students keep the coefficient of the variable positive whenever possible.

Answers: *(For all graphs, see Mini-Lecture Graphing Answers starting on page M-63): 1a) [-5,∞); 1b) (∞,7); 1c) [- 3/2, ∞); 1d) (-2/5, ∞); 2a)* $(-\infty,5]$ *; 2b)* $(7,\infty)$ *; 2c)* $(3,\infty)$ *; 2d)* $(-\infty,6]$ *; 2e)* $(-\infty,-24]$ *; 2f)* $(-\infty,24\frac{1}{3})$ *; 2g)* $(0,\infty)$ *; 2h)* $[-15,\infty)$ *; 2i)* $(-8,\infty)$ *; 2j)* $[-4,\infty)$ *; 2k) (7/5, ∞); 3a)* $(-5,0]$ *; 3b) [-6,4); 3c) [3,4]; 4a) x<-10; 4b) 14, 84*

Chapter 2

Section 2.1 Practice Exercises

1. a. The numerical coefficient of t is 1, since t is $1t$.

b. The numerical coefficient of $-7x$ is -7.

c. The numerical coefficient of $-\frac{w}{5}$ is $-\frac{1}{5}$, since $-\frac{w}{5}$ means $-\frac{1}{5}\cdot w$.

d. The numerical coefficient of $43x^4$ is 43.

e. The numerical coefficient of $-b$ is -1, since $-b$ is $-1b$.

2. a. $-4xy$ and $5yx$ are like terms, since $xy = yx$ by the commutative property.

b. $5q$ and $-3q^2$ are unlike terms, since the exponents on q are not the same.

c. $3ab^2$, $-2ab^2$, and $43ab^2$ are like terms, since each variable and its exponent match.

d. y^5 and $\frac{y^5}{2}$ are like terms, since the exponents on y are the same.

3. a. $-3y + 11y = (-3 + 11)y = 8y$

b. $4x^2 + x^2 = 4x^2 + 1x^2 = (4+1)x^2 = 5x^2$

c. $5x - 3x^2 + 8x^2 = 5x + (-3+8)x^2 = 5x + 5x^2$

d. $$\begin{aligned} 20y^2 + 2y^2 - y^2 &= 20y^2 + 2y^2 - 1y^2 \\ &= (20+2-1)y^2 \\ &= 21y^2 \end{aligned}$$

4. a. $3y + 8y - 7 + 2 = (3+8)y + (-7+2) = 11y - 5$

b. $$\begin{aligned} 6x - 3 - x - 3 &= 6x - 1x + (-3-3) \\ &= (6-1)x + (-3-3) \\ &= 5x - 6 \end{aligned}$$

c. $\frac{3}{4}t - t = \frac{3}{4}t - 1t = \left(\frac{3}{4} - 1\right)t = -\frac{1}{4}t$

d. $$\begin{aligned} 9y + 3.2y + 10 + 3 &= (9+3.2)y + (10+3) \\ &= 12.2y + 13 \end{aligned}$$

e. $5z - 3z^4$
These two terms cannot be combined because they are unlike terms.

5. a. $3(2x - 7) = 3(2x) + 3(-7) = 6x - 21$

b. $$\begin{aligned} &-5(x - 0.5z - 5) \\ &= -5(x) + (-5)(-0.5z) + (-5)(-5) \\ &= -5x + 2.5z + 25 \end{aligned}$$

c. $$\begin{aligned} &-(2x - y + z - 2) \\ &= -1(2x - y + z - 2) \\ &= -1(2x) - 1(-y) - 1(z) - 1(-2) \\ &= -2x + y - z + 2 \end{aligned}$$

6. a. $4(9x + 1) + 6 = 36x + 4 + 6 = 36x + 10$

b. $$\begin{aligned} -7(2x-1) - (6-3x) &= -14x + 7 - 6 + 3x \\ &= -11x + 1 \end{aligned}$$

c. $8 - 5(6x + 5) = 8 - 30x - 25 = -30x - 17$

7. "Subtract $7x - 1$ from $2x + 3$" translates to
$(2x+3) - (7x-1) = 2x + 3 - 7x + 1 = -5x + 4$

8. a.

Three	added to	double a number
↓	↓	↓
3	+	$2x$

or $2x + 3$

b.

the sum of 5 and a number	subtract	six	
↓	↓	↓	
$(5 + x)$	$-$	6	$= 5 + x - 6$

$(5 + x) - 6 = 5 + x - 6 = x - 1$

c.

two	times	the sum of 3 and a number	increased by	4
↓	↓	↓	↓	↓
2	$\cdot$	$(3 + x)$	$+$	4

$2(3 + x) + 4 = 6 + 2x + 4 = 2x + 10$

d.

a number	added to	half the number	added to	5 times the number
↓	↓	↓	↓	↓
x	$+$	$\frac{1}{2}x$	$+$	$5x$

$$x + \frac{1}{2}x + 5x = \frac{13}{2}x$$

Vocabulary, Readiness & Video Check 2.1

1. $23y^2 + 10y - 6$ is called an expression while $23y^2$, $10y$, and -6 are each called a term.

2. To simplify $x + 4x$, we combine like terms.

3. The term y has an understood numerical coefficient of 1.

4. The terms $7z$ and $7y$ are unlike terms and the terms $7z$ and $-z$ are like terms.

5. For the term $-\frac{1}{2}xy^2$, the number $-\frac{1}{2}$ is the numerical coefficient.

6. $5(3x - y)$ equals $15x - 5y$ by the distributive property.

7. Although these terms have exactly the same variables, the exponents on each are not exactly the same—the exponents on x differ in each term.

8. distributive property

9. -1

10. The sum of 5 times a number and -2, added to 7 times the number; $5x + (-2) + 7x$; because there are like terms.

Exercise Set 2.1

2. The numerical coefficient of $3x$ is 3.

4. The numerical coefficient of $-y$ is -1, since $-y = -1y$.

6. The numerical coefficient of $1.2xyz$ is 1.2.

8. $-2x^2y$ and $6xy$ are unlike terms, since the exponents on x are not the same.

10. ab^2 and $-7ab^2$ are like terms, since each variable and its exponent match.

12. $7.4p^3q^2$ and $6.2p^3q^2r$ are unlike terms, since the exponents on r are not the same.

14. $3x + 2x = (3 + 2)x = 5x$

16. $c - 7c + 2c = (1 - 7 + 2)c = -4c$

18. $$\begin{aligned} 6g+5-3g-7 &= 6g-3g+5-7 \\ &= (6-3)g-2 \\ &= 3g-2 \end{aligned}$$

20. $$\begin{aligned} a+3a-2-7a &= a+3a-7a-2 \\ &= (1+3-7)a-2 \\ &= -3a-2 \end{aligned}$$

22. $$\begin{aligned} 8p+4-8p-15 &= (8p-8p)+(4-15) \\ &= (8-8)p+(-11) \\ &= 0p-11 \\ &= -11 \end{aligned}$$

24. $$\begin{aligned} 7.9y-0.7-y+0.2 &= 7.9y-y-0.7+0.2 \\ &= (7.9-1)y-0.5 \\ &= 6.9y-0.5 \end{aligned}$$

26. $$\begin{aligned} 8h+13h-6+7h-h &= 8h+13h+7h-h-6 \\ &= (8+13+7-1)h-6 \\ &= 27h-6 \end{aligned}$$

28. $8x^3+x^3-11x^3 = (8+1-11)x^3 = -2x^3$

30. $$\begin{aligned} &0.4y - 6.7 + y - 0.3 - 2.6y \\ &= 0.4y + y - 2.6y - 6.7 - 0.3 \\ &= (0.4 + 1 - 2.6)y - 7.0 \\ &= -1.2y - 7 \end{aligned}$$

32. $7(r - 3) = 7(r) - 7(3) = 7r - 21$

34. $-4(y + 6) = -4(y) + (-4)(6) = -4y - 24$

36. $9(z + 7) - 15 = 9z + 63 - 15 = 9z + 48$

38. $$\begin{aligned} -2(4x-3z-1) &= -2(4x)-(-2)(3z)-(-2)(1) \\ &= -8x+6z+2 \end{aligned}$$

40. $-(y + 5z - 7) = -y - 5z + 7$

42. $$\begin{aligned} 4(2x-3)-2(x+1) &= 8x-12-2x-2 \\ &= 6x-14 \end{aligned}$$

44. $$\begin{array}{ccc} 3y-5 & \text{added to} & y+16 \\ \downarrow & \downarrow & \downarrow \\ (3y-5) & + & (y+16) = 3y+y-5+16 \\ & & \quad = 4y+11 \end{array}$$

46. $$\begin{array}{ccc} 12+x & \text{minus} & 4x-7 \\ \downarrow & \downarrow & \downarrow \\ (12+x) & - & (4x-7) = 12+x-4x+7 \\ & & \quad = 12+7+x-4x \\ & & \quad = 19-3x \end{array}$$

48. $$\begin{array}{ccc} 2m-6 & \text{minus} & m-3 \\ \downarrow & \downarrow & \downarrow \\ (2m-6) & - & (m-3) = 2m-6-m+3 \\ & & \quad = 2m-m-6+3 \\ & & \quad = m-3 \end{array}$$

50. $7c - 8 - c = 7c - c - 8 = (7 - 1)c - 8 = 6c - 8$

52. $$\begin{aligned} 5y-14+7y-20y &= 5y+7y-20y-14 \\ &= (5+7-20)y-14 \\ &= -8y-14 \end{aligned}$$

54. $$\begin{aligned} -3(2x+5)-6x &= -3(2x)+(-3)(5)-6x \\ &= -6x-15-6x \\ &= -6x-6x-15 \\ &= -12x-15 \end{aligned}$$

56. $$\begin{aligned} 2(6x-1)-(x-7) &= 12x-2-x+7 \\ &= 11x+5 \end{aligned}$$

58. $8y-2-3(y+4) = 8y-2-3y-12 = 5y-14$

60. $-11c - (4 - 2c) = -11c - 4 + 2c = -9c - 4$

62. $(8-5y)-(4+3y) = 8-5y-4-3y = -8y+4$

64. $$\begin{aligned} 2.8w-0.9-0.5-2.8w &= 2.8w-2.8w-0.9-0.5 \\ &= -1.4 \end{aligned}$$

66. $$\begin{aligned}\frac{1}{5}(9y+2)+\frac{1}{10}(2y-1) &= \frac{9}{5}y+\frac{2}{5}+\frac{2}{10}y-\frac{1}{10}\\ &= \frac{9}{5}y+\frac{1}{5}y+\frac{2}{5}-\frac{1}{10}\\ &= \frac{10}{5}y+\frac{4}{10}-\frac{1}{10}\\ &= 2y+\frac{3}{10}\end{aligned}$$

68. $8 + 4(3x - 4) = 8 + 12x - 16 = -8 + 12x$

70. $0.2(k+8)-0.1k = 0.2k+1.6-0.1k = 0.1k+1.6$

72. $14 - 11(5m + 3n) = 14 - 55m - 33n$

74. $$\begin{aligned}7(2x+5)-4(x+2)-20x &= 14x+35-4x-8-20x\\ &= 14x-4x-20x+35-8\\ &= -10x+27\end{aligned}$$

76. $$\begin{aligned}\frac{1}{3}(9x-6)-(x-2) &= 3x-2-x+2\\ &= 2x\end{aligned}$$

78.

The difference of a number and 2	divided by	5
↓	↓	↓
$(x-2)$	$\div$	$5 = \frac{x-2}{5}$

80.

8	more than	triple a number
↓	↓	↓
8	+	$3x$

82.

Eleven	increased by	two-thirds of a number
↓	↓	↓
11	+	$\frac{2}{3}x$

84.

9 times a number	subtract	3 times the number and 10
↓	↓	↓
$9x$	$-$	$(3x+10)$

$9x - (3x + 10) = 9x - 3x - 10 = 6x - 10$

86.

Six	times	the difference of a number and 5
$\downarrow$	$\downarrow$	$\downarrow$
6	$\cdot$	$(x-5)$

$6(x-5) = 6x - 30$

88.

Half a number	minus	the product of the number and 8
$\downarrow$	$\downarrow$	$\downarrow$
$\frac{1}{2}x$	$-$	$8x$

$\frac{1}{2}x - 8x = -7.5x$

90.

Twice a number	added to	-1	added to	5 times the number	added to	-12
$\downarrow$	$\downarrow$	$\downarrow$	$\downarrow$	$\downarrow$	$\downarrow$	$\downarrow$
$2x$	$+$	-1	$+$	$5x$	$+$	-12

$2x + (-1) + 5x + (-12) = 7x - 13$

92. $gh - h^2 = 0(-4) - (-4)^2 = 0 - 16 = -16$

94. $$\begin{aligned} x^3 - x^2 + 4 &= (-3)^3 - (-3)^2 + 4 \\ &= -27 - 9 + 4 \\ &= -32 \end{aligned}$$

96. $$\begin{aligned} x^3 - x^2 - x &= (-2)^3 - (-2)^2 - (-2) \\ &= -8 - 4 + 2 \\ &= -10 \end{aligned}$$

98. $$\begin{aligned} 5 + (3x - 1) + (2x + 5) &= 5 + 3x - 1 + 2x + 5 \\ &= 5x + 9 \end{aligned}$$
The perimeter is $(5x + 9)$ centimeters.

100. $$\begin{aligned} \text{2 cylinders} &\stackrel{?}{=} \text{3 cubes} \\ \text{2 cubes} + \text{2 cubes} &\stackrel{?}{=} \text{3 cubes} \\ \text{4 cubes} &= \text{3 cubes: Not balanced} \end{aligned}$$

102. $$\begin{aligned} \text{1 cylinder} &\stackrel{?}{=} \text{1 cone} + \text{1 cube} \\ \text{2 cubes} &\stackrel{?}{=} \text{1 cube} + \text{1 cube} \\ \text{2 cubes} &= \text{2 cubes: Balanced} \end{aligned}$$

104. answers may vary

106. $$\begin{aligned} 5x + 10(3x) + 25(30x - 1) &= 5x + 30x + 750x - 25 \\ &= 785x - 25 \end{aligned}$$
The total value is $(785x - 25)$¢.

108. no; answers may vary

110. $4m^4p^2 + m^4p^2 - 5m^2p^4 = 5m^4p^2 - 5m^2p^4$

112. $9y^2 - (6xy^2 - 5y^2) - 8xy^2$
$= 9y^2 - 6xy^2 + 5y^2 - 8xy^2$
$= 14y^2 - 14xy^2$

114. $-(7c^3d - 8c) - 5c - 4c^3d$
$= -7c^3d + 8c - 5c - 4c^3d$
$= -11c^3d + 3c$

Section 2.2 Practice Exercises

1. $x + 3 = -5$
$x + 3 - 3 = -5 - 3$
$x = -8$
Check: $x + 3 = -5$
$-8 + 3 \stackrel{?}{=} -5$
$-5 = -5$
The solution is −8.

2. $y - 0.3 = -2.1$
$y - 0.3 + 0.3 = -2.1 + 0.3$
$y = -1.8$
Check: $y - 0.3 = -2.1$
$-1.8 - 0.3 \stackrel{?}{=} -2.1$
$-2.1 = -2.1$
The solution is −1.8.

3. $\frac{2}{5} = x + \frac{3}{10}$
$\frac{2}{5} - \frac{3}{10} = x + \frac{3}{10} - \frac{3}{10}$
$\frac{2}{2} \cdot \frac{2}{5} - \frac{3}{10} = x$
$\frac{4}{10} - \frac{3}{10} = x$
$\frac{1}{10} = x$

Check: $\frac{2}{5} = x + \frac{3}{10}$
$\frac{2}{5} \stackrel{?}{=} \frac{1}{10} + \frac{3}{10}$
$\frac{2}{5} = \frac{2}{5}$
The solution is $\frac{1}{10}$.

4. $4t + 7 = 5t - 3$
$4t + 7 - 4t = 5t - 3 - 4t$
$7 = t - 3$
$7 + 3 = t - 3 + 3$
$10 = t$
Check: $4t + 7 = 5t - 3$
$4(10) + 7 \stackrel{?}{=} 5(10) - 3$
$40 + 7 \stackrel{?}{=} 50 - 3$
$47 = 47$
The solution is 10.

5. $8x - 5x - 3 + 9 = x + x + 3 - 7$
$3x + 6 = 2x - 4$
$3x + 6 - 2x = 2x - 4 - 2x$
$x + 6 = -4$
$x + 6 - 6 = -4 - 6$
$x = -10$
Check:
$8x - 5x - 3 + 9 = x + x + 3 - 7$
$8(-10) - 5(-10) - 3 + 9 \stackrel{?}{=} -10 + (-10) + 3 - 7$
$-80 + 50 - 3 + 9 \stackrel{?}{=} -10 + (-10) + 3 - 7$
$-24 = -24$
The solution is −10.

6. $4(2a - 3) - (7a + 4) = 2$
$4(2a) + 4(-3) - 7a - 4 = 2$
$8a - 12 - 7a - 4 = 2$
$a - 16 = 2$
$a - 16 + 16 = 2 + 16$
$a = 18$
Check by replacing a with 18 in the original equation.

7. $12 - x = 20$
$12 - x - 12 = 20 - 12$
$-x = 8$
$x = -8$
Check: $12 - x = 20$
$12 - (-8) \stackrel{?}{=} 20$
$20 = 20$
The solution is −8.

8. **a.** The other number is 9 − 2 = 7.

b. The other number is $9 - x$.

c. The other piece has length $(9 - x)$ feet.

9. The speed of the French TGV is $(s - 67.2)$ mph.

Vocabulary, Readiness & Video Check 2.2

1. The difference between an equation and an expression is that an equation contains an equal sign, whereas an expression does not.

2. Equivalent equations are equations that have the same solution.

3. A value of the variable that makes the equation a true statement is called a solution of the equation.

4. The process of finding the solution of an equation is called solving the equation for the variable.

5. By the addition property of equality, $x = -2$ and $x + 10 = -2 + 10$ are equivalent equations.

6. The equations $x = \frac{1}{2}$ and $\frac{1}{2} = x$ are equivalent equations. The statement is true.

7. The addition property of equality means that if we have an equation, we can add the same real number to both sides of the equation and have an equivalent equation.

8. To confirm our solution, we replace the variable with the solution in the original equation to make sure we have a true statement.

9. $\frac{1}{7}x$

Exercise Set 2.2

2.
$$\begin{aligned} x+14 &= 25 \\ x+14-14 &= 25-14 \\ x &= 11 \end{aligned}$$
Check:
$$\begin{aligned} x+14 &= 25 \\ 11+14 &\stackrel{?}{=} 25 \\ 25 &= 25 \end{aligned}$$
The solution is 11.

4.
$$\begin{aligned} y-9 &= 1 \\ y-9+9 &= 1+9 \\ y &= 10 \end{aligned}$$
Check:
$$\begin{aligned} y-9 &= 1 \\ 10-9 &\stackrel{?}{=} 1 \\ 1 &= 1 \end{aligned}$$
The solution is 10.

6.
$$\begin{aligned} -17 &= x+3 \\ -17-3 &= x+3-3 \\ -20 &= x \end{aligned}$$
Check:
$$\begin{aligned} -17 &= x+3 \\ -17 &\stackrel{?}{=} -20+3 \\ -17 &= -17 \end{aligned}$$
The solution is −20.

8.
$$\begin{aligned} t-9.2 &= -6.8 \\ 5-9.2+9.2 &= -6.8+9.2 \\ t &= 2.4 \end{aligned}$$
Check:
$$\begin{aligned} t-9.2 &= -6.8 \\ 2.4-9.2 &\stackrel{?}{=} -6.8 \\ -6.8 &= -6.8 \end{aligned}$$
The solution is 2.4.

10.
$$\begin{aligned} \frac{3}{8} &= c+\frac{1}{6} \\ \frac{3}{8}-\frac{1}{6} &= c+\frac{1}{6}-\frac{1}{6} \\ \frac{9}{24}-\frac{4}{24} &= c \\ \frac{5}{24} &= c \end{aligned}$$
Check:
$$\begin{aligned} \frac{3}{8} &= c+\frac{1}{6} \\ \frac{3}{8} &\stackrel{?}{=} \frac{5}{24}+\frac{1}{6} \\ \frac{3}{8} &\stackrel{?}{=} \frac{5}{24}+\frac{4}{24} \\ \frac{3}{8} &\stackrel{?}{=} \frac{9}{24} \\ \frac{3}{8} &= \frac{3}{8} \end{aligned}$$
The solution is $\frac{5}{24}$.

12.
$$\begin{aligned} 9x+5.5 &= 10x \\ 9x-9x+5.5 &= 10x-9x \\ 5.5 &= x \end{aligned}$$
Check:
$$\begin{aligned} 9x+5.5 &= 10x \\ 9(5.5)+5.5 &\stackrel{?}{=} 10(5.5) \\ 49.5+5.5 &\stackrel{?}{=} 55 \\ 55 &= 55 \end{aligned}$$
The solution is 5.5.

14. $18x-9=19x$
$18x-18x-9=19x-18x$
$-9=x$
Check: $18x-9=19x$
$18(-9)-9 \stackrel{?}{=} 19(-9)$
$-162-9 \stackrel{?}{=} -171$
$-171=171$
The solution is −9.

16. $z+\frac{9}{19}=-\frac{2}{19}$
$z+\frac{9}{19}-\frac{9}{19}=-\frac{2}{19}-\frac{9}{19}$
$z=-\frac{11}{19}$
Check: $z+\frac{9}{19}=-\frac{2}{19}$
$-\frac{11}{19}+\frac{9}{19} \stackrel{?}{=} -\frac{2}{19}$
$-\frac{2}{19}=-\frac{2}{19}$
The solution is $-\frac{11}{19}$.

18. $3n+2n=7+4n$
$5n=7+4n$
$5n-4n=7+4n-4n$
$n=7$
Check: $3n+2n=7+4n$
$3(7)+2(7) \stackrel{?}{=} 7+4(7)$
$21+14 \stackrel{?}{=} 7+28$
$35=35$
The solution is 7.

20. $\frac{13}{11}y-\frac{2}{11}y=-3$
$\frac{11}{11}y=-3$
$y=-3$
Check: $\frac{13}{11}y-\frac{2}{11}y=-3$
$\frac{13}{11}(-3)-\frac{2}{11}(-3) \stackrel{?}{=} -3$
$-\frac{39}{11}+\frac{6}{11} \stackrel{?}{=} -3$
$-3=-3$
The solution is −3.

22. $4x-4=10x-7x$
$4x-4=3x$
$4x-3x-4=3x-3x$
$x-4=0$
$x-4+4=0+4$
$x=4$
Check: $4x-4=10x-7x$
$4(4)-4 \stackrel{?}{=} 10(4)-7(4)$
$16-4 \stackrel{?}{=} 40-28$
$12=12$
The solution is 4.

24. $-4(z-3)=2-3z$
$-4z+12=2-3z$
$-4z+4z+12=2-3z+4z$
$12=2+z$
$12-2=2-2+z$
$10=z$
Check: $-4(z-3)=2-3z$
$-4(10-3) \stackrel{?}{=} 2-3(10)$
$-4(7) \stackrel{?}{=} 2-30$
$-28=-28$
The solution is 10.

26. $\frac{1}{5}x-1=-\frac{4}{5}x-13$
$\frac{1}{5}x-1+\frac{4}{5}x=-\frac{4}{5}x-13+\frac{4}{5}x$
$\frac{5}{5}x-1=-13$
$x-1+1=-13+1$
$x=-12$
Check: $\frac{1}{5}x-1=-\frac{4}{5}x-13$
$\frac{1}{5}(-12)-1 \stackrel{?}{=} -\frac{4}{5}(-12)-13$
$-\frac{12}{5}-\frac{5}{5} \stackrel{?}{=} \frac{48}{5}-\frac{65}{5}$
$-\frac{17}{5}=-\frac{17}{5}$
The solution is −12.

28. $2x+7=x-10$
$2x+7-x=x-10-x$
$x+7=-10$
$x+7-7=-10-7$
$x=-17$

Check:
$$\begin{aligned} 2x+7 &= x-10 \\ 2(-17)+7 &\stackrel{?}{=} (-17)-10 \\ -34+7 &\stackrel{?}{=} -27 \\ -27 &= -27 \end{aligned}$$
The solution is −17.

30.
$$\begin{aligned} 4p-11-p &= 2+2p-20 \\ 3p-11 &= 2p-18 \\ 3p-2p-11 &= 2p-2p-18 \\ p-11 &= -18 \\ p-11+11 &= -18+11 \\ p &= -7 \end{aligned}$$

Check:
$$\begin{aligned} 4p-11-p &= 2+2p-20 \\ 4(-7)-11-(-7) &\stackrel{?}{=} 2+2(-7)-20 \\ -28-11+7 &\stackrel{?}{=} 2-14-20 \\ -32 &= -32 \end{aligned}$$
The solution is −7.

32.
$$\begin{aligned} -2(x-1) &= -3x \\ -2x+2 &= -3x \\ -2x+2+2x &= -3x+2x \\ 2 &= -x \\ x &= -2 \end{aligned}$$
Check:
$$\begin{aligned} -2(x-1) &= -3x \\ -2(-2-1) &\stackrel{?}{=} -3(-2) \\ -2(-3) &\stackrel{?}{=} 6 \\ 6 &= 6 \end{aligned}$$
The solution is −2.

34.
$$\begin{aligned} \frac{2}{5}x-\frac{1}{12} &= -\frac{3}{5}x-\frac{3}{4} \\ \frac{2}{5}x+\frac{3}{5}x-\frac{1}{12} &= -\frac{3}{5}x+\frac{3}{5}x-\frac{3}{4} \\ \frac{5}{5}x-\frac{1}{12} &= -\frac{3}{4} \\ x-\frac{1}{12}+\frac{1}{12} &= -\frac{3}{4}+\frac{1}{12} \\ x &= -\frac{9}{12}+\frac{1}{12} \\ x &= -\frac{8}{12} \\ x &= -\frac{2}{3} \end{aligned}$$

Check:
$$\begin{aligned} \frac{2}{5}x-\frac{1}{12} &= -\frac{3}{5}x-\frac{3}{4} \\ \frac{2}{5}\left(-\frac{2}{3}\right)-\frac{1}{12} &\stackrel{?}{=} -\frac{3}{5}\left(-\frac{2}{3}\right)-\frac{3}{4} \\ -\frac{4}{15}-\frac{1}{12} &\stackrel{?}{=} \frac{6}{15}-\frac{3}{4} \\ -\frac{16}{60}-\frac{5}{60} &\stackrel{?}{=} \frac{24}{60}-\frac{45}{60} \\ -\frac{21}{60} &= -\frac{21}{60} \end{aligned}$$
The solution is $-\frac{2}{3}$.

36.
$$\begin{aligned} 3(y+7) &= 2y-5 \\ 3y+21 &= 2y-5 \\ 3y-2y+21 &= 2y-2y-5 \\ y+21 &= -5 \\ y+21-21 &= -5-21 \\ y &= -26 \end{aligned}$$

Check:
$$\begin{aligned} 3(y+7) &= 2x-5 \\ 3(-26+7) &\stackrel{?}{=} 2(-26)-5 \\ 3(-19) &\stackrel{?}{=} -52-5 \\ -57 &= -57 \end{aligned}$$
The solution is −26.

38.
$$\begin{aligned} 5(3+z)-(8z+9) &= -4z \\ 15+5z-8z-9 &= -4z \\ 6-3z &= -4z \\ 6-3z+4z &= -4z+4z \\ 6+z &= 0 \\ 6-6+z &= -6 \\ z &= -6 \end{aligned}$$
Check:
$$\begin{aligned} 5(3+z)-(8z+9) &= -4z \\ 5(3+(-6))-(8(-6)+9) &\stackrel{?}{=} -4(-6) \\ 5(-3)-(-48+9) &\stackrel{?}{=} 24 \\ -15-(-39) &\stackrel{?}{=} 24 \\ 24 &= 24 \end{aligned}$$
The solution is −6.

40.
$$\begin{aligned} -5(x+1)+4(2x-3) &= 2(x+2)-8 \\ -5x-5+8x-12 &= 2x+4-8 \\ 3x-17 &= 2x-4 \\ 3x-2x-17 &= 2x-2x-4 \\ x-17 &= -4 \\ x-17+17 &= -4+17 \\ x &= 13 \end{aligned}$$

Check:
$$\begin{aligned} -5(x+1)+4(2x-3) &= 2(x+2)-8 \\ -5(13+1)+4(2(13)-3) &\stackrel{?}{=} 2(13+2)-8 \\ -5(14)+4(26-3) &\stackrel{?}{=} 2(15)-8 \\ -70+4(23) &\stackrel{?}{=} 30-8 \\ -70+92 &\stackrel{?}{=} 22 \\ 22 &= 22 \end{aligned}$$

The solution is 13.

42.
$$\begin{aligned} -8 &= 8+z \\ -8-8 &= 8+z-8 \\ -16 &= z \end{aligned}$$

44.
$$\begin{aligned} y-\frac{4}{7} &= -\frac{3}{14} \\ y-\frac{4}{7}+\frac{4}{7} &= -\frac{3}{14}+\frac{4}{7} \\ y &= -\frac{3}{14}+\frac{8}{14} \\ y &= \frac{5}{14} \end{aligned}$$

46.
$$\begin{aligned} 7y+2 &= 6y+2 \\ 7y-6y+2 &= 6y-6y+2 \\ y+2 &= 2 \\ y+2-2 &= 2-2 \\ y &= 0 \end{aligned}$$

48.
$$\begin{aligned} 15x+20-10x-9 &= 25x+8-21x-7 \\ 5x+11 &= 4x+1 \\ 5x+11-4x &= 4x+1-4x \\ x+11 &= 1 \\ x+11-11 &= 1-11 \\ x &= -10 \end{aligned}$$

50.
$$\begin{aligned} 6(5+c) &= 5(c-4) \\ 30+6c &= 5c-20 \\ 30+6c-5c &= 5c-5c-20 \\ 30+c &= 20 \\ 30-30+c &= -20-30 \\ c &= -50 \end{aligned}$$

52.
$$\begin{aligned} m+2 &= 7.1 \\ m+2-2 &= 7.1-2 \\ m &= 5.1 \end{aligned}$$

54.
$$\begin{aligned} 15-(6-7k) &= 2+6k \\ 15-6+7k &= 2+6k \\ 9+7k &= 2+6k \\ 9+7k-6k &= 2+6k-6k \\ 9+k &= 2 \\ 9-9+k &= 2-9 \\ k &= -7 \end{aligned}$$

56.
$$\begin{aligned} \frac{1}{11} &= y+\frac{10}{11} \\ \frac{1}{11}-\frac{10}{11} &= y+\frac{10}{11}-\frac{10}{11} \\ -\frac{9}{11} &= y \end{aligned}$$

58.
$$\begin{aligned} -1.4-7x-3.6-2x &= -8x+4.4 \\ -9x-5.0 &= -8x+4.4 \\ -9x+9x-5.0 &= -8x+9x+4.4 \\ -5.0 &= x+4.4 \\ -5.0-4.4 &= x+4.4-4.4 \\ -9.4 &= x \end{aligned}$$

60.
$$\begin{aligned} -2\left(x-\frac{1}{7}\right) &= -3x \\ -2x+\frac{2}{7} &= -3x \\ -2x+3x+\frac{2}{7} &= -3x+3x \\ x+\frac{2}{7} &= 0 \\ x+\frac{2}{7}-\frac{2}{7} &= 0-\frac{2}{7} \\ x &= -\frac{2}{7} \end{aligned}$$

62.
$$\begin{aligned} -4(x-1)-5(2-x) &= -6 \\ -4x+4-10+5x &= -6 \\ x-6 &= -6 \\ x-6+6 &= -6+6 \\ x &= 0 \end{aligned}$$

64.
$$\begin{aligned} 0.6v+0.4(0.3+v) &= 2.34 \\ 0.6v+0.12+0.4v &= 2.34 \\ 1v+0.12 &= 2.34 \\ v+0.12-0.12 &= 2.34-0.12 \\ v &= 2.22 \end{aligned}$$

66. The other number is $13-y$.

68. The length of the other piece is $(5-x)$ feet.

70. The complement of the angle $x°$ is $(90 - x)°$.

72. If the length of I-80 is m miles and the length of I-90 is 178.5 miles longer than I-80, the length of I-90 is $m + 178.5$.

74. The weight of the Hoba West meteorite is $3y$ kilograms.

76. The reciprocal of $\frac{7}{6}$ is $\frac{6}{7}$ since $\frac{7}{6}\cdot\frac{6}{7}=1.$

78. The reciprocal of 5 is $\frac{1}{5}$ since $5\cdot\frac{1}{5}=1.$

80. The reciprocal of $-\frac{3}{5}$ is $-\frac{5}{3}$ since $-\frac{3}{5}\cdot-\frac{5}{3}=1.$

82. $\frac{-2y}{-2} = y$

84. $7\left(\frac{1}{7}r\right)=r$

86. $\frac{9}{2}\left(\frac{2}{9}x\right)=x$

88. $360 - (x + 3x + 5x) = 360 - (9x) = 360 - 9x$
The fourth angle is $(360 - 9x)°$.

90. answers may vary

92. answers may vary

94.
$$\begin{aligned}100+250+500+x&=1000\\ 850+x&=1000\\ 850+x-850&=1000-850\\ x&=150\end{aligned}$$
The fluid needed by the patient is 150 ml.

96. answers may vary.

98.
$$\begin{aligned}a+9&=15\\ a+9+(-9)&=15+(-9)\\ a&=6\end{aligned}$$
The answer is –9.

100. answers may vary

102. Check $y = 1.2$: $8.13 + 5.85y = 20.05y - 8.91$
$$\begin{aligned}8.13+5.85(1.2)&\stackrel{?}{=}20.05(1.2)-8.91\\ 8.13+7.02&\stackrel{?}{=}24.06-8.91\\ 15.15&=15.15\end{aligned}$$
Solution

104. Check $z = 4.8$:
$$\begin{aligned}7(z-1.7)+9.5&=5(z+3.2)-9.2\\ 7(4.8-1.7)+9.5&\stackrel{?}{=}5(4.8+3.2)-9.2\\ 7(3.1)+9.55&\stackrel{?}{=}5(8.0)-9.2\\ 21.7+9.55&\stackrel{?}{=}40.0-9.2\\ 31.2&\neq 30.8\end{aligned}$$
Not a solution

Section 2.3 Practice Exercises

1.
$$\begin{aligned}\frac{4}{5}x&=16\\ \frac{5}{4}\cdot\frac{4}{5}x&=\frac{5}{4}\cdot16\\ \left(\frac{5}{4}\cdot\frac{4}{5}\right)x&=\frac{5}{4}\cdot16\\ 1x&=20\\ x&=20\end{aligned}$$
Check:
$$\begin{aligned}\frac{4}{5}x&=16\\ \frac{4}{5}\cdot20&\stackrel{?}{=}16\\ 16&=16\end{aligned}$$
The solution is 20.

2.
$$\begin{aligned}8x&=-96\\ \frac{8x}{8}&=\frac{-96}{8}\\ x&=-12\end{aligned}$$
Check:
$$\begin{aligned}8x&=-96\\ 8(-12)&\stackrel{?}{=}-96\\ -96&=-96\end{aligned}$$
The solution is –12.

3.
$$\begin{aligned}\frac{x}{5}&=13\\ 5\cdot\frac{x}{5}&=5\cdot13\\ x&=65\end{aligned}$$
Check:
$$\begin{aligned}\frac{x}{5}&=13\\ \frac{65}{5}&\stackrel{?}{=}13\\ 13&=13\end{aligned}$$
The solution is 65.

4. $2.7x = 4.05$

$$\frac{2.7x}{2.7} = \frac{4.05}{2.7}$$
$$x = 1.5$$

The solution is 1.5.
Check by replacing x with 1.5 in the original equation.

5. $-\frac{5}{3}x = \frac{4}{7}$

$$-\frac{3}{5} \cdot -\frac{5}{3}x = -\frac{3}{5} \cdot \frac{4}{7}$$
$$x = -\frac{12}{35}$$

Check by replacing x with $-\frac{12}{35}$ in the original equation. The solution is $-\frac{12}{35}$.

6. $-y + 3 = -8$

$$-y + 3 - 3 = -8 - 3$$
$$-y = -11$$
$$\frac{-y}{-1} = \frac{-11}{-1}$$
$$y = 11$$

To check, replace y with 11 in the original equation. The solution is 11.

7. $6b - 11b = 18 + 2b - 6 + 9$

$$-5b = 21 + 2b$$
$$-5b - 2b = 21 + 2b - 2b$$
$$-7b = 21$$
$$\frac{-7b}{-7} = \frac{21}{-7}$$
$$b = -3$$

Check by replacing b with -3 in the original equation. The solution is -3.

8. $10x - 4 = 7x + 14$

$$10x - 4 - 7x = 7x + 14 - 7x$$
$$3x - 4 = 14$$
$$3x - 4 + 4 = 14 + 4$$
$$3x = 18$$
$$\frac{3x}{3} = \frac{18}{3}$$
$$x = 6$$

To check, replace x with 6 in the original equation to see that a true statement results. The solution is 6.

9. $4(3x - 2) = -1 + 4$

$$4(3x) - 4(2) = -1 + 4$$
$$12x - 8 = 3$$
$$12x - 8 + 8 = 3 + 8$$
$$12x = 11$$
$$\frac{12x}{12} = \frac{11}{12}$$
$$x = \frac{11}{12}$$

To check, replace x with $\frac{11}{12}$ in the original equation to see that a true statement results. The solution is $\frac{11}{12}$.

10. Let x = first integer.
$x + 2$ = second even integer.
$x + 4$ = third even integer.
$x + (x + 2) + (x + 4) = 3x + 6$

Vocabulary, Readiness & Video Check 2.3

1. By the <u>multiplication</u> property of equality, $y = \frac{1}{2}$ and $5 \cdot y = 5 \cdot \frac{1}{2}$ are equivalent equations.

2. The equations $\frac{z}{4} = 10$ and $4 \cdot \frac{z}{4} = 10$ are not equivalent equations. The statement is false.

3. The equations $-7x = 30$ and $\frac{-7x}{-7} = \frac{30}{7}$ are not equivalent equations. The statement is false.

4. By the <u>multiplication</u> property of equality, $9x = -63$ and $\frac{9x}{9} = \frac{-63}{9}$ are equivalent equations.

5. We can multiply both sides of an equation by the <u>same</u> nonzero number and have an equivalent equation.

6. addition property; multiplication property; answers may vary

7. $(x + 1) + (x + 3) = 2x + 4$

Exercise Set 2.3

2. $-7x = -49$
$$\frac{-7x}{-7} = \frac{-49}{-7}$$
$$x = 7$$
Check: $-7x = -49$
$$-7(7) \stackrel{?}{=} -49$$
$$-49 = -49$$
The solution is 7.

4. $2x = 0$
$$\frac{2x}{2} = \frac{0}{2}$$
$$x = 0$$
Check: $2x = 0$
$$2(0) \stackrel{?}{=} 0$$
$$0 = 0$$
The solution is 0.

6. $-y = 8$
$$\frac{-y}{-1} = \frac{8}{-1}$$
$$y = -8$$
Check: $-y = 8$
$$-(-8) \stackrel{?}{=} 8$$
$$8 = 8$$
The solution is −8.

8. $\frac{3}{4}n = -15$
$$\frac{4}{3}\left(\frac{3}{4}n\right) = \frac{4}{3}(-15)$$
$$n = -20$$
Check: $\frac{3}{4}n = -15$
$$\frac{3}{4}(-20) \stackrel{?}{=} -15$$
$$-15 = -15$$
The solution is −20.

10. $\frac{1}{4} = \frac{1}{8}v$
$$8\left(\frac{1}{4}\right) = 8\left(\frac{1}{8}v\right)$$
$$2 = v$$
Check: $\frac{1}{4} = \frac{1}{8}v$
$$\frac{1}{4} \stackrel{?}{=} \frac{1}{8}(2)$$
$$\frac{1}{4} = \frac{1}{4}$$
The solution is 2.

12. $\frac{d}{15} = 2$
$$15\left(\frac{d}{15}\right) = 15(2)$$
$$d = 30$$
Check: $\frac{d}{15} = 2$
$$\frac{30}{15} \stackrel{?}{=} 2$$
$$2 = 2$$
The solution is 30.

14. $\frac{f}{-5} = 0$
$$-5\left(\frac{f}{-5}\right) = -5(0)$$
$$f = 0$$
Check: $\frac{f}{-5} = 0$
$$\frac{0}{-5} \stackrel{?}{=} 0$$
$$0 = 0$$
The solution is 0.

16. $19.55 = 8.5y$
$$\frac{19.55}{8.5} = \frac{8.5y}{8.5}$$
$$2.3 = y$$
Check: $19.55 = 8.5y$
$$19.55 \stackrel{?}{=} 8.5(2.3)$$
$$19.55 = 19.55$$
The solution is 2.3.

18. $3x - 1 = 26$
$$3x - 1 + 1 = 26 + 1$$
$$3x = 27$$
$$\frac{3x}{3} = \frac{27}{3}$$
$$x = 9$$

Check: $3x-1=26$

$3(9)-1 \stackrel{?}{=} 26$

$27-1 \stackrel{?}{=} 26$

$26=26$

The solution is 9.

20. $-x+4=-24$

$-x+4-4=-24-4$

$-x=-28$

$x=28$

Check: $-x+4=-24$

$-(28)+4 \stackrel{?}{=} -24$

$-28+4 \stackrel{?}{=} -24$

$-24=-24$

The solution is 28.

22. $8t+5=5$

$8t+5-5=5-5$

$8t=0$

$\frac{8t}{8}=\frac{0}{8}$

$t=0$

Check: $8t+5=5$

$8(0)+5 \stackrel{?}{=} 5$

$0+5 \stackrel{?}{=} 5$

$5=5$

The solution is 0.

24. $\frac{b}{4}-1=-7$

$\frac{b}{4}-1+1=-7+1$

$\frac{b}{4}=-6$

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

$b=-24$

Check: $\frac{b}{4}-1=-7$

$\frac{-24}{4}-1 \stackrel{?}{=} -7$

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

$-7=-7$

The solution is –24.

26. $4a+a=-1+3a-1-2$

$5a=3a-4$

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

$2a=-4$

$\frac{2a}{2}=\frac{-4}{2}$

$a=-2$

Check: $4a+a=-1+3a-1-2$

$4(-2)+(-2) \stackrel{?}{=} -1+3(-2)-1-2$

$-8-2 \stackrel{?}{=} -1-6-1-2$

$-10=-10$

The solution is –2.

28. $19=0.4x-0.9x-6$

$19=-0.5x-6$

$19+6=-0.5x-6+6$

$25=-0.5x$

$\frac{25}{-0.5}=\frac{-0.5x}{-0.5}$

$-50=x$

Check: $19=0.4x-0.9x-6$

$19 \stackrel{?}{=} 0.4(-50)-0.9(-50)-6$

$19 \stackrel{?}{=} -20+45-6$

$19=19$

The solution is –50.

30. $\frac{3}{5}x-14=-8$

$\frac{3}{5}x-14+14=-8+14$

$\frac{3}{5}x=6$

$\frac{5}{3}\cdot\frac{3}{5}x=\frac{5}{3}\cdot 6$

$x=10$

Check: $\frac{3}{5}x-14=-8$

$\frac{3}{5}\cdot 10-14 \stackrel{?}{=} -8$

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

$-8=-8$

The solution is 10.

32.
$$\begin{aligned}
\frac{2}{7}z-\frac{1}{5}&=\frac{1}{2}\\
\frac{2}{7}z-\frac{1}{5}+\frac{1}{5}&=\frac{1}{2}+\frac{1}{5}\\
\frac{2}{7}z&=\frac{7}{10}\\
\frac{7}{2}\cdot\frac{2}{7}z&=\frac{7}{2}\cdot\frac{7}{10}\\
z&=\frac{49}{20}
\end{aligned}$$

Check:
$$\begin{aligned}
\frac{2}{7}z-\frac{1}{5}&=\frac{1}{2}\\
\frac{2}{7}\left(\frac{49}{20}\right)-\frac{1}{5}&\stackrel{?}{=}\frac{1}{2}\\
\frac{7}{10}-\frac{1}{5}&\stackrel{?}{=}\frac{1}{2}\\
\frac{5}{10}&\stackrel{?}{=}\frac{1}{2}\\
\frac{1}{2}&=\frac{1}{2}
\end{aligned}$$

The solution is $\frac{49}{20}$.

34.
$$\begin{aligned}
11x+13&=9x+9\\
11x+13-9x&=9x+9-9x\\
2x+13&=9\\
2x+13-13&=9-13\\
2x&=-4\\
\frac{2x}{2}&=\frac{-4}{2}\\
x&=-2
\end{aligned}$$

36.
$$\begin{aligned}
2(4x+1)&=-12+6\\
8x+2&=-6\\
8x+2-2&=-6-2\\
8x&=-8\\
\frac{8x}{8}&=\frac{-8}{8}\\
x&=-1
\end{aligned}$$

38.
$$\begin{aligned}
6x-4&=-2x-10\\
6x-4+2x&=-2x-10+2x\\
8x-4&=-10\\
8x-4+4&=-10+4\\
8x&=-6\\
\frac{8x}{8}&=\frac{-6}{8}\\
x&=-\frac{3}{4}
\end{aligned}$$

40.
$$\begin{aligned}
8+4&=-6(5x-2)\\
12&=-30x+12\\
12-12&=-30x+12-12\\
0&=-30x\\
\frac{0}{-30}&=\frac{-30x}{-30}\\
0&=x
\end{aligned}$$

42.
$$\begin{aligned}
-17z-4&=-16z-20\\
-17z-4+17z&=-16z-20+17z\\
-4&=z-20\\
-4+20&=z-20+20\\
16&=z
\end{aligned}$$

44.
$$\begin{aligned}
\frac{1}{3}(3x-1)&=-\frac{1}{10}-\frac{2}{10}\\
x-\frac{1}{3}&=-\frac{3}{10}\\
x-\frac{1}{3}+\frac{1}{3}&=-\frac{3}{10}+\frac{1}{3}\\
x&=-\frac{9}{30}+\frac{10}{30}\\
x&=\frac{1}{30}
\end{aligned}$$

46.
$$\begin{aligned}
-14y-1.8&=-24y+3.9\\
-14y-1.8+24y&=-24y+3.9+24y\\
10y-1.8&=3.9\\
10y-1.8+1.8&=3.9+1.8\\
10y&=5.7\\
\frac{10y}{10}&=\frac{5.7}{10}\\
y&=0.57
\end{aligned}$$

48.
$$\begin{aligned}
-3x+15&=3x-15\\
-3x+15+3x&=3x-15+3x\\
15&=6x-15\\
15+15&=6x-15+15\\
30&=6x\\
\frac{30}{6}&=\frac{6x}{6}\\
5&=x
\end{aligned}$$

50.
$$\begin{aligned}
81&=3x\\
\frac{81}{3}&=\frac{3x}{3}\\
27&=x
\end{aligned}$$

52.
$$\begin{aligned} 6.3 &= -0.6x \\ \frac{6.3}{-0.6} &= \frac{-0.6x}{-0.6} \\ -10.5 &= x \end{aligned}$$

54.
$$\begin{aligned} 10y+15 &= -5 \\ 10y+15-15 &= -5-15 \\ 10y &= -20 \\ \frac{10y}{10} &= \frac{-20}{10} \\ y &= -2 \end{aligned}$$

56.
$$\begin{aligned} 2-0.4p &= 2 \\ 2-2-0.4p &= 2-2 \\ -0.4p &= 0 \\ \frac{-0.4p}{-0.4} &= \frac{0}{-0.4} \\ p &= 0 \end{aligned}$$

58.
$$\begin{aligned} 20x-20 &= 16x-40 \\ 20x-20-16x &= 16x-40-16x \\ 4x-20 &= -40 \\ 4x-20+20 &= -40+20 \\ 4x &= -20 \\ \frac{4x}{4} &= \frac{-20}{4} \\ x &= -5 \end{aligned}$$

60.
$$\begin{aligned} 7(2x+1) &= 18x-19x \\ 14x+7 &= -x \\ 14x+7-14x &= -x-14x \\ 7 &= -15x \\ \frac{7}{-15} &= \frac{-15x}{-15} \\ -\frac{7}{15} &= x \end{aligned}$$

62.
$$\begin{aligned} -\frac{4}{5}r &= -5 \\ -\frac{5}{4}\left(-\frac{4}{5}r\right) &= -\frac{5}{4}(-5) \\ r &= \frac{25}{4} \end{aligned}$$

64.
$$\begin{aligned} -\frac{10}{3}x &= 30 \\ -\frac{3}{10}\left(-\frac{10}{3}x\right) &= -\frac{3}{10}(30) \\ x &= -9 \end{aligned}$$

66.
$$\begin{aligned} -3n-\frac{1}{3} &= \frac{8}{3} \\ -3n-\frac{1}{3}+\frac{1}{3} &= \frac{8}{3}+\frac{1}{3} \\ -3n &= \frac{9}{3} \\ -3n &= 3 \\ \frac{-3n}{-3} &= \frac{3}{-3} \\ n &= -1 \end{aligned}$$

68.
$$\begin{aligned} 12 &= 3j-4 \\ 12+4 &= 3j-4+4 \\ 16 &= 3j \\ \frac{16}{3} &= \frac{3j}{3} \\ \frac{16}{3} &= j \end{aligned}$$

70.
$$\begin{aligned} 12x+30+8x-6 &= 10 \\ 20x+24 &= 10 \\ 20x+24-24 &= 10-24 \\ 20x &= -14 \\ \frac{20x}{20} &= \frac{-14}{20} \\ x &= -\frac{7}{10} \end{aligned}$$

72.
$$\begin{aligned} t-6t &= -13+t-3t \\ -5t &= -2t-13 \\ -5t+2t &= -2t+2t-13 \\ -3t &= -13 \\ \frac{-3t}{-3} &= \frac{-13}{-3} \\ t &= \frac{13}{3} \end{aligned}$$

74.
$$\begin{aligned}
x+\frac{3}{7} &= -x+\frac{1}{3}+\frac{4}{7}\\
x+\frac{3}{7} &= -x+\frac{19}{21}\\
x+\frac{3}{7}+x &= -x+\frac{19}{21}+x\\
2x+\frac{3}{7} &= \frac{19}{21}\\
2x+\frac{3}{7}-\frac{3}{7} &= \frac{19}{21}-\frac{3}{7}\\
2x &= \frac{10}{21}\\
\frac{1}{2}\cdot 2x &= \frac{1}{2}\cdot\frac{10}{21}\\
x &= \frac{5}{21}
\end{aligned}$$

76.
$$\begin{aligned}
-19+74 &= -5(x+3)\\
55 &= -5x-15\\
55+15 &= -5x-15+15\\
70 &= -5x\\
\frac{70}{-5} &= \frac{-5x}{-5}\\
-14 &= x
\end{aligned}$$

78. Sum = first integer + second integer + third integer + fourth integer.
$$\begin{aligned}
\text{Sum} &= x+(x+2)+(x+4)+(x+6)\\
&= x+x+2+x+4+x+6\\
&= 4x+12
\end{aligned}$$

80. Sum = 20 + second integer.
$$\begin{aligned}
\text{Sum} &= 20+(x+1)\\
&= 20+x+1\\
&= x+21
\end{aligned}$$

82. Let x be an odd integer.
Then $x + 2$ is the next odd integer.
$x + (x + 2) + x + (x + 2) = 4x + 4$

84.
$$\begin{aligned}
-7y+2y-3(y+1) &= -7y+2y-3\cdot y-3\cdot 1\\
&= -7y+2y-3y-3\\
&= -8y-3
\end{aligned}$$

86.
$$\begin{aligned}
8(z-6)+7z-1 &= 8\cdot z+8\cdot(-6)+7z-1\\
&= 8z-48+7z-1\\
&= 15z-49
\end{aligned}$$

88. $-(x-1)+x = -x+1+x = -x+x+1 = 1$

90.
$$\begin{aligned}
&(-2)^4 = (-2)(-2)(-2)(-2) = 16\\
&-2^4 = -2\cdot 2\cdot 2\cdot 2 = -16\\
&(-2)^4 > -2^4
\end{aligned}$$

92.
$$\begin{aligned}
&(-4)^3 = (-4)(-4)(-4) = -64\\
&-4^3 = -4\cdot 4\cdot 4 = -64\\
&(-4)^3 = -4^3
\end{aligned}$$

94.
$$\begin{aligned}
\underline{\quad}\, x &= 10\\
\underline{\quad}\cdot\frac{1}{2} &= 10\\
\underline{\quad}\cdot\frac{1}{2}\cdot 2 &= 10\cdot 2\\
\underline{\quad} &= 20
\end{aligned}$$

96. answers may vary

98. answers may vary

100.
$$\begin{aligned}
9x &= 13.5\\
\frac{9x}{9} &= \frac{13.5}{9}\\
x &= 1.5
\end{aligned}$$
Each dose should be 1.5 milliliters.

102.
$$\begin{aligned}
4.95y &= -31.185\\
\frac{4.95y}{4.95} &= \frac{-31.185}{4.95}\\
y &= -6.3
\end{aligned}$$

104.
$$\begin{aligned}
0.06y+2.63 &= 2.5562\\
0.06y+2.63-2.63 &= 2.5562-2.63\\
0.06y &= -0.0738\\
\frac{0.06y}{0.06} &= \frac{-0.0738}{0.06}\\
y &= -1.23
\end{aligned}$$

Section 2.4 Practice Exercises

1.
$$\begin{aligned}
2(4a-9)+3 &= 5a-6\\
8a-18+3 &= 5a-6\\
8a-15 &= 5a-6\\
8a-15-5a &= 5a-6-5a\\
3a-15 &= -6\\
3a-15+15 &= -6+15\\
3a &= 9\\
\frac{3a}{3} &= \frac{9}{3}\\
a &= 3
\end{aligned}$$

Check: $2(4a-9)+3=5a-6$

$$\begin{aligned} 2[4(3)-9]+3 &\stackrel{?}{=} 5(3)-6 \\ 2(12-9)+3 &\stackrel{?}{=} 15-6 \\ 2(3)+3 &\stackrel{?}{=} 9 \\ 6+3 &\stackrel{?}{=} 9 \\ 9 &= 1 \end{aligned}$$

The solution is 3 or the solution set is {3}.

2.
$$\begin{aligned} 7(x-3) &= -6x \\ 7x-21 &= -6x \\ 7x-21-7x &= -6x-7x \\ -21 &= -13x \\ \frac{-21}{-13} &= \frac{-13x}{-13} \\ \frac{21}{13} &= x \end{aligned}$$

Check: $7(x-3)=-6x$

$$\begin{aligned} 7\left(\frac{21}{13}-3\right) &\stackrel{?}{=} -6\left(\frac{21}{13}\right) \\ 7\left(\frac{21}{13}-\frac{39}{13}\right) &\stackrel{?}{=} -\frac{126}{13} \\ 7\left(-\frac{18}{13}\right) &\stackrel{?}{=} -\frac{126}{13} \\ -\frac{126}{13} &= -\frac{126}{13} \end{aligned}$$

The solution is $\frac{21}{13}$.

3.
$$\begin{aligned} \frac{3}{5}x-2 &= \frac{2}{3}x-1 \\ 15\left(\frac{3}{5}x-2\right) &= 15\left(\frac{2}{3}x-1\right) \\ 15\left(\frac{3}{5}x\right)-15(2) &= 15\left(\frac{2}{3}x\right)-15(1) \\ 9x-30 &= 10x-15 \\ 9x-30-9x &= 10x-15-9x \\ -30 &= x-15 \\ -30+15 &= x-15+15 \\ -15 &= x \end{aligned}$$

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

$$\begin{aligned} \frac{3}{5}\cdot -15-2 &\stackrel{?}{=} \frac{2}{3}\cdot -15-1 \\ -9-2 &\stackrel{?}{=} -10-1 \\ -11 &= -11 \end{aligned}$$

The solution is −15.

4.
$$\begin{aligned} \frac{4(y+3)}{3} &= 5y-7 \\ 3\cdot\frac{4(y+3)}{3} &= 3\cdot(5y-7) \\ 4(y+3) &= 3(5y-7) \\ 4y+12 &= 15y-21 \\ 4y+12-4y &= 15y-21-4y \\ 12 &= 11y-21 \\ 12+21 &= 11y-21+21 \\ 33 &= 11y \\ \frac{33}{11} &= \frac{11y}{11} \\ 3 &= y \end{aligned}$$

To check, replace y with 3 in the original equation. The solution is 3.

5.
$$\begin{aligned} 0.35x+0.09(x+4) &= 0.30(12) \\ 100[0.35x+0.09(x+4)] &= 100[0.03(12)] \\ 35x+9(x+4) &= 3(12) \\ 35x+9x+36 &= 36 \\ 44x+36 &= 36 \\ 44x+36-36 &= 36-36 \\ 44x &= 0 \\ \frac{44x}{44} &= \frac{0}{44} \\ x &= 0 \end{aligned}$$

To check, replace x with 0 in the original equation. The solution is 0.

6.
$$\begin{aligned} 4(x+4)-x &= 2(x+11)+x \\ 4x+16-x &= 2x+22+x \\ 3x+16 &= 3x+22 \\ 3x+16-3x &= 3x+22-3x \\ 16 &= 22 \end{aligned}$$

There is no solution.

7.
$$\begin{aligned} 12x-18 &= 9(x-2)+3x \\ 12x-18 &= 9x-18+3x \\ 12x-18 &= 12x-18 \\ 12x-18+18 &= 12x-18+18 \\ 12x &= 12x \\ 12x-12x &= 12x-12x \\ 0 &= 0 \end{aligned}$$

The solution is all real numbers.

Calculator Explorations

1. Solution (−24 = −24)
2. Solution (−4 = −4)
3. Not a solution (19.4 ≠ 10.4)

4. Not a solution ($-11.9 \neq -60.1$)

5. Solution (17,061 = 17,061)

6. Solution ($-316 = -316$)

Vocabulary, Readiness & Video Check 2.4

1. $x = -7$ is an equation.

2. $x - 7$ is an expression.

3. $4y - 6 + 9y + 1$ is an expression.

4. $4y - 6 = 9y + 1$ is an equation.

5. $\frac{1}{x} - \frac{x-1}{8}$ is an expression.

6. $\frac{1}{x} - \frac{x-1}{8} = 6$ is an equation.

7. $0.1x + 9 = 0.2x$ is an equation.

8. $0.1x^2 + 9y - 0.2x^2$ is an expression.

9. 3; distributive property, addition property of equality, multiplication property of equality

10. Because both sides have more than one term, you need to apply the distributive property to make sure you multiply every single term in the equation by the LCD.

11. The number of decimal places in each number helps you determine what power of 10 you can multiply through by so you are no longer dealing with decimals.

12. When solving a linear equation and all variable terms, subtract out:

    a. If you have a true statement, then the equation has <u>all real numbers as a</u> solution.

    b. If you have a false statement, then the equation has <u>no</u> solution.

Exercise Set 2.4

2.
$$\begin{aligned} -3x+1 &= -2(4x+2) \\ -3x+1 &= -8x-4 \\ -3x+1-1 &= -8x-4-1 \\ -3x &= -8x-5 \\ -3x+8x &= -8x-5+8x \\ 5x &= -5 \\ \frac{5x}{5} &= \frac{-5}{5} \\ x &= -1 \end{aligned}$$

4.
$$\begin{aligned} 15x-5 &= 7+12x \\ 15x-5+5 &= 7+12x+5 \\ 15x &= 12+12x \\ 15x-12x &= 12+12x-12x \\ 3x &= 12 \\ \frac{3x}{3} &= \frac{12}{3} \\ x &= 4 \end{aligned}$$

6.
$$\begin{aligned} -(5x-10) &= 5x \\ -5x+10 &= 5x \\ -5x+10+5x &= 5x+5x \\ 10 &= 10x \\ \frac{10}{10} &= \frac{10x}{10} \\ 1 &= x \end{aligned}$$

8.
$$\begin{aligned} 3(2-5x)+4(6x) &= 12 \\ 6-15x+24x &= 12 \\ 6+9x &= 12 \\ 6-6+9x &= 12-6 \\ 9x &= 6 \\ \frac{9x}{9} &= \frac{6}{9} \\ x &= \frac{2}{3} \end{aligned}$$

10.
$$\begin{aligned} -4(n-4)-23 &= -7 \\ -4n+16-23 &= -7 \\ -4n-7 &= -7 \\ -4n-7+7 &= -7+7 \\ -4n &= 0 \\ \frac{-4n}{-4} &= \frac{0}{-4} \\ n &= 0 \end{aligned}$$

12.
$$\begin{aligned}5-6(2+b)&=b-14\\5-12-6b&=b-14\\-7-6b&=b-14\\-7-6b-b&=b-b-14\\-7-7b&=-14\\-7+7-7b&=-14+7\\-7b&=-7\\\frac{-7b}{-7}&=\frac{-7}{-7}\\b&=1\end{aligned}$$

14.
$$\begin{aligned}6y-8&=-6+3y+13\\6y-8&=3y+7\\6y-3y-8&=3y-3y+7\\3y-8&=7\\3y-8+8&=7+8\\3y&=15\\\frac{3y}{3}&=\frac{15}{3}\\y&=5\end{aligned}$$

16.
$$\begin{aligned}-7n+5&=8n-10\\-7n+5-5&=8n-10-5\\-7n&=8n-15\\-7n-8n&=8n-15-8n\\-15n&=-15\\\frac{-15n}{-15}&=\frac{-15}{-15}\\n&=1\end{aligned}$$

18.
$$\begin{aligned}\frac{4}{5}x-\frac{8}{5}&=-\frac{16}{5}\\5\left(\frac{4}{5}x-\frac{8}{5}\right)&=5\left(-\frac{16}{5}\right)\\4x-8&=-16\\4x-8+8&=-16+8\\4x&=-8\\\frac{4x}{4}&=\frac{-8}{4}\\x&=-2\end{aligned}$$

20.
$$\begin{aligned}\frac{2}{9}x-\frac{1}{3}&=1\\9\left(\frac{2}{9}x-\frac{1}{3}\right)&=9(1)\\2x-3&=9\\2x-3+3&=9+3\\2x&=12\\\frac{2x}{2}&=\frac{12}{2}\\x&=6\end{aligned}$$

22.
$$\begin{aligned}0.40x+0.06(30)&=9.8\\100[0.40x+0.06(30)]&=100(9.8)\\40x+6(30)&=980\\40x+180&=980\\40x+180-180&=980-180\\40x&=800\\\frac{40x}{40}&=\frac{800}{40}\\x&=20\end{aligned}$$

24.
$$\begin{aligned}\frac{3(y+3)}{5}&=2y+6\\5\left[\frac{3(y+3)}{5}\right]&=5[2y+6]\\3(y+3)&=10y+30\\3y+9&=10y+30\\3y-10y+9&=10y-10y+30\\-7y+9&=30\\-7y+9-9&=30-9\\-7y&=21\\\frac{-7y}{-7}&=\frac{21}{-7}\\y&=-3\end{aligned}$$

26.
$$\begin{aligned}\frac{5}{2}x-1&=x+\frac{1}{4}\\4\left(\frac{5}{2}x-1\right)&=4\left(x+\frac{1}{4}\right)\\10x-4&=4x+1\\10x-4x-4&=4x-4x+1\\6x-4&=1\\6x-4+4&=1+4\\6x&=5\\\frac{6x}{6}&=\frac{5}{6}\\x&=\frac{5}{6}\end{aligned}$$

28.
$$\begin{aligned}0.60(z-300)+0.05z&=0.70z-205\\100[0.60(z-300)+0.05z]&=100[0.70z-205]\\60(z-300)+5z&=70z-20,500\\60z-18,000+5z&=70z-20,500\\65z-18,000&=70z-20,500\\65z-70z-18,000&=70z-70z-20,500\\-5z-18,000&=-20,500\\-5z-18,000+18,000&=-20,500+18,000\\-5z&=-2500\\\frac{-5z}{-5}&=\frac{-2500}{-5}\\z&=500\end{aligned}$$

30.
$$\begin{aligned}14x+7&=7(2x+1)\\14x+7&=14x+7\\14x+7-14x&=14x+7-14x\\7&=7\end{aligned}$$
All real numbers are solutions.

32.
$$\begin{aligned}\frac{x}{3}-2&=\frac{x}{3}\\3\left(\frac{x}{3}-2\right)&=3\left(\frac{x}{3}\right)\\x-6&=x\\x-x-6&=x-x\\-6&=0\end{aligned}$$
There is no solution.

34.
$$\begin{aligned}2(x-5)&=2x+10\\2x-10&=2x+10\\2x-2x-10&=2x-2x+10\\-10&=10\end{aligned}$$
There is no solution.

36.
$$\begin{aligned}-5(4y-3)+2&=-20y+17\\-20y+15+2&=-20y+17\\-20y+17&=-20y+17\\-20y+17+20y&=-20y+17+20y\\17&=17\end{aligned}$$
All real numbers are solutions.

38.
$$\begin{aligned}\frac{4(5-w)}{3}&=-w\\3\left[\frac{4(5-w)}{3}\right]&=3(-w)\\4(5-w)&=-3w\\20-4w&=-3w\\20-4w+4w&=-3w+4w\\20&=w\end{aligned}$$

40.
$$\begin{aligned}-(4a-7)-5a&=10+a\\-4a+7-5a&=10+a\\-9a+7&=10+a\\-9a-a+7&=10+a-a\\-10a+7&=10\\-10a+7-7&=10-7\\-10a&=3\\\frac{-10a}{-10}&=\frac{3}{-10}\\a&=-\frac{3}{10}\end{aligned}$$

42.
$$\begin{aligned}9x+3(x-4)&=10(x-5)+7\\9x+3x-12&=10x-50+7\\12x-12&=10x-43\\12x-12+12&=10x-43+12\\12x&=10x-31\\12x-10x&=10x-31-10x\\2x&=-31\\\frac{2x}{2}&=\frac{-31}{2}\\x&=-\frac{31}{2}\end{aligned}$$

44.
$$\begin{aligned}\frac{5(x-1)}{4}&=\frac{3(x+1)}{2}\\4\left[\frac{5(x-1)}{4}\right]&=4\left[\frac{3(x+1)}{2}\right]\\5(x-1)&=6(x+1)\\5x-5&=6x+6\\5x-6x-5&=6x-6x+6\\-x-5&=6\\-x-5+5&=6+5\\-x&=11\\\frac{-x}{-1}&=\frac{11}{-1}\\x&=-11\end{aligned}$$

46.
$$\begin{aligned}0.9x-4.1&=0.4\\10(0.9x-4.1)&=10(0.4)\\9x-41&=4\\9x-41+41&=4+41\\9x&=45\\\frac{9x}{9}&=\frac{45}{9}\\x&=5\end{aligned}$$

48.
$$\begin{aligned} 3(2x-1)+5 &= 6x+2 \\ 6x-3+5 &= 6x+2 \\ 6x+2 &= 6x+2 \\ 6x-6x+2 &= 6x-6x+2 \\ 2 &= 2 \end{aligned}$$
All real numbers are solutions.

50.
$$\begin{aligned} 4(4y+2) &= 2(1+6y)+8 \\ 16y+8 &= 2+12y+8 \\ 16y+8 &= 10+12y \\ 16y+8-8 &= 10+12y-8 \\ 16y &= 2+12y \\ 16y-12y &= 2+12y-12y \\ 4y &= 2 \\ \frac{4y}{4} &= \frac{2}{4} \\ y &= \frac{1}{2} \end{aligned}$$

52.
$$\begin{aligned} \frac{7}{8}x+\frac{1}{4} &= \frac{3}{4}x \\ 8\left(\frac{7}{8}x+\frac{1}{4}\right) &= 8\left(\frac{3}{4}x\right) \\ 7x+2 &= 6x \\ 7x+2-7x &= 6x-7x \\ 2 &= -x \\ \frac{2}{-1} &= \frac{-x}{-1} \\ -2 &= x \end{aligned}$$

54.
$$\begin{aligned} \frac{x}{5}-7 &= \frac{x}{3}-5 \\ 15\left(\frac{x}{5}-7\right) &= 15\left(\frac{x}{3}-5\right) \\ 3x-105 &= 5x-75 \\ 3x-105-3x &= 5x-75-3x \\ -105 &= 2x-75 \\ -105+75 &= 2x-75+75 \\ -30 &= 2x \\ \frac{-30}{2} &= \frac{2x}{2} \\ -15 &= x \end{aligned}$$

56.
$$\begin{aligned} 4(2+x)+1 &= 7x-3(x-2) \\ 8+4x+1 &= 7x-3x+6 \\ 9+4x &= 4x+6 \\ 9+4x-4x &= 4x-4x+6 \\ 9 &= 6 \end{aligned}$$
There is no solution.

58.
$$\begin{aligned} -0.01(5x+4) &= 0.04-0.01(x+4) \\ 100[-0.01(5x+4)] &= 100[0.04-0.01(x+4)] \\ -(5x+4) &= 4-1(x+4) \\ -5x-4 &= 4-x-4 \\ -5x-4 &= -x \\ -5x+x-4 &= -x+x \\ -4x-4 &= 0 \\ -4x-4+4 &= 0+4 \\ -4x &= 4 \\ \frac{-4x}{-4} &= \frac{4}{-4} \\ x &= -1 \end{aligned}$$

60.
$$\begin{aligned} 3-\frac{1}{2}x &= 5x-8 \\ 2\left(3-\frac{1}{2}x\right) &= 2(5x-8) \\ 6-x &= 10x-16 \\ 6-x+x &= 10x-16+x \\ 6 &= 11x-16 \\ 6+16 &= 11x-16+16 \\ 22 &= 11x \\ \frac{22}{11} &= \frac{11x}{11} \\ 2 &= x \end{aligned}$$

62.
$$\begin{aligned} 7n+5 &= 10n-10 \\ 7n+5-5 &= 10n-10-5 \\ 7n &= 10n-15 \\ 7n-10n &= 10n-15-10n \\ -3n &= -15 \\ \frac{-3n}{-3} &= \frac{-15}{-3} \\ n &= 5 \end{aligned}$$

64.
$$\begin{aligned} 0.2x-0.1 &= 0.6x-2.1 \\ 10(0.2x-0.1) &= 10(0.6x-2.1) \\ 2x-1 &= 6x-21 \\ 2x-6x-1 &= 6x-6x-21 \\ -4x-1 &= -21 \\ -4x-1+1 &= -21+1 \\ -4x &= -20 \\ \frac{-4x}{-4} &= \frac{-20}{-4} \\ x &= 5 \end{aligned}$$

66.
$$\begin{aligned} 0.03(2m+7) &= 0.06(5+m)-0.09 \\ 100[0.03(2m+7)] &= 100[0.06(5+m)-0.09] \\ 3(2m+7) &= 6(5+m)-9 \\ 6m+21 &= 30+6m-9 \\ 6m+21 &= 21+6m \\ 6m-6m+21 &= 21+6m-6m \\ 21 &= 21 \end{aligned}$$
All real numbers are solutions.

68.
$$\begin{array}{cccc} 3 & \text{times} & \text{a number} & \\ \downarrow & \downarrow & \downarrow & \\ 3 & \cdot & x & = 3x \end{array}$$

70.
$$\begin{array}{ccc} 8 & \text{minus} & \text{twice a number} \\ \downarrow & \downarrow & \downarrow \\ 8 & - & 2x \end{array}$$

72.
$$\begin{array}{cccc} \text{the quotient of } -12 & \text{and} & \text{the difference of a number and 3} & \\ \downarrow & \downarrow & \downarrow & \\ -12 & \div & (x-3) & = \dfrac{-12}{x-3} \end{array}$$

74. $x + (7x - 9) = x + 7x - 9 = 8x - 9$
The total length is $(8x - 9)$ feet.

76. **a.**
$$\begin{aligned} x+3 &= x+5 \\ x+3-x &= x+5-x \\ 3 &= 5 \end{aligned}$$
There is no solution.

b. answers may vary

c. answers may vary

78.
$$\begin{aligned} 3x+1 &= 3x+2 \\ 3x+1-3x &= 3x+2-3x \\ 1 &= 2 \end{aligned}$$
There is no solution. The answer is B.

80.
$$\begin{aligned} x-11x-3 &= -10x-1-2 \\ -10x-3 &= -10x-3 \\ -10x-3+10x &= -10x-3+10x \\ -3 &= -3 \end{aligned}$$
All real numbers are solutions. The answer is A.

82.
$$\begin{aligned} -x+15 &= x+15 \\ -x+15+x &= x+15+x \\ 15 &= 2x+15 \\ 15-15 &= 2x+15-15 \\ 0 &= 2x \\ \frac{0}{2} &= \frac{2x}{2} \\ 0 &= x \end{aligned}$$
The answer is C.

84. answers may vary

86. **a.** Since the perimeter is the sum of the lengths of the sides, $x + (2x + 1) + (3x - 2) = 35$.

b.
$$\begin{aligned} x+2x+1+3x-2 &= 35 \\ 6x-1 &= 35 \\ 6x-1+1 &= 35+1 \\ 6x &= 36 \\ \frac{6x}{6} &= \frac{36}{6} \\ x &= 6 \end{aligned}$$

c. $2x + 1 = 2(6) + 1 = 13$
$3x - 2 = 3(6) - 2 = 16$
The lengths are $x = 6$ meters, $2x + 1 = 13$ meters and $3x - 2 = 16$ meters.

88. answers may vary

90.
$$\begin{aligned} 1000(x+40) &= 100(16+7x) \\ 1000x+40,000 &= 1600+700x \\ 1000x+40,000-700x &= 1600+700x-700x \\ 300x+40,000 &= 1600 \\ 300x+40,000-40,000 &= 1600-40,000 \\ 300x &= -38,400 \\ \frac{300x}{300} &= \frac{-38,400}{300} \\ x &= -128 \end{aligned}$$

92.
$$\begin{aligned} 0.127x-2.685 &= 0.027x-2.38 \\ 1000(0.127x-2.685) &= 1000(0.027x-2.38) \\ 127x-2685 &= 27x-2380 \\ 127x-27x-2685 &= 27x-27x-2380 \\ 100x-2685 &= -2380 \\ 100x-2685+2685 &= -2380+2685 \\ 100x &= 305 \\ \frac{100x}{100} &= \frac{305}{100} \\ x &= 3.05 \end{aligned}$$

94.
$$\begin{aligned} t^2 - 6t &= t(8+t) \\ t^2 - 6t &= 8t + t^2 \\ t^2 - t^2 - 6t &= 8t + t^2 - t^2 \\ -6t &= 8t \\ -6t + 6t &= 8t + 6t \\ 0 &= 14t \\ \frac{0}{14} &= \frac{14t}{14} \\ 0 &= t \end{aligned}$$

96.
$$\begin{aligned} y^2 - 4y + 10 &= y(y-5) \\ y^2 - 4y + 10 &= y^2 - 5y \\ y^2 - y^2 - 4y + 10 &= y^2 - y^2 - 5y \\ -4y + 10 &= -5y \\ -4y + 5y + 10 &= -5y + 5y \\ y + 10 &= 0 \\ y + 10 - 10 &= -10 \\ y &= -10 \end{aligned}$$

Integrated Review

1.
$$\begin{aligned} x - 10 &= -4 \\ x - 10 + 10 &= -4 + 10 \\ x &= 6 \end{aligned}$$

2.
$$\begin{aligned} y + 14 &= -3 \\ y + 14 - 14 &= -3 - 14 \\ y &= -17 \end{aligned}$$

3.
$$\begin{aligned} 9y &= 108 \\ \frac{9y}{9} &= \frac{108}{9} \\ y &= 12 \end{aligned}$$

4.
$$\begin{aligned} -3x &= 78 \\ \frac{-3x}{-3} &= \frac{78}{-3} \\ x &= -26 \end{aligned}$$

5.
$$\begin{aligned} -6x + 7 &= 25 \\ -6x + 7 - 7 &= 25 - 7 \\ -6x &= 18 \\ \frac{-6x}{-6} &= \frac{18}{-6} \\ x &= -3 \end{aligned}$$

6.
$$\begin{aligned} 5y - 42 &= -47 \\ 5y - 42 + 42 &= -47 + 42 \\ 5y &= -5 \\ \frac{5y}{5} &= \frac{-5}{5} \\ y &= -1 \end{aligned}$$

7.
$$\begin{aligned} \frac{2}{3}x &= 9 \\ \frac{3}{2}\left(\frac{2}{3}x\right) &= \frac{3}{2}(9) \\ x &= \frac{27}{2} \end{aligned}$$

8.
$$\begin{aligned} \frac{4}{5}z &= 10 \\ \frac{5}{4}\left(\frac{4}{5}z\right) &= \frac{5}{4}(10) \\ z &= \frac{25}{2} \end{aligned}$$

9.
$$\begin{aligned} \frac{r}{-4} &= -2 \\ -4\left(\frac{r}{-4}\right) &= -4(-2) \\ r &= 8 \end{aligned}$$

10.
$$\begin{aligned} \frac{y}{-8} &= 8 \\ -8\left(\frac{y}{-8}\right) &= -8(8) \\ y &= -64 \end{aligned}$$

11.
$$\begin{aligned} 6 - 2x + 8 &= 10 \\ -2x + 14 &= 10 \\ -2x + 14 - 14 &= 10 - 14 \\ -2x &= -4 \\ \frac{-2x}{-2} &= \frac{-4}{-2} \\ x &= 2 \end{aligned}$$

12.
$$\begin{aligned} -5 - 6y + 6 &= 19 \\ -6y + 1 &= 19 \\ -6y + 1 - 1 &= 19 - 1 \\ -6y &= 18 \\ \frac{-6y}{-6} &= \frac{18}{-6} \\ y &= -3 \end{aligned}$$

13.
$$\begin{aligned} 2x-7&=2x-27\\ 2x-2x-7&=2x-2x-27\\ -7&=-27 \end{aligned}$$
There is no solution.

14.
$$\begin{aligned} 3+8y&=8y-2\\ 3+8y-8y&=8y-8y-2\\ 3&=-2 \end{aligned}$$
There is no solution.

15.
$$\begin{aligned} -3a+6+5a&=7a-8a\\ 2a+6&=-a\\ 2a-2a+6&=-a-2a\\ 6&=-3a\\ \frac{6}{-3}&=\frac{-3a}{-3}\\ -2&=a \end{aligned}$$

16.
$$\begin{aligned} 4b-8-b&=10b-3b\\ 3b-8&=7b\\ 3b-3b-8&=7b-3b\\ -8&=4b\\ \frac{-8}{4}&=\frac{4b}{4}\\ -2&=b \end{aligned}$$

17.
$$\begin{aligned} -\frac{2}{3}x&=\frac{5}{9}\\ -\frac{3}{2}\left(-\frac{2}{3}x\right)&=-\frac{3}{2}\left(\frac{5}{9}\right)\\ x&=-\frac{5}{6} \end{aligned}$$

18.
$$\begin{aligned} -\frac{3}{8}y&=-\frac{1}{16}\\ -\frac{8}{3}\left(-\frac{3}{8}y\right)&=-\frac{8}{3}\left(-\frac{1}{16}\right)\\ y&=\frac{1}{6} \end{aligned}$$

19.
$$\begin{aligned} 10&=-6n+16\\ 10-16&=-6n+16-16\\ -6&=-6n\\ \frac{-6}{-6}&=\frac{-6n}{-6}\\ 1&=n \end{aligned}$$

20.
$$\begin{aligned} -5&=-2m+7\\ -5-7&=-2m+7-7\\ -12&=-2m\\ \frac{-12}{-2}&=\frac{-2m}{-2}\\ 6&=m \end{aligned}$$

21.
$$\begin{aligned} 3(5c-1)-2&=13c+3\\ 15c-3-2&=13c+3\\ 15c-5&=13c+3\\ 15c-13c-5&=13c-13c+3\\ 2c-5&=3\\ 2c-5+5&=3+5\\ 2c&=8\\ \frac{2c}{2}&=\frac{8}{2}\\ c&=4 \end{aligned}$$

22.
$$\begin{aligned} 4(3t+4)-20&=3+5t\\ 12t+16-20&=3+5t\\ 12t-4&=3+5t\\ 12t-5t-4&=3+5t-5t\\ 7t-4&=3\\ 7t-4+4&=3+4\\ 7t&=7\\ \frac{7t}{7}&=\frac{7}{7}\\ t&=1 \end{aligned}$$

23.
$$\begin{aligned} \frac{2(z+3)}{3}&=5-z\\ 3\left[\frac{2(z+3)}{3}\right]&=3(5-z)\\ 2z+6&=15-3z\\ 2z+3z+6&=15-3z+3z\\ 5z+6&=15\\ 5z+6-6&=15-6\\ 5z&=9\\ \frac{5z}{5}&=\frac{9}{5}\\ z&=\frac{9}{5} \end{aligned}$$

24.
$$\begin{aligned}
\frac{3(w+2)}{4} &= 2w+3\\
4\left[\frac{3(w+2)}{4}\right] &= 4(2w+3)\\
3w+6 &= 8w+12\\
3w-8w+6 &= 8w-8w+12\\
-5w+6 &= 12\\
-5w+6-6 &= 12-6\\
-5w &= 6\\
\frac{-5w}{-5} &= \frac{6}{-5}\\
w &= -\frac{6}{5}
\end{aligned}$$

25.
$$\begin{aligned}
-2(2x-5) &= -3x+7-x+3\\
-4x+10 &= -4x+10\\
-4x+4x+10 &= -4x+4x+10\\
10 &= 10
\end{aligned}$$
All real numbers are solutions.

26.
$$\begin{aligned}
-4(5x-2) &= -12x+4-8x+4\\
-20x+8 &= -20x+8\\
-20x+20x+8 &= -20x+20x+8\\
8 &= 8
\end{aligned}$$
All real numbers are solutions.

27.
$$\begin{aligned}
0.02(6t-3) &= 0.04(t-2)+0.02\\
100[0.02(6t-3)] &= 100[0.04(t-2)+0.02]\\
2(6t-3) &= 4(t-2)+2\\
12t-6 &= 4t-8+2\\
12t-6 &= 4t-6\\
12t-4t-6 &= 4t-4t-6\\
8t-6 &= -6\\
8t-6+6 &= -6+6\\
8t &= 0\\
\frac{8t}{8} &= \frac{0}{8}\\
t &= 0
\end{aligned}$$

28.
$$\begin{aligned}
0.03(m+7) &= 0.02(5-m)+0.03\\
100[0.03(m+7)] &= 100[0.02(5-m)+0.03]\\
3(m+7) &= 2(5-m)+3\\
3m+21 &= 10-2m+3\\
3m+21 &= 13-2m\\
3m+2m+21 &= 13-2m+2m\\
5m+21 &= 13\\
5m+21-21 &= 13-21\\
5m &= -8\\
\frac{5m}{5} &= \frac{-8}{5}\\
m &= -\frac{8}{5} = -1.6
\end{aligned}$$

29.
$$\begin{aligned}
-3y &= \frac{4(y-1)}{5}\\
5(-3y) &= 5\left[\frac{4(y-1)}{5}\right]\\
-15y &= 4y-4\\
-15y-4y &= 4y-4y-4\\
-19y &= -4\\
\frac{-19y}{-19} &= \frac{-4}{-19}\\
y &= \frac{4}{19}
\end{aligned}$$

30.
$$\begin{aligned}
-4x &= \frac{5(1-x)}{6}\\
6(-4x) &= 6\left[\frac{5(1-x)}{6}\right]\\
-24x &= 5-5x\\
-24x+5x &= 5-5x+5x\\
-19x &= 5\\
\frac{-19x}{-19} &= \frac{5}{-19}\\
x &= -\frac{5}{19}
\end{aligned}$$

31.
$$\begin{aligned}
\frac{5}{3}x-\frac{7}{3} &= x\\
3\left(\frac{5}{3}x-\frac{7}{3}\right) &= 3(x)\\
5x-7 &= 3x\\
5x-5x-7 &= 3x-5x\\
-7 &= -2x\\
\frac{-7}{-2} &= \frac{-2x}{-2}\\
\frac{7}{2} &= x
\end{aligned}$$

32. $$\begin{aligned} \frac{7}{5}n+\frac{3}{5} &= -n \\ 5\left(\frac{7}{5}n+\frac{3}{5}\right) &= 5(-n) \\ 7n+3 &= -5n \\ 7n-7n+3 &= -5n-7n \\ 3 &= -12n \\ \frac{3}{-12} &= \frac{-12n}{-12} \\ -\frac{1}{4} &= n \end{aligned}$$

33. $$\begin{aligned} 9(3x-1) &= -4+49 \\ 27x-9 &= 45 \\ 27x-9+9 &= 45+9 \\ 27x &= 54 \\ \frac{27x}{27} &= \frac{54}{27} \\ x &= 2 \end{aligned}$$

34. $$\begin{aligned} 12(2x+1) &= -6+66 \\ 24x+12 &= 60 \\ 24x+12-12 &= 60-12 \\ 24x &= 48 \\ \frac{24x}{24} &= \frac{48}{24} \\ x &= 2 \end{aligned}$$

35. $$\begin{aligned} \frac{1}{10}(3x-7) &= \frac{3}{10}x+5 \\ 10\left[\frac{1}{10}(3x-7)\right] &= 10\left(\frac{3}{10}x+5\right) \\ 3x-7 &= 3x+50 \\ 3x-7-3x &= 3x+50-3x \\ -7 &= 50 \end{aligned}$$
There is no solution.

36. $$\begin{aligned} \frac{1}{7}(2x-5) &= \frac{2}{7}x+1 \\ 7\left[\frac{1}{7}(2x-5)\right] &= 7\left(\frac{2}{7}x+1\right) \\ 2x-5 &= 2x+7 \\ 2x-5-2x &= 2x+7-2x \\ -5 &= 7 \end{aligned}$$
There is no solution.

37. $$\begin{aligned} 5+2(3x-6) &= -4(6x-7) \\ 5+6x-12 &= -24x+28 \\ 6x-7 &= -24x+28 \\ 6x-7+24x &= -24x+28+24x \\ 30x-7 &= 28 \\ 30x-7+7 &= 28+7 \\ 30x &= 35 \\ \frac{30x}{30} &= \frac{35}{30} \\ x &= \frac{7}{6} \end{aligned}$$

38. $$\begin{aligned} 3+5(2x-4) &= -7(5x+2) \\ 3+10x-20 &= -35x-14 \\ 10x-17 &= -35x-14 \\ 10x-17+35x &= -35x-14+35x \\ 45x-17 &= -14 \\ 45x-17+17 &= -14+17 \\ 45x &= 3 \\ \frac{45x}{45} &= \frac{3}{45} \\ x &= \frac{1}{15} \end{aligned}$$

Section 2.5 Practice Exercises

1. Let x = the number.
$$\begin{aligned} 3x-6 &= 2x+3 \\ 3x-6-2x &= 2x+3-2x \\ x-6 &= 3 \\ x-6+6 &= 3+6 \\ x &= 9 \end{aligned}$$
The number is 9.

2. Let x = the number.
$$\begin{aligned} 3x-4 &= 2(x-1) \\ 3x-4 &= 2x-2 \\ 3x-4-2x &= 2x-2-2x \\ x-4 &= -2 \\ x-4+4 &= -2+4 \\ x &= 2 \end{aligned}$$
The number is 2.

3. Let x = the length of short piece,
then $4x$ = the length of long piece.
$$x+4x=45$$
$$5x=45$$
$$\frac{5x}{5}=\frac{45}{5}$$
$$x=9$$
$4x = 4(9) = 36$
The short piece is 9 inches and the long piece is 36 inches.

4. Let x = number of Republican governors, then
$x - 7$ = number of Democratic governors.
$$x+x-7=49$$
$$2x-7=49$$
$$2x-7+7=49+7$$
$$2x=56$$
$$\frac{2x}{2}=\frac{56}{2}$$
$$x=28$$
$x - 7 = 28 - 7 = 21$
There were 28 Republican and 21 Democratic governors.

5. x = degree measure of first angle
$3x$ = degree measure of second angle
$x + 55$ = degree measure of third angle
$$x+3x+(x+55)=180$$
$$5x+55=180$$
$$5x+55-55=180-55$$
$$5x=125$$
$$\frac{5x}{5}=\frac{125}{5}$$
$$x=25$$
$3x = 3(25) = 75$
$x + 55 = 25 + 55 = 80$
The measures of the angles are 25°, 75°, and 80°.

6. Let x = the first even integer, then
$x + 2$ = the second even integer, and
$x + 4$ = the third even integer.
$$x+(x+2)+(x+4)=144$$
$$3x+6=144$$
$$3x+6-6=144-6$$
$$3x=138$$
$$\frac{3x}{3}=\frac{138}{3}$$
$$x=46$$
$x + 2 = 46 + 2 = 48$
$x + 4 = 46 + 4 = 50$
The integers are 46, 48, and 50.

Vocabulary, Readiness & Video Check 2.5

1. $2x$; $2x - 31$

2. $3x$; $3x + 17$

3. $x + 5$; $2(x + 5)$

4. $x - 11$; $7(x - 11)$

5. $20 - y$; $\frac{20-y}{3}$ or $(20 - y) \div 3$

6. $-10 + y$; $\frac{-10+y}{9}$ or $(-10 + y) \div 9$

7. in the statement of the application

8. The original application asks for the measure of two supplementary angles. The solution of $x = 43$ only gives us the measure of one of the angles.

9. That the 3 angle measures are consecutive even integers and that they sum to 180°.

Exercise Set 2.5

2. Let x = the number.
$$3x-1=2x$$
$$3x-1-3x=2x-3x$$
$$3x-1-3x=2x-3x$$
$$-1=-x$$
$$\frac{-1}{-1}=\frac{-x}{-1}$$
$$1=x$$
The number is 1.

4. Let x = the number.
$$4x+(-2)=5x+(-2)$$
$$4x-2=5x-2$$
$$4x-2+2=5x-2+2$$
$$4x=5x$$
$$4x-4x=5x-4x$$
$$0=x$$
The number is 0.

6. Let x = the number.

$$\begin{aligned} 5[x+(-1)] &= 6(x-5) \\ 5x+5(-1) &= 6x+6(-5) \\ 5x-5 &= 6x-30 \\ 5x-5x-5 &= 6x-5x-30 \\ -5 &= x-30 \\ -5+30 &= x-30+30 \\ 25 &= x \end{aligned}$$

The number is 25.

8. Let x = the number.

$$\begin{aligned} 2(x-4) &= x-\frac{1}{4} \\ 2x-8 &= x-\frac{1}{4} \\ 4(2x-8) &= 4\left(x-\frac{1}{4}\right) \\ 8x-32 &= 4x-1 \\ 8x-4x-32 &= 4x-4x-1 \\ 4x-32 &= -1 \\ 4x-32+32 &= -1+32 \\ 4x &= 31 \\ \frac{4x}{4} &= \frac{31}{4} \end{aligned}$$

The number is $\frac{31}{4}$.

10. The sum of the three lengths is 46 feet.

$$\begin{aligned} x+3x+2+7x &= 46 \\ 11x+2 &= 46 \\ 11x+2-2 &= 46-2 \\ 11x &= 44 \\ \frac{11x}{11} &= \frac{44}{11} \\ x &= 4 \end{aligned}$$

$3x = 3(4) = 12$

$2 + 7x = 2 + 7(4) = 2 + 28 = 30$

The lengths are 4 feet, 12 feet, and 30 feet.

12. Let x be the length of the shorter piece. Then $3x$ is the length of the 2nd piece and the 3rd piece. The sum of the lengths is 21 feet.

$$\begin{aligned} x+3x+3x &= 21 \\ 7x &= 21 \\ \frac{7x}{7} &= \frac{21}{7} \\ x &= 3 \end{aligned}$$

$3x = 3(3) = 9$

The shorter piece is 3 feet and the longer pieces are each 9 feet.

14.

$$\begin{aligned} x+x+39,771 &= 43,265 \\ 2x+39,771 &= 43,265 \\ 2x+39,771-39,771 &= 43,265-39,771 \\ 2x &= 3494 \\ \frac{2x}{2} &= \frac{3494}{2} \\ x &= 1747 \end{aligned}$$

In 2014, 1747 screens were analog.

16. Let x be the measure of the smaller angle. Then $2x - 15$ is the measure of the larger angle. The sum of the four angles is 360°.

$$\begin{aligned} 2x+2(2x-15) &= 360 \\ 2x+4x-30 &= 360 \\ 6x-30 &= 360 \\ 6x-30+30 &= 360+30 \\ 6x &= 390 \\ \frac{6x}{6} &= \frac{390}{6} \\ x &= 65 \end{aligned}$$

$2x - 15 = 2(65) - 15 = 130 - 15 = 115$

Two angles measure 65° and two angles measure 115°.

18. Three consecutive integers:
Integer: x
Next integers: $x + 1$, $x + 2$
Sum of the second and third consecutive integers, simplified: $(x + 1) + (x + 2) = 2x + 3$

20. Three consecutive odd integers:
Odd integer: x
Next integers: $x + 2$, $x + 4$
Sum of the three consecutive odd integers, simplified: $x + (x + 2) + (x + 4) = 3x + 6$

22. Four consecutive integers:
Integer: x
Next integers: $x + 1$, $x + 2$, $x + 3$
Sum of the first and fourth consecutive integers, simplified: $x + (x + 3) = 2x + 3$

24. Three consecutive even integers:
Even integer: x
Next integers: $x + 2$, $x + 4$
Sum of the three consecutive even integers, simplified: $x + (x + 2) + (x + 4) = 3x + 6$

26. Let x = the number of one room and $x + 2$ = the number of the other.

$$x+x+2=654$$
$$2x+2=654$$
$$2x+2-2=654-2$$
$$2x=652$$
$$\frac{2x}{2}=\frac{652}{2}$$
$$x=326$$

$x + 2 = 326 + 2 = 328$
The room numbers are 326 and 328.

28. Let x = code for Mali Republic, $x + 2$ = code for Cote d'Ivoire, and $x + 4$ = code for Niger.

$$x+x+2+x+4=675$$
$$3x+6=675$$
$$3x+6-6=675-6$$
$$3x=669$$
$$\frac{3x}{3}=\frac{669}{3}$$
$$x=223$$

$x + 2 = 223 + 2 = 225$
$x + 4 = 223 + 4 = 227$
The codes are: 223 for Mali, 225 for Cote d'Ivoire, 227 for Niger.

30. Let x represent the weight of the Armanty meteorite. Then $3x$ represents the weight of the Hoba West meteorite.

$$x+3x=88$$
$$4x=88$$
$$\frac{4x}{4}=\frac{88}{4}$$
$$x=22$$

$3x = 3(22) = 66$
The Armanty meteorite weighs 22 tons and the Hoba West meteorite weighs 66 tons.

32. Let x be the measure of the shorter piece. Then $5x + 1$ is the measure of the longer piece. The measures sum to 25 feet.

$$x+5x+1=25$$
$$6x+1=25$$
$$6x+1-1=25-1$$
$$6x=24$$
$$\frac{6x}{6}=\frac{24}{6}$$
$$x=4$$

$5x + 1 = 5(4) + 1 = 20 + 1 = 21$
The pieces measure 4 feet and 21 feet.

34. Let x = the number.

$$9=2x-10$$
$$9+10=2x-10+10$$
$$19=2x$$
$$\frac{19}{2}=\frac{2x}{2}$$
$$\frac{19}{2}=x$$

The number is $\frac{19}{2}$.

36. Let x = species of grasshoppers, then $20x$ = species of beetles.

$$x+20x=420,000$$
$$21x=420,000$$
$$\frac{21x}{21}=\frac{420,000}{21}$$
$$x=20,000$$

$20x = 20(20,000) = 400,000$
There are 400,000 species of beetles and 20,000 species of grasshoppers.

38. Let x = the measure of the smallest angle, $x + 2$ = the measure of the second, $x + 4$ = the measure of the third, and $x + 6$ = the measure of the fourth.

$$x+x+2+x+4+x+6=360$$
$$4x+12=360$$
$$4x+12-12=360-12$$
$$4x=348$$
$$\frac{4x}{4}=\frac{348}{4}$$
$$x=87$$

$x + 2 = 87 + 2 = 89$
$x + 4 = 87 + 4 = 91$
$x + 6 = 87 + 6 = 93$
The angles are 87°, 89°, 91°, and 93°.

40. Let x = first odd integer, then $x + 2$ = next odd integer, and $x + 4$ = third consecutive odd integer.

$$x+(x+2)+(x+4)=51$$
$$3x+6=51$$
$$3x+6-6=51-6$$
$$3x=45$$
$$\frac{3x}{3}=\frac{45}{3}$$
$$x=15$$

$x + 2 = 15 + 2 = 17$
$x + 4 = 15 + 4 = 19$
The code is 15, 17, 19.

42. Let x = the number.

$$\begin{aligned} 2(x+6) &= 3(x+4) \\ 2x+12 &= 3x+12 \\ 2x+12-12 &= 3x+12-12 \\ 2x &= 3x \\ 2x-2x &= 3x-2x \\ 0 &= x \end{aligned}$$

The number is 0.

44. Let x = the measure of the first angle then $2x - 3$ = the measure of the other.

$$\begin{aligned} x+2x-3 &= 90 \\ 3x-3 &= 90 \\ 3x-3+3 &= 90+3 \\ 3x &= 93 \\ \frac{3x}{3} &= \frac{93}{3} \\ x &= 31 \end{aligned}$$

$2x - 3 = 2(31) - 3 = 59$

The angles are 31° and 59°.

46.
$$\begin{aligned} \frac{1}{5}+2x &= 3x-\frac{4}{5} \\ \frac{1}{5}+2x-2x &= 3x-\frac{4}{5}-2x \\ \frac{1}{5} &= x-\frac{4}{5} \\ \frac{1}{5}+\frac{4}{5} &= x-\frac{4}{5}+\frac{4}{5} \\ \frac{5}{5} &= x \\ 1 &= x \end{aligned}$$

The number is 1.

48. Let x = the number.

$$\begin{aligned} \frac{3}{4}+3x &= 2x-\frac{1}{2} \\ 4\left(\frac{3}{4}+3x\right) &= 4\left(2x-\frac{1}{2}\right) \\ 3+12x &= 8x-2 \\ 3+12x-8x &= 8x-2-8x \\ 3+4x &= -2 \\ 3+4x-3 &= -2-3 \\ 4x &= -5 \\ \frac{4x}{4} &= \frac{-5}{4} \\ x &= -\frac{5}{4} \end{aligned}$$

The number is $-\frac{5}{4}$.

50. Let x = floor space of Empire State Building, then $3x$ = floor space of the Pentagon.

$$\begin{aligned} x+3x &= 8700 \\ 4x &= 8700 \\ \frac{4x}{4} &= \frac{8700}{4} \\ x &= 2175 \end{aligned}$$

$3x = 3(2175) = 6525$

The Empire State Building has 2175 thousand square feet and the Pentagon has 6525 thousand square feet.

52. Let x = the number.

$$\begin{aligned} \frac{7}{8}\cdot x &= \frac{1}{2} \\ \frac{8}{7}\cdot\frac{7}{8}x &= \frac{8}{7}\cdot\frac{1}{2} \\ x &= \frac{4}{7} \end{aligned}$$

The number is $\frac{4}{7}$.

54. Let x = first integer (smallest piece) then $x + 2$ = second integer (middle piece) and $x + 4$ = third integer (longest piece)

$$\begin{aligned} x+(x+2)+(x+4) &= 48 \\ 3x+6 &= 48 \\ 3x+6-6 &= 48-6 \\ 3x &= 42 \\ \frac{3x}{3} &= \frac{42}{3} \\ x &= 14 \end{aligned}$$

$x + 2 = 14 + 2 = 16$

$x + 4 = 14 + 4 = 18$

The pieces measure 14 inches, 16 inches, and 18 inches.

56. Let x = smallest angle, then $4x$ = largest angles.

$$\begin{aligned} x+4x+4x &= 180 \\ 9x &= 180 \\ \frac{9x}{9} &= \frac{180}{9} \\ x &= 20 \end{aligned}$$

$4x = 4(20) = 80$

The angles measure 20°, 80°, and 80°.

58. Let x = length of first piece,
then $5x$ = length of second piece,
and $6x$ = length of third piece.

$$x+5x+6x=48$$
$$12x=48$$
$$\frac{12x}{12}=\frac{48}{12}$$
$$x=4$$

$5x = 5(4) = 20$
$6x = 6(4) = 24$
The first piece is 4 feet, the second piece is 20 feet, and the third piece is 24 feet.

60. The bars ending between 3 and 5 represent the games Destiny and Grand Theft Auto V, so those games sold between 3 and 5 million copies in 2014.

62. Let x represent the sales of Minecraft, in millions. Then $x + 0.6$ represents the sales of Grand Theft Auto V.

$$x+x+0.6=6$$
$$2x+0.6=6$$
$$2x+0.6-0.6=6-0.6$$
$$2x=5.4$$
$$\frac{2x}{2}=\frac{5.4}{2}$$
$$x=2.7$$

$x + 0.6 = 2.7 + 0.6 = 3.3$
Minecraft sold 2.7 million copies and Grand Theft Auto V sold 3.3 million copies.

64. answers may vary

66. Replace B by 14 and h by 22.

$$\frac{1}{2}Bh=\frac{1}{2}(14)(22)=7(22)=154$$

68. Replace r by 15 and t by 2.
$r \cdot t = 15 \cdot 2 = 30$

70. Let x be the measure of the first angle. Then $2x$ is the measure of the second angle and $5x$ is the measure of the third angle. The measures sum to 180°.

$$x+2x+5x=180$$
$$8x=180$$
$$\frac{8x}{8}=\frac{180}{8}$$
$$x=22.5$$

$2x = 2(22.5) = 45$
$5x = 5(22.5) = 112.5$
Yes, the triangle exists and has angles that measure 22.5°, 45°, and 112.5°.

72. One blink every 5 seconds is $\frac{1\text{ blink}}{5\text{ sec}}$.
There are $60 \cdot 60 = 3600$ seconds in one hour.

$$\frac{1\text{ blink}}{5\text{ sec}}\cdot 3600\text{ sec}=720\text{ blinks}$$

The average eye blinks 720 times each hour.
$16 \cdot 720 = 11,520$
The average eye blinks 11,520 times while awake for a 16-hour day.
$11,520 \cdot 365 = 4,204,800$
The average eye blinks 4,204,800 times in one year.

74. answers may vary

76. answers may vary

78. Measurements may vary. Rectangle (b) best approximates the shape of a golden rectangle.

Section 2.6 Practice Exercises

1. Let $d = 580$ and $r = 5$.

$$d=r\cdot t$$
$$580=5t$$
$$\frac{580}{5}=\frac{5t}{5}$$
$$116=t$$

It takes 116 seconds or 1 minute 56 seconds.

2. Let $l = 40$ and $P = 98$.

$$P=2l+2w$$
$$98=2\cdot 40+2w$$
$$98=80+2w$$
$$98-80=80+2w-80$$
$$18=2w$$
$$\frac{18}{2}=\frac{2w}{2}$$
$$9=w$$

The dog run is 9 feet wide.

3. Let $C = 8$.

$$F=\frac{9}{5}C+32$$
$$F=\frac{9}{5}\cdot 8+32$$
$$F=\frac{72}{5}+\frac{160}{5}$$
$$F=\frac{232}{5}=46.4$$

The equivalent temperature is 46.4°F.

4. Let w = width of sign, then
$5w + 3$ = length of sign.

$$P = 2l + 2w$$
$$66 = 2(5w + 3) + 2w$$
$$66 = 10w + 6 + 2w$$
$$66 = 12w + 6$$
$$66 - 6 = 12w + 6 - 6$$
$$60 = 12w$$
$$\frac{60}{12} = \frac{12w}{12}$$
$$5 = w$$

$5w + 3 = 5(5) + 3 = 28$
The sign has length 28 inches and width 5 inches.

5.
$$I = PRT$$
$$\frac{I}{PT} = \frac{PRT}{PT}$$
$$\frac{I}{PT} = R \text{ or } R = \frac{I}{PT}$$

6.
$$H = 5as + 10a$$
$$H - 10a = 5as + 10a - 10a$$
$$H - 10a = 5as$$
$$\frac{H - 10a}{5a} = \frac{5as}{5a}$$
$$\frac{H - 10a}{5a} = s \text{ or } s = \frac{H - 10a}{5a}$$

7.
$$N = F + d(n - 1)$$
$$N - F = F + d(n - 1) - F$$
$$N - F = d(n - 1)$$
$$\frac{N - F}{n - 1} = \frac{d(n - 1)}{n - 1}$$
$$\frac{N - F}{n - 1} = d \text{ or } d = \frac{N - F}{n - 1}$$

8.
$$A = \frac{1}{2}a(b + B)$$
$$2 \cdot A = 2 \cdot \frac{1}{2}a(b + B)$$
$$2A = a(b + B)$$
$$2A = ab + aB$$
$$2A - ab = ab + aB - ab$$
$$2A - ab = aB$$
$$\frac{2A - ab}{a} = \frac{aB}{a}$$
$$\frac{2A - ab}{a} = B \text{ or } B = \frac{2A - ab}{a}$$

Vocabulary, Readiness & Video Check 2.6

1. A formula is an equation that describes known <u>relationships</u> among quantities.

2. This is a distance, rate, and time problem. The distance is given in miles and the time is given in hours, so the rate that we are finding must be in miles per hour (mph).

3. To show that the process of solving this equation for x—dividing both sides by 5, the coefficient of x—is the same process used to solve a formula for a specific variable. Treat whatever is multiplied by that specific variable as the coefficient—the coefficient is all the factors except that specific variable.

Exercise Set 2.6

2. Let $d = 195$ and $t = 3$.
$$d = rt$$
$$195 = r(3)$$
$$\frac{195}{3} = \frac{3r}{3}$$
$$65 = r$$

4. Let $l = 14$, $w = 8$, and $h = 3$.
$$V = lwh$$
$$V = 14(8)(3)$$
$$V = 336$$

6. Let $A = 60$, $B = 7$, and $b = 3$.
$$A = \frac{1}{2}h(B + b)$$
$$60 = \frac{1}{2}h(7 + 3)$$
$$2(60) = 2\left[\frac{1}{2}h(10)\right]$$
$$120 = 10h$$
$$\frac{120}{10} = \frac{10h}{10}$$
$$12 = h$$

8. Let $V = 45$, and $h = 5$.

$$\begin{aligned} V &= \frac{1}{3}Ah \\ 45 &= \frac{1}{3}A(5) \\ 3(45) &= 3\left[\frac{1}{3}(5A)\right] \\ 135 &= 5A \\ \frac{135}{5} &= \frac{5A}{5} \\ 27 &= A \end{aligned}$$

10. Let $r = 4.5$, and $\pi \approx 3.14$.

$$\begin{aligned} A &= \pi r^2 \\ A &\approx 3.14(4.5)^2 \\ A &\approx 3.14(20.25) \\ A &\approx 63.6 \end{aligned}$$

12. Let $I = 1{,}056{,}000$, $R = 0.055$, and $T = 6$.

$$\begin{aligned} I &= PRT \\ 1{,}056{,}000 &= P(0.055)(6) \\ 1{,}056{,}000 &= 0.33P \\ \frac{1{,}056{,}000}{0.33} &= \frac{0.33P}{0.33} \\ 3{,}200{,}000 &= P \end{aligned}$$

14. Let $r = 3$ and $\pi \approx 3.14$.

$$\begin{aligned} V &= \frac{4}{3}\pi r^3 \\ V &\approx \frac{4}{3}(3.14)(3)^3 \\ V &\approx \frac{4}{3}(3.14)(27) \\ V &\approx \frac{4}{3}(84.78) \\ V &\approx 113.0 \end{aligned}$$

($V \approx 113.1$ using a calculator.)

16.

$$\begin{aligned} A &= \pi ab \\ \frac{A}{\pi a} &= \frac{\pi ab}{\pi a} \\ \frac{A}{\pi a} &= b \end{aligned}$$

18.

$$\begin{aligned} T &= mnr \\ \frac{T}{mr} &= \frac{mnr}{mr} \\ \frac{T}{mr} &= n \end{aligned}$$

20.

$$\begin{aligned} -x + y &= 13 \\ -x + x + y &= 13 + x \\ y &= 13 + x \end{aligned}$$

22.

$$\begin{aligned} A &= P + PRT \\ A - P &= P - P + PRT \\ A - P &= PRT \\ \frac{A-P}{PR} &= \frac{PRT}{PR} \\ \frac{A-P}{PR} &= T \end{aligned}$$

24.

$$\begin{aligned} D &= \frac{1}{4}fk \\ 4D &= 4\left(\frac{1}{4}fk\right) \\ 4D &= fk \\ \frac{4D}{f} &= \frac{fk}{f} \\ \frac{4D}{f} &= k \end{aligned}$$

26.

$$\begin{aligned} PR &= x + y + z + w \\ PR - (x + y + w) &= x + y + z + w - (x + y + w) \\ PR - x - y - w &= x + y + z + w - x - y - w \\ PR - x - y - w &= z \end{aligned}$$

28.

$$\begin{aligned} S &= 4lw + 2wh \\ S - 4lw &= 4lw - 4lw + 2wh \\ S - 4lw &= 2wh \\ \frac{S-4lw}{2w} &= \frac{2wh}{2w} \\ \frac{S-4lw}{2w} &= h \end{aligned}$$

30. Use $A = lw$ when $A = 52{,}400$ and $l = 400$.

$$\begin{aligned} A &= lw \\ 52{,}400 &= 400 \cdot w \\ \frac{52{,}400}{400} &= \frac{400w}{400} \\ 131 &= w \end{aligned}$$

The width of the sign is 131 feet.

32. a.

$$\begin{aligned} A &= \frac{1}{2}bh \\ A &= \frac{1}{2}\cdot 36\cdot 27 \\ A &= 486 \end{aligned}$$

$$\begin{aligned} P &= l_1 + l_2 + l_3 \\ P &= 27 + 36 + 45 \\ P &= 108 \end{aligned}$$

The area is 486 square feet and the perimeter is 108 feet.

b. The fence has to do with perimeter because it is located around the edge of the property. The grass seed has to do with area because it is located in the middle of the property.

34. a.
$$A = bh \qquad P = 2l_1 + 2l_2$$
$$A = 9.3(7) \qquad P = 2(11.7) + 2(9.3)$$
$$A = 65.1 \qquad P = 23.4 + 18.6$$
$$P = 42$$
The area is 65.1 square feet and the perimeter is 42 feet.

b. The border has to do with the perimeter because it surrounds the edge. The paint has to do with the area because it covers the wall.

36. Let $C = -5$.
$$F = \frac{9}{5}(-5) + 32 = -9 + 32 = 23$$
The equivalent temperature is 23°F.

38. Let P = 400 and $l = 2w - 10$.
$$P = 2l + 2w$$
$$400 = 2(2w - 10) + 2w$$
$$400 = 4w - 20 + 2w$$
$$400 = 6w - 20$$
$$400 + 20 = 6w - 20 + 20$$
$$420 = 6w$$
$$\frac{420}{6} = \frac{6w}{6}$$
$$70 = w$$
$$l = 2w - 10 = 2(70) - 10 = 140 - 10 = 130$$
The length is 130 meters.

40. Let x = the measure of each of the two equal sides, and $x - 2$ = the measure of the third.
$$x + x + x - 2 = 22$$
$$3x - 2 = 22$$
$$3x - 2 + 2 = 22 + 2$$
$$3x = 24$$
$$\frac{3x}{3} = \frac{24}{3}$$
$$x = 8$$
$x - 2 = 8 - 2 = 6$
The shortest side is 6 feet.

42. Let d = 700 and r = 55.
$$d = rt$$
$$700 = 55t$$
$$\frac{700}{55} = \frac{55t}{55}$$
$$\frac{700}{55} = t$$
$$t = \frac{700}{55} = \frac{140}{11} = 12\frac{8}{11}$$
The trip will take $12\frac{8}{11}$ hours.

44. Let r = 4 and h = 3. Use $\pi \approx 3.14$.
$$V = \pi r^2 h$$
$$V \approx (3.14)(4)^2(3)$$
$$\approx (3.14)(16)(3)$$
$$\approx 150.72$$
Let x = number of goldfish and volume per fish = 2.
$$150.72 = 2x$$
$$\frac{150.72}{2} = \frac{2x}{2}$$
$$75.36 = x$$
75 goldfish can be placed in the tank.

46. Use N = 94.
$$T = 50 + \frac{N - 40}{4}$$
$$T = 50 + \frac{94 - 40}{4}$$
$$T = 50 + \frac{54}{4}$$
$$T = 50 + 13.5$$
$$T = 63.5$$
The temperature is 63.5° Fahrenheit.

48. Use T = 65.
$$T = 50 + \frac{N - 40}{4}$$
$$65 = 50 + \frac{N - 40}{4}$$
$$65 - 50 = 50 + \frac{N - 40}{4} - 50$$
$$15 = \frac{N - 40}{4}$$
$$4 \cdot 15 = 4 \cdot \frac{N - 40}{4}$$
$$60 = N - 40$$
$$60 + 40 = N - 40 + 40$$
$$100 = N$$
There are 100 chirps per minute.

50. As the air temperature of their environment decreases, the number of cricket chirps per minute decreases.

52. Let $A = 20$, and $b = 5$.

$$A = \frac{1}{2}bh$$
$$20 = \frac{1}{2}(5)h$$
$$2(20) = 2\left(\frac{5}{2}h\right)$$
$$40 = 5h$$
$$\frac{40}{5} = \frac{5h}{5}$$
$$8 = h$$

The height is 8 feet.

54. Let $r = 4000$. Use $\pi \approx 3.14$.

$$C = 2\pi r \approx 2(3.14)(4000)$$
$$C \approx 25{,}120$$

The length of rope is 25,120 miles.

56.

$$x + (2x - 8) + (3x - 12) = 82$$
$$6x - 20 = 82$$
$$6x - 20 + 20 = 82 + 20$$
$$6x = 102$$
$$\frac{6x}{6} = \frac{102}{6}$$
$$x = 17$$

$2x - 8 = 2(17) - 8 = 26$

$3x - 12 = 3(17) - 12 = 39$

The lengths are 17 feet, 26 feet, and 39 feet.

58. $A = 3990$ and $w = 57$.

$$A = lw$$
$$3990 = l \cdot 57$$
$$\frac{3990}{57} = \frac{57l}{57}$$
$$70 = l$$

The length is 70 feet.

60. Let x = the length of a side of the square and $2x - 15$ = the length of a side of the triangle.

$$P(\text{triangle}) = P(\text{square})$$
$$3(2x - 15) = 4x$$
$$6x - 45 = 4x$$
$$6x - 4x - 45 = 4x - 4x$$
$$2x - 45 = 0$$
$$2x - 45 + 45 = 45$$
$$2x = 45$$
$$\frac{2x}{2} = \frac{45}{2}$$
$$x = 22.5$$

$2x - 15 = 2(22.5) - 15 = 45 - 15 = 30$

The side of the triangle is 30 units and the side of the square is 22.5 units.

62. Let $d = 150$ and $r = 45$.

$$d = rt$$
$$150 = 45t$$
$$\frac{150}{45} = \frac{45t}{45}$$
$$\frac{150}{45} = t$$
$$t = \frac{150}{45} = \frac{10}{3}$$

The trip will take $\frac{10}{3} = 3\frac{1}{3}$ hours or 3 hours 20 minutes.

He should arrive at 7:20 A.M.

64. Let $F = 78$.

$$F = \frac{9}{5}C + 32$$
$$78 = \frac{9}{5}C + 32$$
$$5(78) = 5\left(\frac{9}{5}C + 32\right)$$
$$390 = 9C + 160$$
$$390 - 160 = 9C + 160 - 160$$
$$230 = 9C$$
$$\frac{230}{9} = \frac{9C}{9}$$
$$\frac{230}{9} = C$$
$$C = \frac{230}{9} = 25\frac{5}{9}$$

The equivalent temperature is $25\frac{5}{9}$°C.

66. Let $C = -10.$

$$\begin{aligned} F &= \frac{9}{5}C + 32 \\ &= \frac{9}{5}(-10) + 32 \\ &= -18 + 32 \\ &= 14 \end{aligned}$$

The equivalent temperature is 14°F

68. Let $F = -227.$

$$C = \frac{5}{9}(F - 32)$$

$$C = \frac{5}{9}(-227 - 32) \approx -144$$

The equivalent temperature is −144°C.

70. Use $V = \frac{4}{3}\pi r^3$ when $r = \frac{30}{2} = 15$ and $\pi = 3.14.$

$$V = \frac{4}{3}\pi r^3 = \frac{4}{3}(3.14)(15)^3 = 14{,}130$$

The volume of the sphere is 14,130 cubic inches.

72. 8% = 0.08

74. 0.5% = 0.005

76. 0.03 = 0.03(100%) = 3%

78. 5 = 5(100%) = 500%

80. Use $A = bh$. If the base is doubled, the new base is $2b$. If the height is doubled, the new height is $2h$.

$A = (2b)(2h) = 2 \cdot 2 \cdot b \cdot h = 4bh$

The area is multiplied by 4.

82. Let x be the temperature. Use $F = \frac{9}{5}C + 32$ when $F = C = x$.

$$\begin{aligned} F &= \frac{9}{5}C + 32 \\ x &= \frac{9}{5}x + 32 \\ x - \frac{9}{5}x &= \frac{9}{5}x + 32 - \frac{9}{5}x \\ \frac{5}{5}x - \frac{9}{5}x &= 32 \\ -\frac{4}{5}x &= 32 \\ -\frac{5}{4}\cdot\left(-\frac{4}{5}x\right) &= -\frac{5}{4}\cdot 32 \\ x &= -40 \end{aligned}$$

They are the same when the temperature is −40°.

84.

$$\begin{aligned} B &= \frac{F}{P - V} \\ B(P - V) &= \frac{F}{P - V}(P - V) \\ B(P - V) &= F \\ BP - BV &= F \\ BP - BV - BP &= F - BP \\ -BV &= F - BP \\ \frac{-BV}{-B} &= \frac{F - BP}{-B} \\ V &= \frac{BP - F}{B} \\ V &= \frac{BP}{B} - \frac{F}{B} \\ V &= P - \frac{F}{B} \end{aligned}$$

86. $\pentagon \cdot \square + \triangle = \bigcirc$

$$\begin{aligned} \pentagon \cdot \square &= \bigcirc - \triangle \\ \square &= \frac{\bigcirc - \triangle}{\pentagon} \end{aligned}$$

88. Let d = 238,860 and r = 186,000.

$$\begin{aligned} d &= rt \\ 238{,}860 &= 186{,}000t \\ \frac{238{,}860}{186{,}000} &= \frac{186{,}000t}{186{,}000} \\ 1.3 &\approx t \end{aligned}$$

It will take 1.3 seconds.

90. $20\ \dfrac{\text{miles}}{\text{hour}}$
$= 20\ \dfrac{\text{miles}}{\text{hour}}\left(\dfrac{5280\text{ feet}}{1\text{ mile}}\right)\left(\dfrac{1\text{ hour}}{3600\text{ seconds}}\right)$
$= \dfrac{88}{3}$ feet/second

Let $d = 1300$ and $r = \dfrac{88}{3}$.

$$d = rt$$
$$1300 = \frac{88}{3}t$$
$$\frac{3}{88}(1300) = \frac{3}{88}\left(\frac{88}{3}\right)t$$
$$44.3 \approx t$$

It will take about 44.3 seconds.

92. Use $d = rt$ when $d = 25{,}000$ and $r = 3800$.
$$d = rt$$
$$25{,}000 = 3800 \cdot t$$
$$\frac{25{,}000}{3800} = \frac{3800t}{3800}$$
$$6.58 \approx t$$
6 hr and $0.58(60) \approx 35$ min
It would take the Boeing X-51 6 hours 35 minutes to travel around Earth.

94. Let $d = 2$ then $r = 1$.
$15\text{ feet} = \dfrac{15\text{ feet}}{1} \cdot \dfrac{12\text{ inches}}{1\text{ foot}} = 180\text{ inches, so}$
$h = 180$.
$$V = \pi r^2 h$$
$$V = (\pi)(1)^2(180) = 180\pi \approx 565.5$$
The volume of the column is 565.5 cubic inches.

Section 2.7 Practice Exercises

1. Let x = the unknown percent.
$$35 = x \cdot 56$$
$$\frac{35}{56} = \frac{56x}{56}$$
$$0.625 = x$$
The number 35 is 62.5% of 56.

2. Let x = the unknown number.
$$198 = 55\% \cdot x$$
$$198 = 0.55x$$
$$\frac{198}{0.55} = \frac{0.55x}{0.55}$$
$$360 = x$$
The number 198 is 55% of 360.

3. a. From the circle graph, we see that 41% of pets owned are freshwater fish and 3% are saltwater fish; thus 41% + 3% = 44% of pets owned are freshwater fish or saltwater fish.

b. The circle graph percents have a sum of 100%; thus the percent of pets that are not equines is 100% − 3% = 97%.

c. To find the number of dogs owned, we find 19% of 396.12
= (0.19)(396.12)
= 75.2628
≈ 75.3
Thus, about 75.3 million dogs are owned in the United States.

4. Let x = discount.
$x = 85\% \cdot 480$
$x = 0.85 \cdot 480$
$x = 408$
The discount is \$408.
New price = \$480 − \$408 = \$72

5. Increase = 2710 − 1900 = 810
Let x = percent of increase.
$$810 = x \cdot 1900$$
$$\frac{810}{1900} = \frac{1900x}{1900}$$
$$0.426 \approx x$$
The percent of increase is 42.6%.

6. Let x = number of digital 3D screens in 2012.
$$x + 0.07x = 15{,}782$$
$$1.07x = 15{,}782$$
$$\frac{1.07x}{1.07} = \frac{15{,}782}{1.07}$$
$$x \approx 14{,}750$$
There were 14,750 digital 3D screens in 2012.

7. Let x = number of liters of 2% solution.

Eyewash	No. of gallons ·	Acid Strength =	Amt. of Acid
2%	x	2%	$0.02x$
5%	$6 - x$	5%	$0.05(6 - x)$
Mix: 3%	6	3%	$0.03(6)$

$$
\begin{aligned}
0.02x + 0.05(6 - x) &= 0.03(6) \\
0.02x + 0.3 - 0.05x &= 0.18 \\
-0.03x + 0.3 &= 0.18 \\
-0.03x + 0.3 - 0.3 &= 0.18 - 0.3 \\
-0.03x &= -0.12 \\
\frac{-0.03x}{-0.03} &= \frac{-0.12}{-0.03} \\
x &= 4
\end{aligned}
$$

$6 - x = 6 - 4 = 2$

She should mix 4 liters of 2% eyewash with 2 liters of 5% eyewash.

Vocabulary, Readiness & Video Check 2.7

1. No, 25% + 25% + 40% = 90% ≠ 100%.

2. No, 30% + 30% + 30% = 90% ≠ 100%.

3. Yes, 25% + 25% + 25% + 25% = 100%.

4. Yes, 40% + 50% + 10% = 100%.

5. **a.** equals; =

b. multiplication; ·

c. Drop the percent symbol and move the decimal point two places to the left.

6. **a.** You also find a discount amount by multiplying the (discount) percent by the original price.

b. For discount, the new price is the original price minus the discount amount, so you *subtract* from the original price rather than *add* as with mark-up.

7. You must first find the actual amount of increase in price by subtracting the original price from the new price.

8.

Alloy	**Ounces**	**Copper Strength**	**Amount of Copper**
10%	x	0.10	$0.10x$
30%	400	0.30	$0.30(400)$
20%	$x + 400$	0.20	$0.20(x + 400)$

$0.10x + 0.30(400) = 0.20(x + 400)$

Exercise Set 2.7

2. Let x be the unknown number.
$x = 88\% \cdot 1000$
$x = 0.88 \cdot 1000$
$x = 880$
880 is 88% of 1000.

4. Let x be the unknown percent.
$87.2 = x \cdot 436$
$\frac{87.2}{436} = \frac{436x}{436}$
$0.2 = x$
$20\% = x$
The number 87.2 is 20% of 436.

6. Let x be the unknown number.
$126 = 35\% \cdot x$
$126 = 0.35 \cdot x$
$\frac{126}{0.35} = \frac{0.35x}{0.35}$
$360 = x$
126 is 35% of 360.

8. 21% + 10% + 20% = 51%
51% of Earth's land area is in Asia, Antarctica, or Africa.

10. The land area of Africa is 20% of Earth's land area.
$20\% \text{ of } 56.4 = 20\% \cdot 56.4 = 0.20 \cdot 56.4 = 11.28$
The land area of Africa is 11.28 million square areas.

12. Let x = amount of discount.
$x = 25\% \cdot 12.50$
$x = 0.25 \cdot 12.50$
$x = 3.125 \approx 3.13$
New price = 12.50 − 3.13 = 9.37
The discount was \$3.13 and the new price is \$9.37.

14. Let x = tip.
$x = 20\% \cdot 65.40$
$x = 0.2 \cdot 65.4$
$x = 13.08$
Total = 65.40 + 13.08 = 78.48
The total cost is \$78.48.

16. Decrease = 314 − 290 = 24
Let x = percent.
$24 = x \cdot 314$
$\frac{24}{314} = \frac{314x}{314}$
$0.076 \approx x$
The percent of decrease is 7.6%.

18. Decrease = 100 − 81 = 11
Let x = percent.
$11 = x \cdot 100$
$\frac{11}{100} = \frac{100x}{100}$
$0.11 = x$
The percent of decrease is 11%.

20. Let x = original price and $0.25x$ = increase.
$x + 0.25x = 80$
$1.25x = 80$
$\frac{1.25x}{1.25} = \frac{80}{1.25}$
$x = 64$
The original price was \$64.

22. Let x = last year's salary, and $0.03x$ = increase.
$x + 0.03x = 55,620$
$1.03x = 55,620$
$\frac{1.03x}{1.03} = \frac{55,620}{1.03}$
$x = 54,000$
Last year's salary was \$54,000.

24. Let x = the amount of 25% solution.

	No. of cu cm	· Strength =	Amt. of Antibiotic
25%	x	0.25	$0.25x$
60%	10	0.6	10(0.6)
30%	$x + 10$	0.3	$0.3(x + 10)$

$$0.25x + 10(0.6) = 0.3(x + 10)$$
$$0.25x + 6 = 0.3x + 3$$
$$0.25x - 0.25x + 6 = 0.3x - 0.25x + 3$$
$$6 = 0.05x + 3$$
$$6 - 3 = 0.05x + 3 - 3$$
$$3 = 0.05x$$
$$\frac{3}{0.05} = \frac{0.05x}{0.05}$$
$$60 = x$$
Add 60 cc of 25% solution.

26. Let x = the pounds of cashew nuts.

	No. of lb	· Cost/lb	= Value
Peanuts	20	3	3(20)
Cashews	x	5	$5x$
Mix	$x + 20$	3.50	$3.50(x + 20)$

$$
\begin{aligned}
3(20)+5x &= 3.50(x+20)\\
60+5x &= 3.5x+70\\
60+5x-3.5x &= 3.5x-3.5x+70\\
60+1.5x &= 70\\
60-60+1.5x &= 70-60\\
1.5x &= 10\\
\frac{1.5x}{1.5} &= \frac{10}{1.5}\\
x &= 6\frac{2}{3}
\end{aligned}
$$

Add $6\frac{2}{3}$ pounds of cashews.

28. Let x = the number.
$x = 140\% \cdot 86$
$x = 1.4 \cdot 86$
$x = 120.4$
140% of 86 is 120.4.

30. Let x = the number.

$$
\begin{aligned}
56.25 &= 45\% \cdot x\\
56.25 &= 0.45x\\
\frac{56.25}{0.45} &= \frac{0.45x}{0.45}\\
125 &= x
\end{aligned}
$$

56.25 is 45% of 125.

32. Let x = the percent.

$$
\begin{aligned}
42 &= x \cdot 35\\
\frac{42}{35} &= \frac{35x}{35}\\
1.2 &= x
\end{aligned}
$$

42 is 120% of 35.

34. From the graph, the height of the bar is about 23. Therefore, the average American spends about 23 minutes on Internet browsers.

36. 17 is what percent of 162?

$$
\begin{aligned}
17 &= x \cdot 162\\
\frac{17}{162} &= \frac{162x}{162}\\
0.105 &\approx x
\end{aligned}
$$

10.5% of online time is spent following news.

38.

Unit Case Volume for Coca-Cola (in billions of cases)		
World Region	*Case Volume*	*Percent of Total (rounded to nearest percent)*
North America	5.9	$\frac{5.9}{28.2} \approx 21\%$
Latin America	8.2	$\frac{8.2}{28.2} \approx 29\%$
Europe	3.9	$\frac{3.9}{28.2} \approx 14\%$
Eurasia and Africa	4.3	$\frac{4.3}{28.2} \approx 15\%$
Pacific	5.9	$\frac{5.9}{28.2} \approx 21\%$
Total	28.2	100%

40. Let x = the decrease in price.
$x = 0.15(0.95) = 0.1425 \approx 0.14$
The decrease in price is \$0.14.
The new price is $0.95 - 0.14 = \$0.81$.

42. Increase $= 1.49 - 1.19 = 0.30$
Let x = the percent.

$$0.3 = x \cdot 1.19$$
$$\frac{0.3}{1.19} = \frac{1.19x}{1.19}$$
$$0.252 \approx x$$

The percent of increase was 25.2%.

44. Let x represent the amount Charles paid for the car.

$$x + 20\% \cdot x = 4680$$
$$x + 0.20x = 4680$$
$$1.2x = 4680$$
$$\frac{1.2x}{1.2} = \frac{4680}{1.2}$$
$$x = 3900$$

Charles paid \$3900 for the car.

46.
$$\text{percent of increase} = \frac{\text{amount of increase}}{\text{original amount}} = \frac{24-6}{6} = \frac{18}{6} = 3$$

The area increased by 300%.

48. Let x be the gallons of water.

	gallons	concentration	amount
water	x	0%	$0x = 0$
70% antifreeze	30	70%	0.7(30)
60% antifreeze	$x + 30$	60%	$0.6(x + 30)$

The amount of antifreeze being combined must be the same as that in the mixture.

$$\begin{aligned} 0+0.7(30) &= 0.6(x+30) \\ 21 &= 0.6x+18 \\ 21-18 &= 0.6x+18-18 \\ 3 &= 0.6x \\ \frac{3}{0.6} &= \frac{0.6x}{0.6} \\ 5 &= x \end{aligned}$$

Thus, 5 gallons of water should be used.

50.

$$\begin{aligned} \text{percent of increase} &= \frac{\text{amount of increase}}{\text{original amount}} \\ &= \frac{88-72}{72} \\ &= \frac{16}{72} \\ &\approx 0.222 \end{aligned}$$

The number of decisions by the Supreme Court increased 22.2%.

52. Let x be the average number of children per woman in 1920.

$$\begin{aligned} x-0.44x &= 1.9 \\ 0.56x &= 1.9 \\ \frac{0.56x}{0.56} &= \frac{1.9}{0.56} \\ x &\approx 3.4 \end{aligned}$$

There were 3.4 children per woman in 1920.

54. $64\% \cdot 9800 = 0.64 \cdot 9800 = 6272$

You would expect 6272 post-secondary institutions to have Internet access in their classrooms.

56. Let x be the pounds of chocolate-covered peanuts.

	pounds	cost ($)	value
chocolate-covered	x	5	$5x$
granola bites	10	2	2(10)
trail mix	$x + 10$	3	$3(x + 10)$

The value of those being combined must be the same as the value as the mixture.

$$
\begin{aligned}
5x+2(10) &= 3(x+10)\\
5x+20 &= 3x+30\\
5x+20-3x &= 3x+30-3x\\
2x+20 &= 30\\
2x+20-20 &= 30-20\\
2x &= 10\\
\frac{2x}{2} &= \frac{10}{2}\\
x &= 5
\end{aligned}
$$

Therefore, 5 pounds of chocolate-covered peanuts should be used.

58. Let x be the length of Christian's throw.

$$
\begin{aligned}
x &= 148.00+0.689(148.00)\\
&= 148.00+101.972\\
&= 249.972\\
&\approx 250
\end{aligned}
$$

Christian Sandstrom's world record throw was 250 meters.

60. $\frac{12}{3} = 2^2$

62. $-3^3 = (-3)^3$

64. $|-2| = 2;\ -|-2| = -2$
$|-2| > -|-2|$

66. answers may vary

68. **a.** yes; answers may vary

b. no; answers may vary

70. 23 g is what percent of 300 g? Let y represent the unknown percent.

$$
\begin{aligned}
y \cdot 300 &= 23\\
\frac{300y}{300} &= \frac{23}{300}\\
y &= 0.07\overline{6}
\end{aligned}
$$

This food contains 7.7% of the daily value of total carbohydrate in one serving.

72. 6g · 9 calories/gram = 54 calories
54 of the 280 calories come from fat.

$\frac{54}{280} \approx 0.193$

19.3% of the calories in this food come from fat.

74. answers may vary

Section 2.8 Practice Exercises

1. Let x = time down, then $x + 1$ = time up.

	Rate ·	Time =	Distance
Up	1.5	$x + 1$	$1.5(x + 1)$
Down	4	x	$4x$

$$\begin{aligned} d &= d \\ 1.5(x+1) &= 4x \\ 1.5x+1.5 &= 4x \\ 1.5 &= 2.5x \\ \frac{1.5}{2.5} &= \frac{2.5x}{2.5} \\ 0.6 &= x \end{aligned}$$

Total Time = $x + 1 + x = 0.6 + 1 + 0.6 = 2.2$
The entire hike took 2.2 hours.

2. Let x = speed of eastbound train, then $x - 10$ = speed of westbound train.

	r ·	t =	d
East	x	1.5	$1.5x$
West	$x - 10$	1.5	$1.5(x - 10)$

$$\begin{aligned} 1.5x+1.5(x-10) &= 171 \\ 1.5x+1.5x-15 &= 171 \\ 3x-15 &= 171 \\ 3x &= 186 \\ \frac{3x}{3} &= \frac{186}{3} \\ x &= 62 \end{aligned}$$

$x - 10 = 62 - 10 = 52$
The eastbound train is traveling at 62 mph and the westbound train is traveling at 52 mph.

3. Let x = the number of \$20 bills, then $x + 47$ = number of \$5 bills.

Denomination	Number	Value
\$5 bills	$x + 47$	$5(x + 47)$
\$20 bills	x	$20x$

$$\begin{aligned} 5(x+47)+20x &= 1710 \\ 5x+235+20x &= 1710 \\ 235+25x &= 1710 \\ 25x &= 1475 \\ x &= 59 \end{aligned}$$

$x + 47 = 59 + 47 = 106$
There are 106 \$5 bills and 59 \$20 bills.

4. Let x = amount invested at 11.5%, then
$30{,}000 - x$ = amount invested at 6%.

	Principal ·	Rate ·	Time =	Interest
11.5%	x	0.115	1	$x(0.115)(1)$
6%	$30{,}000 - x$	0.06	1	$0.06(30{,}000 - x)(1)$
Total	30,000			2790

$$\begin{aligned} 0.115x + 0.06(30{,}000 - x) &= 2790 \\ 0.115x + 1800 - 0.06x &= 2790 \\ 1800 + 0.055x &= 2790 \\ 0.055x &= 990 \\ \frac{0.055x}{0.055} &= \frac{990}{0.055} \\ x &= 18{,}000 \end{aligned}$$

$30{,}000 - x = 30{,}000 - 18{,}000 = 12{,}000$
She invested \$18,000 at 11.5% and \$12,000 at 6%.

Vocabulary, Readiness & Video Check 2.8

1.

	r ·	t =	d
bus	55	x	$55x$
car	50	$x + 3$	$50(x + 3)$

$55x = 50(x + 3)$

2. The important thing is to remember the difference between the *number* of bills you have and the *value* of the bills.

3.

P ·	R ·	T =	I
x	0.06	1	$0.06x$
$36{,}000 - x$	0.04	1	$0.04(36{,}000 - x)$

$0.06x = 0.04(36{,}000 - x)$

Exercise Set 2.8

2. Let x = the time traveled by the bus.

	Rate ·	Time =	Distance
Bus	60	x	$60x$
Car	40	$x + 1.5$	$40(x + 1.5)$

$$\begin{aligned} d &= d \\ 60x &= 40(x+1.5) \\ 60x &= 40x+60 \\ 20x &= 60 \\ \frac{20x}{20} &= \frac{60}{20} \\ x &= 3 \end{aligned}$$

It will take the bus 3 hours to overtake the car.

4. Let x = the time to get to Disneyland and $7.2 - x$ = the time to return

	Rate ·	Time =	Distance
Going	50	x	$50x$
Returning	40	$7.2 - x$	$40(7.2 - x)$

$$\begin{aligned} d &= d \\ 50x &= 40(7.2-x) \\ 50x &= 288-40x \\ 90x &= 288 \\ \frac{90x}{90} &= \frac{288}{90} \\ x &= 3.2 \end{aligned}$$

It took 3.2 hours to get to Disneyland.
$d = rt$
$d = 50(3.2) = 160$
The distance to Disneyland is 160 miles.

6. The value of z quarters is $0.25z$.

8. The value of $(20 - z)$ half-dollars is $0.50(20 - z)$.

10. The value of $97z$ \$100 bills is $100(97z)$ or $9700z$.

12. The value of $(15 - y)$ \$10 bills is $10(15 - y)$.

14. Let x = number of \$50 bills, then $6x$ = number of \$20 bills.

	Number of Bills	Value of Bills
\$20 bills	$6x$	$20(6x)$
\$50 bills	x	$50x$
Total		3910

$$\begin{aligned} 20(6x)+50x &= 3910 \\ 120x+50x &= 3910 \\ 170x &= 3910 \\ x &= 23 \end{aligned}$$

$6x = 6(23) = 138$
There are 138 \$20 bills and 23 \$50 bills.

16. Let x = the amount invested at 9% for one year.

	Principal ·	Rate =	Interest
9%	x	0.09	$0.09x$
10%	$x + 250$	0.10	$0.10(x + 250)$
Total			101

$$\begin{aligned} 0.09x+0.10(x+250) &= 101 \\ 0.09x+0.10x+25 &= 101 \\ 0.19x+25 &= 101 \\ 0.19x &= 76 \\ \frac{0.19x}{0.19} &= \frac{76}{0.19} \\ x &= 400 \end{aligned}$$

$x + 250 = 400 + 250 = 650$
She invested \$650 at 10% and \$400 at 9%.

18. Let x = the amount invested at 10% for one year.

	Principal ·	Rate =	Interest
10%	x	0.10	$0.10x$
12%	$2x$	0.12	$0.12(2x)$
Total			2890

$$\begin{aligned} 0.10x+0.12(2x) &= 2890 \\ 0.10x+0.24x &= 2890 \\ 0.34x &= 2890 \\ \frac{0.34x}{0.34} &= \frac{2890}{0.34} \\ x &= 8500 \end{aligned}$$

$2x = 2(8500) = 17{,}000$
He invested \$17,000 at 12% and \$8500 at 10%.

20. Let x = number of adult tickets, then $732 - x$ = number of child tickets.

	Number ·	Rate =	Cost
Adult	x	22	$22x$
Child	$732 - x$	15	$15(732 - x)$
Total	732		12,912

$$\begin{aligned} 22x + 15(732 - x) &= 12,912 \\ 22x + 10,980 - 15x &= 12,912 \\ 10,980 + 7x &= 12,912 \\ 7x &= 1932 \\ x &= 276 \end{aligned}$$

$732 - x = 732 - 276 = 456$
Sales included 276 adult tickets and 456 child tickets.

22. Let x = the time traveled

	Rate ·	Time =	Distance
Car A	65	x	$65x$
Car B	41	x	$41x$

The total distance is 530 miles.

$$\begin{aligned} 65x + 41x &= 530 \\ 106x &= 530 \\ \frac{106x}{106} &= \frac{530}{106} \\ x &= 5 \end{aligned}$$

The two cars will be 530 miles apart in 5 hours.

24. Let x = the amount invested at 12% for one year.

	Principal ·	Rate =	Interest
12%	x	0.12	$0.12x$
4%	$20,000 - x$	-0.04	$-0.04(20,000 - x)$

$$\begin{aligned} 0.12x - 0.04(20,000 - x) &= 0 \\ 0.12x - 800 + 0.04x &= 0 \\ 0.16x - 800 &= 0 \\ 0.16x &= 800 \\ \frac{0.16x}{0.16} &= \frac{800}{0.16} \\ x &= 5000 \end{aligned}$$

$20,000 - x = 20,000 - 5000 = 15,000$
She invested \$15,000 at 4% and \$5000 at 12%.

26. Let x = the time they are able to talk.

	Rate ·	Time =	Distance
Cade	5	x	$5x$
Kathleen	4	x	$4x$
Total			20

$$\begin{aligned}5x+4x&=2\\9x&=20\\\frac{9x}{9}&=\frac{20}{9}\\x&=2\frac{2}{9}\end{aligned}$$

They can talk for $2\frac{2}{9}$ hours.

28. Let x = the speed of the slower train.

	Rate ·	Time =	Distance
Train A	x	1.5	$1.5x$
Train B	$x + 8$	1.5	$1.5(x + 8)$

The total distance is 162 miles.

$$\begin{aligned}1.5x+1.5(x+8)&=162\\1.5x+1.5x+12&=162\\3x+12&=162\\3x&=150\\\frac{3x}{3}&=\frac{150}{3}\\x&=50\end{aligned}$$

$x + 8 = 58$

The speeds of the trains are 50 mph and 58 mph.

30. Let x = number of quarters, then
$5x$ = number of dimes.

	Number	Value
Quarters	x	$0.25x$
Dimes	$5x$	$0.10(5x)$
Total		27.75

$$\begin{aligned}0.25x+0.10(5x)&=27.75\\0.25x+0.5x&=27.75\\0.75x&=27.75\\x&=37\end{aligned}$$

$5x = 5(37) = 185$

The collection has 37 quarters and 185 dimes.

32. Let x = the time traveled.

	Rate ·	Time =	Distance
Car A	65	x	$65x$
Car B	45	x	$45x$

The total distance is 330.

$$\begin{aligned} 65x+45x &= 330 \\ 110x &= 330 \\ \frac{110x}{110} &= \frac{330}{110} \\ x &= 3 \end{aligned}$$

They will be 330 miles apart in 3 hours.

34. Let x = the time traveled.

	Rate ·	Time =	Distance
Car A	40	x	$40x$
Car B	50	x	$50x$

If two cars are traveling in the same direction, so find the difference in their distances traveled.

$$\begin{aligned} 50x-40x &= 20 \\ 10x &= 20 \\ \frac{10x}{10} &= \frac{20}{10} \\ x &= 2 \end{aligned}$$

They will be 20 miles apart in 2 hours.

36. Let x = the amount invested at 9% for one year.

	Principal ·	Rate =	Interest
9%	x	0.09	$0.09x$
10%	$2x$	0.10	$0.1(2x)$
11%	$3x$	0.11	$0.11(3x)$
Total			2790

$$\begin{aligned} 0.09x+0.1(2x)+0.11(3x) &= 2790 \\ 0.09x+0.2x+0.33x &= 2790 \\ 0.62x &= 2790 \\ \frac{0.62x}{0.62} &= \frac{2790}{0.62} \\ x &= 4500 \end{aligned}$$

$2x = 2(4500) = 9000$

$3x = 3(4500) = 13{,}500$

She invested \$4500 at 9%, \$9000 at 10% and \$13,500 at 11%.

38. Let x = the time it takes them to meet.

	Rate ·	Time =	Distance
Nedra	3	x	$3x$
Latonya	4	x	$4x$
Total			12

$$\begin{aligned} 3x+4x &= 12 \\ 7x &= 12 \\ \frac{7x}{7} &= \frac{12}{7} \\ x &= 1\frac{5}{7} \end{aligned}$$

They meet in $1\frac{5}{7}$ hours.

40. Let x = the time before getting stopped.

	Rate ·	Time =	Distance
Before	70	x	$70x$
After	60	$4 - x$	$60(4 - x)$
Total			255

$$\begin{aligned} 70x+60(4-x) &= 255 \\ 70x+240-60x &= 255 \\ 10x+240 &= 255 \\ 10x &= 15 \\ \frac{10x}{10} &= \frac{15}{10} \\ x &= 1.5 \end{aligned}$$

He drove 1.5 hours before getting stopped.

42. $(-2) + (-8) = -10$

44. $-11 + 2.9 = -8.1$

46. $-12 - 3 = -12 + (-3) = -15$

48. Let x = number of quarters, then
$136 + x$ = number of dimes,
$8x$ = number of nickels,
$16x + 32$ = number of pennies.

	Number	Value
Quarters	x	$0.25x$
Dimes	$136 + x$	$0.10(136 + x)$
Nickels	$8x$	$0.05(8x)$
Pennies	$16x + 32$	$0.01(16x + 32)$
Total		44.86

$$\begin{aligned} 0.25x+0.10(136+x)+0.05(8x)+0.01(16x+32) &= 44.86 \\ 0.25x+13.6+0.1x+0.4x+0.16x+0.32 &= 44.86 \\ 0.91x+13.92 &= 44.86 \\ 0.91x &= 30.94 \\ x &= 34 \end{aligned}$$

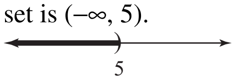
$136 + x = 136 + 34 = 170$
$8x = 8(34) = 272$
$16x + 32 = 16(34) + 32 = 576$
There were 34 quarters, 170 dimes, 272 nickels, and 576 pennies.

50.
$$\begin{aligned} R &= C \\ 60x &= 50x + 5000 \\ 10x &= 5000 \\ \frac{10x}{10} &= \frac{5000}{10} \\ x &= 500 \end{aligned}$$
Should sell 500 boards to break even.
$C = R = 60x = 60(500) = 30{,}000$
It costs $30,000 to produce the break-even number of boards.

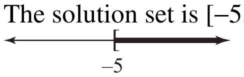
52.
$$\begin{aligned} R &= C \\ 105x &= 875 + 70x \\ 105x - 70x &= 875 + 70x - 70x \\ 35x &= 875 \\ \frac{35x}{35} &= \frac{875}{35} \\ x &= 25 \end{aligned}$$
They should sell 25 monitors to break even.

Section 2.9 Practice Exercises

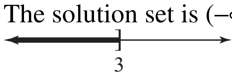
1. $x < 5$
Place a parenthesis at 5 since the inequality symbol is <. Shade to the left of 5. The solution set is $(-\infty, 5)$.



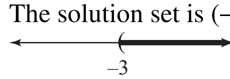
2.
$$\begin{aligned} x + 11 &\ge 6 \\ x + 11 - 11 &\ge 6 - 11 \\ x &\ge -5 \end{aligned}$$
The solution set is $[-5, \infty)$.



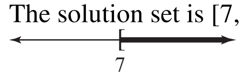
3.
$$\begin{aligned} -5x &\ge -15 \\ \frac{-5x}{-5} &\le \frac{-15}{-5} \\ x &\le 3 \end{aligned}$$
The solution set is $(-\infty, 3]$.



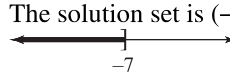
4.
$$\begin{aligned} 3x &> -9 \\ \frac{3x}{3} &> \frac{-9}{3} \\ x &> -3 \end{aligned}$$
The solution set is $(-3, \infty)$.



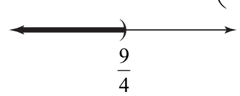
5.
$$\begin{aligned} 45 - 7x &\le -4 \\ 45 - 7x - 45 &\le -4 - 45 \\ -7x &\le -49 \\ \frac{-7x}{-7} &\ge \frac{-49}{-7} \\ x &\ge 7 \end{aligned}$$
The solution set is $[7, \infty)$.



6.
$$\begin{aligned} 3x + 20 &\le 2x + 13 \\ 3x + 20 - 2x &\le 2x + 13 - 2x \\ x + 20 &\le 13 \\ x + 20 - 20 &\le 13 - 20 \\ x &\le -7 \end{aligned}$$
The solution set is $(-\infty, -7]$.

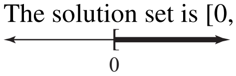


7.
$$\begin{aligned} 6 - 5x &> 3(x - 4) \\ 6 - 5x &> 3x - 12 \\ 6 - 5x - 3x &> 3x - 12 - 3x \\ 6 - 8x &> -12 \\ 6 - 8x - 6 &> -12 - 6 \\ -8x &> -18 \\ \frac{-8x}{-8} &< \frac{-18}{-8} \\ x &< \frac{9}{4} \end{aligned}$$
The solution set is $\left(-\infty, \frac{9}{4}\right)$.



8.
$$\begin{aligned} 3(x-4)-5 &\le 5(x-1)-12 \\ 3x-12-5 &\le 5x-5-12 \\ 3x-17 &\le 5x-17 \\ 3x-17-5x &\le 5x-17-5x \\ -2x-17 &\le -17 \\ -2x-17+17 &\le -17+17 \\ -2x &\le 0 \\ \frac{-2x}{-2} &\ge \frac{0}{-2} \\ x &\ge 0 \end{aligned}$$

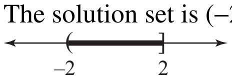
The solution set is $[0, \infty)$.



9. $-3 \le x < 1$
Graph all numbers greater than or equal to −3 and less than 1. Place a bracket at −3 and a parenthesis at 1.
The solution set is $[-3, 1)$.

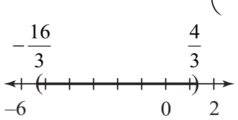
10.
$$\begin{aligned} -4 < 3x+2 &\le 8 \\ -4-2 < 3x+2-2 &\le 8-2 \\ -6 < 3x &\le 6 \\ \frac{-6}{3} < \frac{3x}{3} &\le \frac{6}{3} \\ -2 < x &\le 2 \end{aligned}$$

The solution set is $(-2, 2]$.



11.
$$\begin{aligned} 1 < \frac{3}{4}x+5 &< 6 \\ 4(1) < 4\left(\frac{3}{4}x+5\right) &< 4(6) \\ 4 < 3x+20 &< 24 \\ 4-20 < 3x+20-20 &< 24-20 \\ -16 < 3x &< 4 \\ \frac{-16}{3} < \frac{3x}{3} &< \frac{4}{3} \\ -\frac{16}{3} < x &< \frac{4}{3} \end{aligned}$$

The solution set is $\left(-\frac{16}{3}, \frac{4}{3}\right)$.



12. Let x = the number.
$$\begin{aligned} 35-2x &> 15 \\ 35-2x-35 &> 15-35 \\ -2x &> -20 \\ \frac{-2x}{-2} &< \frac{-20}{-2} \\ x &< 10 \end{aligned}$$
All numbers less than 10.

13. Let x = number of classes.
$$\begin{aligned} 300+375x &\le 1500 \\ 300+375x-300 &\le 1500-300 \\ 375x &\le 1200 \\ \frac{375x}{375} &\le \frac{1200}{375} \\ x &\le 3.2 \end{aligned}$$
Kasonga can afford at most 3 community college classes this semester.

Vocabulary, Readiness & Video Check 2.9

1. $6x - 7(x + 9)$ is an expression.

2. $6x = 7(x + 9)$ is an equation.

3. $6x < 7(x + 9)$ is an inequality.

4. $5y - 2 \ge -38$ is an inequality.

5. -5 is not a solution to $x \ge -3$.

6. $|-6| = 6$ is not a solution to $x < 6$.

7. The graph of Example 1 is shaded from $-\infty$ to and including -1, as indicated by a bracket. To write interval notation, you write down what is shaded for the inequality from left to right. A parenthesis is always used with $-\infty$, so from the graph, the interval notation is $(-\infty, -1]$.

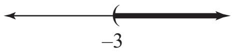
8. Step 5 is where you apply the multiplication property of inequality. If a negative number is multiplied or divided when applying this property, you need to make sure you remember to reverse the direction of the inequality symbol.

9. You would divide the left, middle, and right by −3 instead of 3, which would reverse the directions of both inequality symbols.

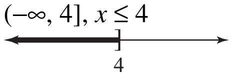
10. no greater than; $\le$

Exercise Set 2.9

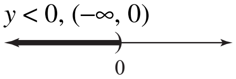
2. $(-3, \infty)$, $x > -3$



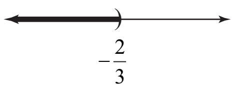
4. $(-\infty, 4]$, $x \le 4$



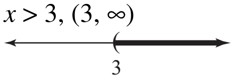
6. $y < 0$, $(-\infty, 0)$



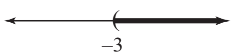
8. $z < -\frac{2}{3}$, $\left(-\infty, -\frac{2}{3}\right)$



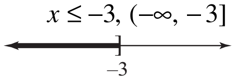
10. $x > 3$, $(3, \infty)$



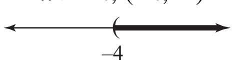
12. $3x > -9$
$x > -3$, $(-3, \infty)$



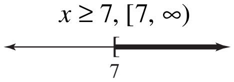
14. $x + 4 \le 1$
$x \le -3$, $(-\infty, -3]$



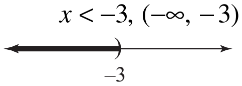
16.
$$\begin{aligned} -5x &< 20 \\ \frac{-5x}{-5} &> \frac{20}{-5} \\ x &> -4,\ (-4, \infty) \end{aligned}$$



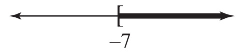
18.
$$\begin{aligned} 3 - 7x &\ge 10 - 8x \\ 3 + x &\ge 10 \\ x &\ge 7,\ [7, \infty) \end{aligned}$$



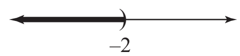
20.
$$\begin{aligned} 7x + 3 &< 9x - 3x \\ 7x + 3 &< 6x \\ x + 3 &< 0 \\ x &< -3,\ (-\infty, -3) \end{aligned}$$



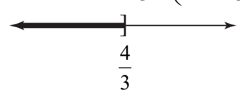
22.
$$\begin{aligned} 3x + 9 &\le 5(x - 1) \\ 3x + 9 &\le 5x - 5 \\ -2x + 9 &\le -5 \\ -2x &\le -14 \\ \frac{-2x}{-2} &\ge \frac{-14}{-2} \\ x &\ge 7,\ [7, \infty) \end{aligned}$$



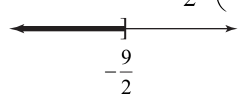
24.
$$\begin{aligned} -7x + 4 &> 3(4 - x) \\ -7x + 4 &> 12 - 3x \\ -4x + 4 &> 12 \\ -4x &> 8 \\ \frac{-4x}{-4} &< \frac{8}{-4} \\ x &< -2,\ (-\infty, -2) \end{aligned}$$



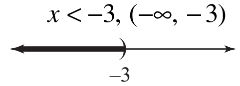
26.
$$\begin{aligned} 3(5x - 4) &\le 4(3x - 2) \\ 15x - 12 &\le 12x - 8 \\ 3x - 12 &\le -8 \\ 3x &\le 4 \\ x &\le \frac{4}{3},\ \left(-\infty, \frac{4}{3}\right] \end{aligned}$$



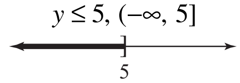
28.
$$\begin{aligned} 7(x - 2) + x &\le -4(5 - x) - 12 \\ 7x - 14 + x &\le -20 + 4x - 12 \\ 8x - 14 &\le -32 + 4x \\ 4x - 14 &\le -32 \\ 4x &\le -18 \\ x &\le -\frac{9}{2},\ \left(-\infty, -\frac{9}{2}\right] \end{aligned}$$

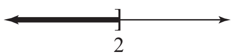


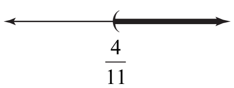
30.
$$\begin{aligned} -7x &> 21 \\ \frac{-7x}{-7} &< \frac{21}{-7} \\ x &< -3,\ (-\infty, -3) \end{aligned}$$

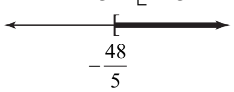


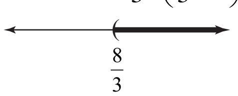
32. $y - 4 \le 1$
$y \le 5$, $(-\infty, 5]$

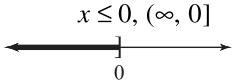


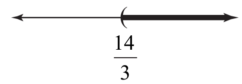
34.
$$\begin{aligned} 2x-1 &\ge 4x-5 \\ -2x-1 &\ge -5 \\ -2x &\ge -4 \\ \frac{-2x}{-2} &\le \frac{-4}{-2} \\ x &\le 2,\ (-\infty,\ 2] \end{aligned}$$


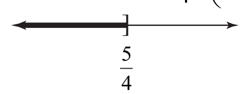
36.
$$\begin{aligned} 4-x &< 8x+2x \\ 4-x &< 10x \\ 4-11x &< 0 \\ -11x &< -4 \\ \frac{-11x}{-11} &> \frac{-4}{-11} \\ x &> \frac{4}{11},\ \left(\frac{4}{11},\ \infty\right) \end{aligned}$$


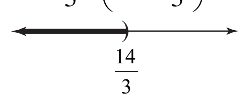
38.
$$\begin{aligned} \frac{5}{6}x &\ge -8 \\ x &\ge -\frac{48}{5},\ \left[-\frac{48}{5},\ \infty\right) \end{aligned}$$


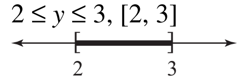
40.
$$\begin{aligned} 5(x+4) &< 4(2x+3) \\ 5x+20 &< 8x+12 \\ -3x+20 &< 12 \\ -3x &< -8 \\ \frac{-3x}{-3} &> \frac{-8}{-3} \\ x &> \frac{8}{3},\ \left(\frac{8}{3},\ \infty\right) \end{aligned}$$


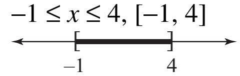
42.
$$\begin{aligned} 6(2-x) &\ge 12 \\ 12-6x &\ge 12 \\ -6x &\ge 0 \\ \frac{-6x}{-6} &\le \frac{0}{-6} \\ x &\le 0,\ (\infty,\ 0] \end{aligned}$$


44.
$$\begin{aligned} -6x+2 &< -3(x+4) \\ -6x+2 &< -3x-12 \\ -3x+2 &< -12 \\ -3x &< -14 \\ \frac{-3x}{-3} &> \frac{-14}{-3} \\ x &> \frac{14}{3},\ \left(\frac{14}{3},\ \infty\right) \end{aligned}$$


46.
$$\begin{aligned} -5(1-x)+x &\le -(6-2x)+6 \\ -5+5x+x &\le -6+2x+6 \\ -5+6x &\le 2x \\ -5+4x &\le 0 \\ 4x &\le 5 \\ x &\le \frac{5}{4},\ \left(-\infty,\ \frac{5}{4}\right] \end{aligned}$$


48.
$$\begin{aligned} \frac{1}{3}(3x-1) &< \frac{1}{2}(x+4) \\ 6\left[\frac{1}{3}(3x-1)\right] &< 6\left[\frac{1}{2}(x+4)\right] \\ 2(3x-1) &< 3(x+4) \\ 6x-2 &< 3x+12 \\ 6x-2+2 &< 3x+12+2 \\ 6x &< 3x+14 \\ 6x-3x &< 3x-3x+14 \\ 3x &< 14 \\ \frac{3x}{3} &< \frac{14}{3} \\ x &< \frac{14}{3},\ \left(-\infty,\ \frac{14}{3}\right) \end{aligned}$$


50. $2 \le y \le 3$, [2, 3]


52. $-1 \le x \le 4$, [−1, 4]


54. $-5 < 2x < -2$

$-\frac{5}{2} < x < -1, \left(-\frac{5}{2}, -1\right)$

56. $4 \le 5x - 6 \le 19$

$10 \le 5x \le 25$

$2 \le x \le 5$, [2, 5]

58. $0 < 4(x+5) \le 8$

$0 < 4x + 20 \le 8$

$-20 < 4x \le -12$

$-5 < x \le -3$, (–5, –3]

60. $1 < 4 + 2x \le 7$

$-3 < 2x \le 3$

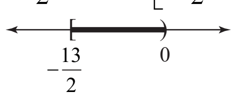
$-\frac{3}{2} < x \le \frac{3}{2}, \left(-\frac{3}{2}, \frac{3}{2}\right]$

62. $-5 \le 2(x+4) < 8$

$-5 \le 2x + 8 < 8$

$-13 \le 2x < 0$

$-\frac{13}{2} \le x < 0, \left[-\frac{13}{2}, 0\right)$



64. Let x be the number.

$$
\begin{aligned}
5x + 1 &\le 10 \\
5x + 1 - 1 &\le 10 - 1 \\
5x &\le 9 \\
\frac{5x}{5} &\le \frac{9}{5} \\
x &\le \frac{9}{5}
\end{aligned}
$$

All numbers less than or equal to $\frac{9}{5}$ make this statement true.

66. Use $P = a + b + c$ when $a = x$, $b = 3x$, $c = 12$, and $P \le 32$.

$$
\begin{aligned}
x + 3x + 12 &\le 32 \\
4x + 12 &\le 32 \\
4x + 12 - 12 &\le 32 - 12 \\
4x &\le 20 \\
\frac{4x}{4} &\le \frac{20}{4} \\
x &\le 5
\end{aligned}
$$

$3x \le 3(5) = 15$

The maximum lengths of the other two sides are 5 inches and 15 inches.

68. Convert heights to inches.

$6'8" = 6 \cdot 12 + 8 = 80$

$6'6" = 6 \cdot 12 + 6 = 78$

$6'0" = 6 \cdot 12 + 0 = 72$

$5'9" = 5 \cdot 12 + 9 = 69$

$6'5" = 6 \cdot 12 + 5 = 77$

Let x be the height of the center.

$$
\begin{aligned}
\frac{x + 80 + 78 + 72 + 69}{5} &\ge 77 \\
\frac{x + 299}{5} &\ge 77 \\
5 \cdot \frac{x + 299}{5} &\ge 5 \cdot 77 \\
x + 299 &\ge 385 \\
x + 299 - 299 &\ge 385 - 299 \\
x &\ge 86
\end{aligned}
$$

$86" = 7'2"$

The center should be at least $7'2"$.

70. Let x represent the number of people. Then the cost is $40 + 15x$.

$$
\begin{aligned}
40 + 15x &\le 860 \\
40 + 15x - 40 &\le 860 - 40 \\
15x &\le 820 \\
\frac{15x}{15} &\le \frac{820}{15} \\
x &\le \frac{820}{15} \approx 54.7
\end{aligned}
$$

They can invite at most 54 people.

72. Let x represent the number of minutes.

$$
\begin{aligned}
5.3x &\ge 200 \\
\frac{5.3x}{5.3} &\ge \frac{200}{5.3} \\
x &\ge \frac{200}{5.3} \approx 38
\end{aligned}
$$

The person must bicycle at least 38 minutes.

74. Let x = the unknown number.

$$2 < \frac{1}{2}x - 4 < 3$$
$$6 < \frac{1}{2}x < 7$$
$$12 < x < 14$$

All numbers between 12 and 14

76. $(3)^3 = (3)(3)(3) = 27$

78. $0^5 = (0)(0)(0)(0)(0) = 0$

80. $\left(\frac{2}{3}\right)^3 = \left(\frac{2}{3}\right)\left(\frac{2}{3}\right)\left(\frac{2}{3}\right) = \frac{8}{27}$

82. Since $m \le n$, then $2m \le 2n$.

84. If $-x < y$, then $x > -y$.

86. Yes; answers may vary

88. Let x be the score on her final exam. Since the final counts as two tests, her final course average is $\frac{85+95+92+3x}{6}$.

$$\frac{85+95+92+3x}{6} \ge 90$$
$$\frac{272+3x}{6} \ge 90$$
$$6\left(\frac{272+3x}{6}\right) \ge 6(90)$$
$$272+3x \ge 540$$
$$272+2x-272 \ge 540-272$$
$$3x \ge 268$$
$$\frac{3x}{3} \ge \frac{268}{3}$$
$$x \ge 89.\overline{3}$$

Her final exam score must be at least 89.3 for her to get an A.

90. answers may vary

92. answers may vary

94. $C = 3.14d$

$$118 \le 3.14d \le 122$$
$$37.58 \le d \le 38.85$$

The diameter must be between 37.58 mm and 38.85 mm.

96. $x(x-3) \ge x^2 - 5x - 8$

$$x^2 - 3x \ge x^2 - 5x - 8$$
$$-3x \ge -5x - 8$$
$$2x \ge -8$$
$$x \ge -4,\ [-4, \infty)$$

98. $x^2 - 4x + 8 < x(x+8)$

$$x^2 - 4x + 8 < x^2 + 8x$$
$$-4x + 8 < 8x$$
$$-12x + 8 < 0$$
$$-12x < -8$$
$$\frac{-12x}{-12} > \frac{-8}{-12}$$
$$x > \frac{2}{3},\ \left(\frac{2}{3}, \infty\right)$$

Chapter 2 Vocabulary Check

1. Terms with the same variables raised to exactly the same powers are called like terms.
2. If terms are not like terms, they are unlike terms.
3. A linear equation in one variable can be written in the form $ax + b = c$.
4. A linear inequality in one variable can be written in the form $ax + b < c$, (or $>$, $\le$, $\ge$).
5. Inequalities containing two inequality symbols are called compound inequalities.
6. An equation that describes a known relationship among quantities is called a formula.
7. The numerical coefficient of a term is its numerical factor.
8. Equations that have the same solution are called equivalent equations.
9. The solutions to the equation $x + 5 = x + 5$ are all real numbers.
10. The solution to the equation $x + 5 = x + 4$ is no solution.

11. If both sides of an inequality are multiplied or divided by the same positive number, the direction of the inequality symbol is <u>the same</u>.

12. If both sides of an inequality are multiplied by the same negative number, the direction of the inequality symbol is <u>reversed</u>.

Chapter 2 Review

1. $5x - x + 2x = 6x$

2. $0.2z - 4.6x - 7.4z = -4.6x - 7.2z$

3. $\frac{1}{2}x+3+\frac{7}{2}x-5=\frac{8}{2}x-2=4x-2$

4. $\frac{4}{5}y+1+\frac{6}{5}y+2=\frac{10}{5}y+3=2y+3$

5. $2(n-4)+n-10=2n-8+n-10=3n-18$

6. $3(w+2)-(12-w)=3w+6-12+w=4w-6$

7. $(x+5)-(7x-2)=x+5-7x+2=-6x+7$

8. $$\begin{aligned}(y-0.7)-(1.4y-3) &= y-0.7-1.4y+3\\ &= -0.4y+2.3\end{aligned}$$

9. Three times a number decreased by 7 is $3x - 7$.

10. Twice the sum of a number and 2.8 added to 3 times the number is $2(x + 2.8) + 3x$.

11. $$\begin{aligned}8x+4&=9x\\ 8x+4-8x&=9x-8x\\ 4&=x\end{aligned}$$

12. $$\begin{aligned}5y-3&=6y\\ 5y-3-5y&=6y-5y\\ -3&=y\end{aligned}$$

13. $$\begin{aligned}\frac{2}{7}x+\frac{5}{7}x&=6\\ \frac{7}{7}x&=6\\ x&=6\end{aligned}$$

14. $$\begin{aligned}3x-5&=4x+1\\ -5&=x+1\\ -6&=x\end{aligned}$$

15. $$\begin{aligned}2x-6&=x-6\\ x-6&=-6\\ x&=0\end{aligned}$$

16. $$\begin{aligned}4(x+3)&=3(1+x)\\ 4x+12&=3+3x\\ x+12&=3\\ x&=-9\end{aligned}$$

17. $$\begin{aligned}6(3+n)&=5(n-1)\\ 18+6n&=5n-5\\ 18+n&=-5\\ n&=-23\end{aligned}$$

18. $$\begin{aligned}5(2+x)-3(3x+2)&=-5(x-6)+2\\ 10+5x-9x-6&=-5x+30+2\\ -4x+4&=-5x+32\\ x+4&=32\\ x&=28\end{aligned}$$

19. $$\begin{aligned}x-5&=3\\ x-5+\underline{5}&=3+\underline{5}\\ x&=8\end{aligned}$$

20. $$\begin{aligned}x+9&=-2\\ x+9-\underline{9}&=-2-\underline{9}\\ x&=-11\end{aligned}$$

21. $10 - x$; choice b.

22. $x - 5$; choice a.

23. Complementary angles sum to 90°.
$(90 - x)°$; choice b.

24. Supplementary angles sum to 180°.
$180 - (x + 5) = 180 - x - 5 = 175 - x$
$(175 - x)°$; choice c.

25. $$\begin{aligned}\frac{3}{4}x&=-9\\ \frac{4}{3}\left(\frac{3}{4}x\right)&=\frac{4}{3}(-9)\\ x&=-12\end{aligned}$$

26. $$\begin{aligned}\frac{x}{6}&=\frac{2}{3}\\ 6\cdot\frac{x}{6}&=6\cdot\frac{2}{3}\\ x&=4\end{aligned}$$

27. $$\begin{aligned} -5x &= 0 \\ \frac{-5x}{-5} &= \frac{0}{-5} \\ x &= 0 \end{aligned}$$

28. $$\begin{aligned} -y &= 7 \\ \frac{-y}{-1} &= \frac{7}{-1} \\ y &= -7 \end{aligned}$$

29. $$\begin{aligned} 0.2x &= 0.15 \\ \frac{0.2x}{0.2} &= \frac{0.15}{0.2} \\ x &= 0.75 \end{aligned}$$

30. $$\begin{aligned} \frac{-x}{3} &= 1 \\ -3\cdot\frac{-x}{3} &= -3\cdot 1 \\ x &= -3 \end{aligned}$$

31. $$\begin{aligned} -3x+1 &= 19 \\ -3x &= 18 \\ \frac{-3x}{-3} &= \frac{18}{-3} \\ x &= -6 \end{aligned}$$

32. $$\begin{aligned} 5x+25 &= 20 \\ 5x &= -5 \\ \frac{5x}{5} &= \frac{-5}{5} \\ x &= -1 \end{aligned}$$

33. $$\begin{aligned} 7(x-1)+9 &= 5x \\ 7x-7+9 &= 5x \\ 7x+2 &= 5x \\ 2 &= -2x \\ \frac{2}{-2} &= \frac{-2x}{-2} \\ -1 &= x \end{aligned}$$

34. $$\begin{aligned} 7x-6 &= 5x-3 \\ 2x-6 &= -3 \\ 2x &= 3 \\ \frac{2x}{2} &= \frac{3}{2} \\ x &= \frac{3}{2} \end{aligned}$$

35. $$\begin{aligned} -5x+\frac{3}{7} &= \frac{10}{7} \\ 7\left(-5x+\frac{3}{7}\right) &= 7\cdot\frac{10}{7} \\ -35x+3 &= 10 \\ -35x &= 7 \\ x &= -\frac{7}{35} \\ x &= -\frac{1}{5} \end{aligned}$$

36. $$\begin{aligned} 5x+x &= 9+4x-1+6 \\ 6x &= 4x+14 \\ 2x &= 14 \\ x &= 7 \end{aligned}$$

37. Let x = the first integer, then
$x + 1$ = the second integer, and
$x + 2$ = the third integer.
sum = $x + (x + 1) + (x + 2) = 3x + 3$

38. Let x = the first integer, then
$x + 2$ = the second integer
$x + 4$ = the third integer
$x + 6$ = the fourth integer.
sum = $x + (x + 6) = 2x + 6$

39. $$\begin{aligned} \frac{5}{3}x+4 &= \frac{2}{3}x \\ 3\left(\frac{5}{3}x+4\right) &= 3\left(\frac{2}{3}x\right) \\ 5x+12 &= 2x \\ 12 &= -3x \\ -4 &= x \end{aligned}$$

40. $$\begin{aligned} \frac{7}{8}x+1 &= \frac{5}{8}x \\ 8\left(\frac{7}{8}x+1\right) &= 8\left(\frac{5}{8}x\right) \\ 7x+8 &= 5x \\ 8 &= -2x \\ -4 &= x \end{aligned}$$

41. $$\begin{aligned} -(5x+1) &= -7x+3 \\ -5x-1 &= -7x+3 \\ 2x-1 &= 3 \\ 2x &= 4 \\ x &= 2 \end{aligned}$$

42. $-4(2x+1) = -5x+5$
$-8x-4 = -5x+5$
$-3x-4 = 5$
$-3x = 9$
$x = -3$

43. $-6(2x-5) = -3(9+4x)$
$-12x+30 = -27-12x$
$30 = -27$
There is no solution.

44. $3(8y-1) = 6(5+4y)$
$24y-3 = 30+24y$
$-3 = 30$
There is no solution.

45. $\frac{3(2-z)}{5} = z$
$3(2-z) = 5z$
$6-3z = 5z$
$6 = 8z$
$\frac{6}{8} = z$
$\frac{3}{4} = z$

46. $\frac{4(n+2)}{5} = -n$
$4(n+2) = -5n$
$4n+8 = -5n$
$8 = -9n$
$-\frac{8}{9} = n$

47. $0.5(2n-3)-0.1 = 0.4(6+2n)$
$10[0.5(2n-3)-0.1] = 10[0.4(6+2n)]$
$5(2n-3)-1 = 4(6+2n)$
$10n-15-1 = 24+8n$
$10n-16 = 24+8n$
$2n-16 = 24$
$2n = 40$
$n = 20$

48. $-9-5a = 3(6a-1)$
$-9-5a = 18a-3$
$-9 = 23a-3$
$-6 = 23a$
$-\frac{6}{23} = a$

49. $\frac{5(c+1)}{6} = 2c-3$
$5(c+1) = 6(2c-3)$
$5c+5 = 12c-18$
$-7c+5 = -18$
$-7c = -23$
$c = \frac{23}{7}$

50. $\frac{2(8-a)}{3} = 4-4a$
$2(8-a) = 3(4-4a)$
$16-2a = 12-12a$
$10a+16 = 12$
$10a = -4$
$a = \frac{-4}{10}$
$a = -\frac{2}{5}$

51. $200(70x-3560) = -179(150x-19,300)$
$14,000x-712,000 = -26,850x+3,454,700$
$40,850x-712,000 = 3,454,700$
$40,850x = 4,166,700$
$x = 102$

52. $1.72y-0.04y = 0.42$
$1.68y = 0.42$
$y = 0.25$

53. Let x = length of a side of the square, then
50.5 + 10x = the height.
$x+(50.5+10x) = 7327$
$11x+50.5 = 7327$
$11x = 7276.5$
$x = 661.5$
50.5 + 10x = 50.5 + 10(661.5) = 6665.5
The height is 6665.5 inches.

54. Let x = the length of the shorter piece and
2x = the length of the other.
$x+2x = 12$
$3x = 12$
$x = 4$
2x = 2(4) = 8
The lengths are 4 feet and 8 feet.

55. Let x = the number of Target Canada stores, then $14x - 69$ = the number of Target US stores.
$$\begin{aligned} x+(14x-69) &= 1926 \\ 15x-69 &= 1926 \\ 15x &= 1995 \\ x &= 133 \end{aligned}$$
$14x - 69 = 14(133) - 69 = 1862 - 69 = 1793$
There were 133 Target Canada stores and 1793 Target US stores.

56. Let x = first integer, then
$x + 1$ = second integer, and
$x + 2$ = third integer.
$$\begin{aligned} x+(x+1)+(x+2) &= -114 \\ 3x+3 &= -114 \\ 3x &= -117 \\ x &= -39 \end{aligned}$$
$x + 1 = -39 + 1 = -38$
$x + 2 = -39 + 2 = -37$
The integers are -39, -38, -37.

57. Let x = the unknown number.
$$\begin{aligned} \frac{x}{3} &= x-2 \\ 3\cdot\frac{x}{3} &= 3(x-2) \\ x &= 3x-6 \\ -2x &= -6 \\ x &= 3 \end{aligned}$$
The number is 3.

58. Let x = the unknown number.
$$\begin{aligned} 2(x+6) &= -x \\ 2x+12 &= -x \\ 12 &= -3x \\ -4 &= x \end{aligned}$$
The number is -4.

59. Let $P = 46$ and $l = 14$.
$$\begin{aligned} P &= 2l+2w \\ 46 &= 2(14)+2w \\ 46 &= 28+2w \\ 18 &= 2w \\ 9 &= w \end{aligned}$$

60. Let $V = 192$, $l = 8$, and $w = 6$.
$$\begin{aligned} V &= lwh \\ 192 &= 8(6)h \\ 192 &= 48h \\ 4 &= h \end{aligned}$$

61.
$$\begin{aligned} y &= mx+b \\ y-b &= mx \\ \frac{y-b}{x} &= m \end{aligned}$$

62.
$$\begin{aligned} r &= vst-5 \\ r+5 &= vst \\ \frac{r+5}{vt} &= s \end{aligned}$$

63.
$$\begin{aligned} 2y-5x &= 7 \\ -5x &= -2y+7 \\ x &= \frac{-2y+7}{-5} \\ x &= \frac{2y-7}{5} \end{aligned}$$

64.
$$\begin{aligned} 3x-6y &= -2 \\ -6y &= -3x-2 \\ y &= \frac{-3x-2}{-6} \\ y &= \frac{3x+2}{6} \end{aligned}$$

65.
$$\begin{aligned} C &= \pi D \\ \frac{C}{D} &= \pi \end{aligned}$$

66.
$$\begin{aligned} C &= 2\pi r \\ \frac{C}{2r} &= \pi \end{aligned}$$

67. Let $V = 900$, $l = 20$, and $h = 3$.
$$\begin{aligned} V &= lwh \\ 900 &= 20w(3) \\ 900 &= 60w \\ 15 &= w \end{aligned}$$
The width is 15 meters.

68. Let x = width, then $x + 6$ = length.
$$\begin{aligned} 60 &= 2x+2(x+6) \\ 60 &= 2x+2x+12 \\ 60 &= 4x+12 \\ 48 &= 4x \\ 12 &= x \end{aligned}$$
$x + 6 = 12 + 6 = 18$
The dimensions are 18 feet by 12 feet.

69. Let $d = 10{,}000$ and $r = 125$.

$$\begin{aligned} d &= rt \\ 10{,}000 &= 125t \\ 80 &= t \end{aligned}$$

It will take 80 minutes or 1 hour and 20 minutes.

70. Let $F = 104$.

$$\begin{aligned} C &= \frac{5}{9}(F-32) \\ &= \frac{5}{9}(104-32) \\ &= \frac{5}{9}(72) \\ &= 40 \end{aligned}$$

The temperature was 40°C.

71. Let x = the percent.

$$\begin{aligned} 9 &= x \cdot 45 \\ \frac{9}{45} &= \frac{45x}{45} \\ 0.2 &= x \end{aligned}$$

9 is 20% of 45.

72. Let x = the percent.

$$\begin{aligned} 59.5 &= x \cdot 85 \\ \frac{59.5}{85} &= \frac{85x}{85} \\ 0.7 &= x \end{aligned}$$

59.5 is 70% of 85.

73. Let x = the number.

$$\begin{aligned} 137.5 &= 125\% \cdot x \\ 137.5 &= 1.25x \\ \frac{137.5}{1.25} &= \frac{1.25x}{1.25} \\ 110 &= x \end{aligned}$$

137.5 is 125% of 110.

74. Let x = the number.

$$\begin{aligned} 768 &= 60\% \cdot x \\ 768 &= 0.6x \\ \frac{768}{0.6} &= \frac{0.6x}{0.6} \\ 1280 &= x \end{aligned}$$

768 is 60% of 1280.

75. Let x = mark-up.

$x = 11\% \cdot 1900$

$x = 0.11 \cdot 1900$

$x = 209$

New price = 1900 + 209 = 2109

The mark-up is \$209 and the new price is \$2109.

76. Find 79% of 76,000.
$0.79 \cdot 76{,}000 = 60{,}040$
We would expect 60,040 people in that city to use the Internet.

77. Let x = gallons of 40% solution.

Strength	gallons	Concentration	
40%	x	0.4	$0.4x$
10%	$30 - x$	0.1	$0.1(30 - x)$
20%	30	0.2	$0.2(30)$

$$\begin{aligned} 0.4x + 0.1(30 - x) &= 0.2(30) \\ 0.4x + 3 - 0.1x &= 6 \\ 0.3x + 3 &= 6 \\ 0.3x &= 3 \\ x &= 10 \end{aligned}$$

$30 - x = 30 - 10 = 20$
Mix 10 gallons of 40% acid solution with 20 gallons of 10% acid solution.

78. Increase = $21.0 - 20.7 = 0.3$
Let x = percent.

$$\begin{aligned} 0.3 &= x \cdot 20.7 \\ \frac{0.3}{20.7} &= \frac{20.7x}{20.7} \\ 0.0145 &\approx x \end{aligned}$$

The percent of increase is 1.45%.

79. From the graph, the height of 'Almost hit a car' is 18%.

80. Choose the tallest bar. The most common effect is swerving into another lane.

81. Find 21% of 4600.
$0.21 \cdot 4600 = 966$
We would expect 966 customers to have cut someone off.

82. Find 41% of 4600.
$0.41 \cdot 4600 = 1886$
We would expect 1886 customers to have sped up.

83.
$$\begin{aligned} \text{percent of decrease} &= \frac{\text{amount of decrease}}{\text{original amount}} \\ &= \frac{250 - 170}{250} \\ &= \frac{80}{250} \\ &= 0.32 \end{aligned}$$

The percent of decrease is 32%.

84. Let x = original price.

$$x - 0.20x = 19.20$$
$$0.80x = 19.20$$
$$\frac{0.80x}{0.80} = \frac{19.20}{0.80}$$
$$x = 24$$

The original price was \$24.

85. Let x = time up, then $3 - x$ = time down.

	Rate	· Time	= Distance
Up	10	x	$10x$
Down	50	$3 - x$	$50(3 - x)$

$$d = d$$
$$10x = 50(3 - x)$$
$$10x = 150 - 50x$$
$$60x = 150$$
$$x = 2.5$$

$$\begin{aligned}\text{Total distance} &= 10x + 50(3 - x)\\ &= 10(2.5) + 50(3 - 2.5)\\ &= 25 + 50(0.5)\\ &= 25 + 25\\ &= 50\end{aligned}$$

The distance traveled was 50 km.

86. Let x = the amount invested at 10.5% for one year.

	Principal	· Rate =	Interest
10.5%	x	0.105	0.105
8.5%	$50{,}000 - x$	0.085	$0.085(50{,}000 - x)$
Total	50,000		4550

$$0.105x + 0.085(50{,}000 - x) = 4550$$
$$0.105x + 4250 - 0.085x = 4550$$
$$0.02x + 4250 = 4550$$
$$0.02x = 300$$
$$x = 15{,}000$$

$50{,}000 - x = 50{,}000 - 15{,}000 = 35{,}000$

Invest \$35,000 at 8.5% and \$15,000 at 10.5%.

87. Let x = the number of dimes,
$2x$ = the number of quarters, and
$500 - x - 2x$ the number of nickels.

	No. of Coins ·	Value =	Amt. of Money
Dimes	x	0.1	$0.1x$
Quarters	$2x$	0.25	$0.25(2x)$
Nickels	$500 - 3x$	0.05	$0.05(500 - 3x)$
Total	500		88

$$
\begin{aligned}
0.1x + 0.25(2x) + 0.05(500 - 3x) &= 88 \\
0.1x + 0.5x + 25 - 0.15x &= 88 \\
0.45x + 25 &= 88 \\
0.45x &= 63 \\
x &= 140
\end{aligned}
$$

$500 - 3x = 500 - 3(140) = 500 - 420 = 80$
There were 80 nickels in the pay phone.

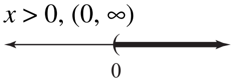
88. Let x = the time traveled by the Amtrak train.

	Rate ·	Time =	Distance
Amtrak	60	x	$60x$
Freight	45	$x + 1.5$	$45(x + 1.5)$

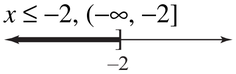
$$
\begin{aligned}
d &= d \\
60x &= 45(x + 1.5) \\
60x &= 45x + 67.5 \\
15x &= 67.5 \\
x &= 4.5
\end{aligned}
$$

It will take 4.5 hours.

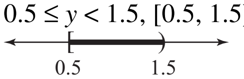
89. $x > 0$, $(0, \infty)$



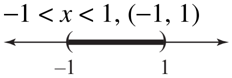
90. $x \le -2$, $(-\infty, -2]$



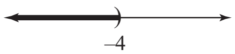
91. $0.5 \le y < 1.5$, $[0.5, 1.5)$



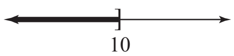
92. $-1 < x < 1$, $(-1, 1)$



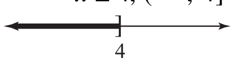
93. $-3x > 12$
$\frac{-3x}{-3} < \frac{12}{-3}$
$x < -4, \ (-\infty, -4)$



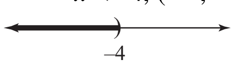
94. $-2x \geq -20$
$\frac{-2x}{-2} \leq \frac{-20}{-2}$
$x \leq 10, \ (-\infty, 10]$



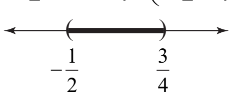
95. $x + 4 \geq 6x - 16$
$-5x + 4 \geq -16$
$-5x \geq -20$
$\frac{-5x}{-5} \leq \frac{-20}{-5}$
$x \leq 4, \ (-\infty, 4]$



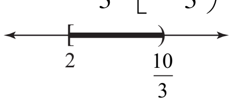
96. $5x - 7 > 8x + 5$
$-3x - 7 > 5$
$-3x > 12$
$\frac{-3x}{-3} < \frac{12}{-3}$
$x < -4, \ (-\infty, -4)$



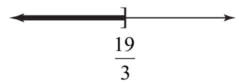
97. $-3 < 4x - 1 < 2$
$-2 < 4x < 3$
$-\frac{1}{2} < x < \frac{3}{4}, \ \left(-\frac{1}{2}, \frac{3}{4}\right)$



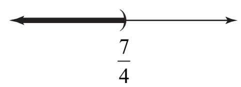
98. $2 \leq 3x - 4 < 6$
$6 \leq 3x < 10$
$2 \leq x < \frac{10}{3}, \ \left[2, \frac{10}{3}\right)$



99. $4(2x - 5) \leq 5x - 1$
$8x - 20 \leq 5x - 1$
$3x - 20 \leq -1$
$3x \leq 19$
$x \leq \frac{19}{3}, \ \left(-\infty, \frac{19}{3}\right]$



100. $-2(x - 5) > 2(3x - 2)$
$-2x + 10 > 6x - 4$
$-8x + 10 > -4$
$-8x > -14$
$\frac{-8x}{-8} < \frac{-14}{-8}$
$x < \frac{7}{4}, \ \left(-\infty, \frac{7}{4}\right)$



101. Let x = the amount of sales then $0.05x$ = her commission.
$175 + 0.05x \geq 300$
$0.05x \geq 125$
$x \geq 2500$
Sales must be at least \$2500.

102. Let x = her score on the fourth round.
$\frac{76 + 82 + 79 + x}{4} < 80$
$237 + x < 320$
$x < 83$
Her score must be less than 83.

103. $6x + 2x - 1 = 5x + 11$
$8x - 1 = 5x + 11$
$3x - 1 = 11$
$3x = 12$
$x = 4$

104. $2(3y - 4) = 6 + 7y$
$6y - 8 = 6 + 7y$
$-8 = 6 + y$
$-14 = y$

105. $4(3-a)-(6a+9)=-12a$
$12-4a-6a-9=-12a$
$3-10a=-12a$
$3=-2a$
$-\frac{3}{2}=a$

106. $\frac{x}{3}-2=5$
$\frac{x}{3}=7$
$3\cdot\frac{x}{3}=3\cdot 7$
$x=21$

107. $2(y+5)=2y+10$
$2y+10=2y+10$
$10=10$
All real numbers are solutions.

108. $7x-3x+2=2(2x-1)$
$4x+2=4x-2$
$2=-2$
There is no solution.

109. Let x = the number.
$6+2x=x-7$
$6+x=-7$
$x=-13$
The number is −13.

110. Let x = length of shorter piece, then
$4x + 3$ = length of longer piece.
$x+(4x+3)=23$
$5x+3=23$
$5x=20$
$x=4$
$4x + 3 = 4(4) + 3 = 19$
The shorter piece is 4 inches and the longer piece is 19 inches.

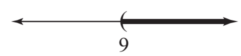
111. $V=\frac{1}{3}Ah$
$3\cdot V=3\cdot\frac{1}{3}Ah$
$3V=Ah$
$\frac{3V}{A}=\frac{Ah}{A}$
$\frac{3V}{A}=h$

112. Let x = the number.
$x = 26\% \cdot 85$
$x = 0.26 \cdot 85$
$x = 22.1$
22.1 is 26% of 85.

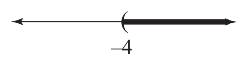
113. Let x = the number.
$72=45\%\cdot x$
$72=0.45x$
$\frac{72}{0.45}=\frac{0.45x}{0.45}$
$160=x$
72 is 45% of 160.

114. Increase = 282 − 235 = 47
Let x = percent.
$47=x\cdot 235$
$\frac{47}{235}=\frac{235x}{235}$
$0.2=x$
The percent of increase is 20%.

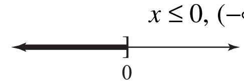
115. $4x-7>3x+2$
$x-7>2$
$x>9$, $(9, \infty)$



116. $-5x<20$
$\frac{-5x}{-5}>\frac{20}{-5}$
$x>-4$, $(-4, \infty)$



117. $-3(1+2x)+x\ge-(3-x)$
$-3-6x+x\ge-3+x$
$-3-5x\ge-3+x$
$-5x\ge x$
$-6x\ge 0$
$\frac{-6x}{-6}\le\frac{0}{-6}$
$x\le 0$, $(-\infty, 0]$



Chapter 2 Getting Ready for the Test

1. There is no equal sign, so this is not an equation that can be solved. Also, there is only one term that cannot be further simplified. Thus the best direction is to identify the numerical coefficient; C.

2. This is an equation that can be solved; A.

3. Two terms are given, so the best direction is to determine whether the given terms are like or unlike terms; D.

4. There is no equal sign, so this is not an equation that can be solved—it is an expression that can be simplified; B.

5. Subtracting $100z$ from $8m$ translates to $8m - 100z$; B.

6. Subtracting $7x - 1$ from $9y$ translates to $9y - (7x - 1)$; C.

7.
$$\begin{aligned} 7x+6 &= 7x+9 \\ 7x-7x+6 &= 7x-7x+9 \\ 6 &= 9 \quad \text{False} \end{aligned}$$
The equation has no solution; B.

8.
$$\begin{aligned} 2y-5 &= 2y-5 \\ 2y-2y-5 &= 2y-2y-5 \\ -5 &= -5 \quad \text{True} \end{aligned}$$
The equation has all real numbers as solutions; A.

9.
$$\begin{aligned} 11x-13 &= 10x-13 \\ 11x-10x-13 &= 10x-10x-13 \\ x-13 &= -13 \\ x-13+13 &= -13+13 \\ x &= 0 \end{aligned}$$
The solution is 0; C.

10.
$$\begin{aligned} x+15 &= -x+15 \\ x+x+15 &= -x+x+15 \\ 2x+15 &= 15 \\ 2x+15-15 &= 15-15 \\ 2x &= 0 \\ \frac{2x}{2} &= \frac{0}{2} \\ x &= 0 \end{aligned}$$
The solution is 0; C.

11. $5(3x - 2) = 5 \cdot 3x - 5 \cdot 2 = 15x - 10$
$$\begin{aligned} -(x+20) &= -1(x+20) \\ &= -1\cdot x + (-1)\cdot 20 \\ &= -x-20 \end{aligned}$$
The resulting equation is $15x - 10 = -x - 20$; B.

12.
$$\begin{aligned} 30\left(\frac{8x}{3}+1\right) &= 30\cdot\frac{8x}{3}+30\cdot 1 \\ &= 10\cdot 8x+30 \\ &= 80x+30 \end{aligned}$$
$$30\left(\frac{x-2}{10}\right) = 3(x-2) = 3\cdot x - 3\cdot 2 = 3x-6$$
The simplified equation is $80x + 30 = 3x - 6$; D.

Chapter 2 Test

1. $2y - 6 - y - 4 = y - 10$

2. $2.7x + 6.1 + 3.2x - 4.9 = 5.9x + 1.2$

3.
$$\begin{aligned} 4(x-2)-3(2x-6) &= 4x-8-6x+18 \\ &= -2x+10 \end{aligned}$$

4. $7 + 2(5y - 3) = 7 + 10y - 6 = 10y + 1$

5.
$$\begin{aligned} -\frac{4}{5}x &= 4 \\ -\frac{5}{4}\cdot\left(-\frac{4}{5}x\right) &= -\frac{5}{4}\cdot 4 \\ x &= -5 \end{aligned}$$

6.
$$\begin{aligned} 4(n-5) &= -(4-2n) \\ 4n-20 &= -4+2n \\ 2n-20 &= -4 \\ 2n &= 16 \\ n &= 8 \end{aligned}$$

7.
$$\begin{aligned} 5y-7+y &= -(y+3y) \\ 6y-7 &= -4y \\ -7 &= -10y \\ \frac{7}{10} &= y \end{aligned}$$

8.
$$\begin{aligned} 4z+1-z &= 1+z \\ 3z+1 &= 1+z \\ 2z+1 &= 1 \\ 2z &= 0 \\ z &= 0 \end{aligned}$$

9.
$$\begin{aligned} \frac{2(x+6)}{3} &= x-5 \\ 2(x+6) &= 3(x-5) \\ 2x+12 &= 3x-15 \\ 12 &= x-15 \\ 27 &= x \end{aligned}$$

10.
$$\begin{aligned}\frac{1}{2}-x+\frac{3}{2}&=x-4\\ 2\left(\frac{1}{2}-x+\frac{3}{2}\right)&=2(x-4)\\ 1-2x+3&=2x-8\\ -2x+4&=2x-8\\ -4x+4&=-8\\ -4x&=-12\\ x&=3\end{aligned}$$

11.
$$\begin{aligned}-0.3(x-4)+x&=0.5(3-x)\\ 10[-0.3(x-4)+x]&=10[0.5(3-x)]\\ -3(x-4)+10x&=5(3-x)\\ -3x+12+10x&=15-5x\\ 7x+12&=15-5x\\ 12x+12&=15\\ 12x&=3\\ x&=\frac{3}{12}=\frac{1}{4}=0.25\end{aligned}$$

12.
$$\begin{aligned}-4(a+1)-3a&=-7(2a-3)\\ -4a-4-3a&=-14a+21\\ -7a-4&=-14a+21\\ 7a-4&=21\\ 7a&=25\\ a&=\frac{25}{7}\end{aligned}$$

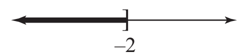
13.
$$\begin{aligned}-2(x-3)&=x+5-3x\\ -2x+6&=-2x+5\\ 6&=5\end{aligned}$$
There is no solution.

14. Let $y=-14$, $m=-2$, and $b=-2$.
$$\begin{aligned}y&=mx+b\\ -14&=-2x-2\\ -12&=-2x\\ 6&=x\end{aligned}$$

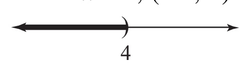
15.
$$\begin{aligned}V&=\pi r^2h\\ \frac{V}{\pi r^2}&=\frac{\pi r^2h}{\pi r^2}\\ \frac{V}{\pi r^2}&=h\end{aligned}$$

16.
$$\begin{aligned}3x-4y&=10\\ -4y&=-3x+10\\ y&=\frac{-3x+10}{-4}\\ y&=\frac{3x-10}{4}\end{aligned}$$

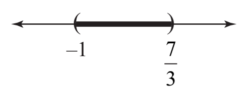
17.
$$\begin{aligned}3x-5&\ge 7x+3\\ -4x-5&\ge 3\\ -4x&\ge 8\\ \frac{-4x}{-4}&\le\frac{8}{-4}\\ x&\le -2,\ (-\infty,-2]\end{aligned}$$



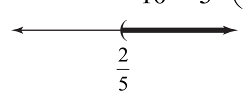
18.
$$\begin{aligned}x+6&>4x-6\\ -3x+6&>-6\\ -3x&>-12\\ \frac{-3x}{-3}&<\frac{-12}{-3}\\ x&<4,\ (-\infty,4)\end{aligned}$$



19.
$$\begin{aligned}&-2<3x+1<8\\ &-3<3x<7\\ &-1<x<\frac{7}{3},\ \left(-1,\frac{7}{3}\right)\end{aligned}$$



20.
$$\begin{aligned}\frac{2(5x+1)}{3}&>2\\ 2(5x+1)&>6\\ 10x+2&>6\\ 10x&>4\\ x&>\frac{4}{10}=\frac{2}{5},\ \left(\frac{2}{5},\infty\right)\end{aligned}$$



21. Let x = the number.

$$x+\frac{2}{3}x=35$$
$$3\left(x+\frac{2}{3}x\right)=3(35)$$
$$3x+2x=105$$
$$5x=105$$
$$x=21$$

The number is 21.

22. Let x = width, then $x + 2$ = length.

$$P=2w+2l$$
$$252=2x+2(x+2)$$
$$252=2x+2x+4$$
$$252=4x+4$$
$$252-4=4x+4-4$$
$$248=4x$$
$$\frac{248}{4}=\frac{4x}{4}$$
$$62=x$$

$64 = x + 2$

The dimensions of the deck are 62 feet by 64 feet.

23. Let x = one area code, then $2x$ = other area code.

$$x+2x=1203$$
$$3x=1203$$
$$\frac{3x}{3}=\frac{1203}{3}$$
$$x=401$$

$2x = 2(401) = 802$

The area codes are 401 and 802.

24. Let x = the amount invested at 10% for one year.

Principal · Rate = Interest

10%	x	0.10	$0.1x$
12%	$2x$	0.12	$0.12(2x)$
Total			2890

$$0.1x+0.12(2x)=2890$$
$$0.1x+0.24x=2890$$
$$0.34x=2890$$
$$x=8500$$

$2x = 2(8500) = 17,000$

He invested \$8500 at 10% and \$17,000 at 12%.

25. Let x = the time they travel.

Rate · Time = Distance

Train 1	50	x	$50x$
Train 2	64	x	$64x$
Total			285

$$50x+64x=285$$
$$114x=285$$
$$x=2\frac{1}{2}$$

They must travel for $2\frac{1}{2}$ hours.

26. From the graph, 69% are classified as weak.
Find 69% of 800.
69% · 800 = 0.69 · 800 = 552
You would expect 552 of the 800 to be classified as weak.

27. Let x be the unknown percent.

$$72=x\cdot 180$$
$$\frac{72}{180}=\frac{180x}{180}$$
$$0.4=x$$

72 is 40% of 180.

28.
$$\text{percent of decrease}=\frac{\text{amount of decrease}}{\text{original amount}}=\frac{225-189}{225}=\frac{36}{225}=0.16$$

The percent of decrease is 16%.

Chapter 2 Cumulative Review

1. **a.** The natural numbers are 11 and 112.

b. The whole numbers are 0, 11, and 112.

c. The integers are −3, −2, 0, 11, and 112.

d. The rational numbers are −3, −2, −1.5, 0, $\frac{1}{4}$, 11, and 112.

e. The irrational number is $\sqrt{2}$.

f. All the numbers in the given set are real numbers.

2. a. The natural numbers are 2, 7, and 8.

b. The whole numbers are 0, 2, 7, and 8.

c. The integers are −185, 0, 2, 7, and 8.

d. The rational numbers are −185, $-\frac{1}{5}$, 0, 2, 7, and 8.

e. The irrational number is $\sqrt{3}$.

f. All the numbers in the given set are real numbers.

3. a. $|4| = 4$

b. $|-5| = 5$

c. $|0| = 0$

d. $\left|-\frac{1}{2}\right| = \frac{1}{2}$

e. $|5.6| = 5.6$

4. a. $|5| = 5$

b. $|-8| = 8$

c. $\left|-\frac{2}{3}\right| = \frac{2}{3}$

5. a. $40 = 2 \cdot 2 \cdot 2 \cdot 5$

b. $63 = 3 \cdot 3 \cdot 7$

6. a. $44 = 2 \cdot 2 \cdot 11$

b. $90 = 2 \cdot 3 \cdot 3 \cdot 5$

7. $\frac{2}{5} = \frac{2}{5} \cdot \frac{4}{4} = \frac{8}{20}$

8. $\frac{2}{3} = \frac{2}{3} \cdot \frac{8}{8} = \frac{16}{24}$

9.
$$\begin{aligned} 3[4+2(10-1)] &= 3[4+2(9)] \\ &= 3[4+18] \\ &= 3[22] \\ &= 66 \end{aligned}$$

10.
$$\begin{aligned} 5[16-4(2+1)] &= 5[16-4(3)] \\ &= 5[16-12] \\ &= 5[4] \\ &= 20 \end{aligned}$$

11. Let $x = 2$.
$$\begin{aligned} 3x+10 &= 8x \\ 3(2)+10 &\stackrel{?}{=} 8(2) \\ 6+10 &\stackrel{?}{=} 16 \\ 16 &= 16 \end{aligned}$$
2 is a solution of the equation.

12. Let $x = 3$.
$$\begin{aligned} 5x-2 &= 4x \\ 5(3)-2 &\stackrel{?}{=} 4(3) \\ 15-2 &\stackrel{?}{=} 12 \\ 13 &\neq 12 \end{aligned}$$
3 is not a solution of the equation.

13. $-1 + (-2) = -3$

14. $(-2) + (-8) = -10$

15. $-4 + 6 = 2$

16. $-3 + 10 = 7$

17. a. $-(-10) = 10$

b. $-\left(-\frac{1}{2}\right) = \frac{1}{2}$

c. $-(-2x) = 2x$

d. $-|-6| = -(6) = -6$

18. a. $-(-5) = 5$

b. $-\left(-\frac{2}{3}\right) = \frac{2}{3}$

c. $-(-a) = a$

d. $-|-3| = -(3) = -3$

19. a. $5.3 - (-4.6) = 5.3 + 4.6 = 9.9$

b. $-\frac{3}{10}-\frac{5}{10}=-\frac{3}{10}+\left(-\frac{5}{10}\right)$
$=\frac{-3-5}{10}$
$=-\frac{8}{10}$
$=-\frac{4}{5}$

c. $-\frac{2}{3}-\left(-\frac{4}{5}\right)=-\frac{2}{3}\cdot\frac{5}{5}+\frac{4}{5}\cdot\frac{3}{3}$
$=-\frac{10}{15}+\frac{12}{15}$
$=\frac{2}{15}$

20. a. $-2.7-8.4=-2.7+(-8.4)=-11.1$

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

c. $\frac{1}{4}-\left(-\frac{1}{2}\right)=\frac{1}{4}+\frac{1}{2}\cdot\frac{2}{2}=\frac{1}{4}+\frac{2}{4}=\frac{3}{4}$

21. a. $x=90-38=90+(-38)=52$
The complementary angle is 52°.

b. $y=180-62=180+(-62)=118$
The supplementary angle is 118°.

22. a. $x=90-72=90+(-72)=18$
The complementary angle is 18°.

b. $y=180-47=180+(-47)=133$
The supplementary angle is 133°.

23. a. $(-1.2)(0.05)=-0.06$

b. $\frac{2}{3}\cdot\left(-\frac{7}{10}\right)=-\frac{2\cdot 7}{3\cdot 10}=-\frac{14}{30}=-\frac{7}{15}$

c. $\left(-\frac{4}{5}\right)(-20)=\frac{4\cdot 20}{5}=\frac{80}{5}=16$

24. a. $(4.5)(-0.08)=-0.36$

b. $-\frac{3}{4}\cdot\left(-\frac{8}{17}\right)=\frac{3\cdot 8}{4\cdot 17}=\frac{24}{68}=\frac{6}{17}$

25. a. $\frac{-24}{-4}=6$

b. $\frac{-36}{3}=-12$

c. $\frac{2}{3}\div\left(-\frac{5}{4}\right)=\frac{2}{3}\left(-\frac{4}{5}\right)=-\frac{8}{15}$

d. $-\frac{3}{2}\div 9=-\frac{3}{2}\div\frac{9}{1}=-\frac{3}{2}\cdot\frac{1}{9}=-\frac{3}{18}=-\frac{1}{6}$

26. a. $\frac{-32}{8}=-4$

b. $\frac{-108}{-12}=9$

c. $-\frac{5}{7}\div\left(\frac{-9}{2}\right)=-\frac{5}{7}\left(-\frac{2}{9}\right)=\frac{10}{63}$

27. a. $x+5=5+x$

b. $3\cdot x=x\cdot 3$

28. a. $y+1=1+y$

b. $y\cdot 4=4\cdot y$

29. a. $8\cdot 2+8\cdot x=8(2+x)$

b. $7s+7t=7(s+t)$

30. a. $4\cdot y+4\cdot\frac{1}{3}=4\left(y+\frac{1}{3}\right)$

b. $0.10x+0.10y=0.10(x+y)$

31. $(2x-3)-(4x-2)=2x-3-4x+2=-2x-1$

32. $(-5x+1)-(10x+3)=-5x+1-10x-3$
$=-15x-2$

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

34.
$$\begin{aligned} \frac{5}{6}+x &= \frac{2}{3} \\ 6\left(\frac{5}{6}\right)+6(x) &= 6\left(\frac{2}{3}\right) \\ 5+6x &= 4 \\ 6x &= -1 \\ x &= -\frac{1}{6} \end{aligned}$$

35.
$$\begin{aligned} 6(2a-1)-(11a+6) &= 7 \\ 12a-6-11a-6 &= 7 \\ a-12 &= 7 \\ a &= 19 \end{aligned}$$

36.
$$\begin{aligned} -3x+1-(-4x-6) &= 10 \\ -3x+1+4x+6 &= 10 \\ x+7 &= 10 \\ x &= 3 \end{aligned}$$

37.
$$\begin{aligned} \frac{y}{7} &= 20 \\ y &= 140 \end{aligned}$$

38.
$$\begin{aligned} \frac{x}{4} &= 18 \\ x &= 72 \end{aligned}$$

39.
$$\begin{aligned} 4(2x-3)+7 &= 3x+5 \\ 8x-12+7 &= 3x+5 \\ 8x-5 &= 3x+5 \\ 5x-5 &= 5 \\ 5x &= 10 \\ x &= 2 \end{aligned}$$

40.
$$\begin{aligned} 6x+5 &= 4(x+4)-1 \\ 6x+5 &= 4x+16-1 \\ 6x+5 &= 4x+15 \\ 2x+5 &= 15 \\ 2x &= 10 \\ x &= 5 \end{aligned}$$

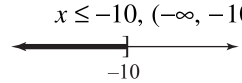
41. Let x = a number.
$$\begin{aligned} 2(x+4) &= 4x-12 \\ 2x+8 &= 4x-12 \\ 8 &= 2x-12 \\ 20 &= 2x \\ 10 &= x \end{aligned}$$
The number is 10.

42. Let x = a number.
$$\begin{aligned} x+4 &= 3x-8 \\ 4 &= 2x-8 \\ 12 &= 2x \\ 6 &= x \end{aligned}$$
The number is 6.

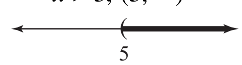
43.
$$\begin{aligned} V &= lwh \\ \frac{V}{wh} &= \frac{lwh}{wh} \\ \frac{V}{wh} &= l \end{aligned}$$

44.
$$\begin{aligned} C &= 2\pi r \\ \frac{C}{2\pi} &= \frac{2\pi r}{2\pi} \\ \frac{C}{2\pi} &= r \end{aligned}$$

45. $x+4 \le -6$
$x \le -10$, $(-\infty, -10]$



46. $x-3 > 2$
$x > 5$, $(5, \infty)$



Additional Exercises 1.2

Name ________________________

Date ________________________

Insert <, >, or = to make a true statement.

1. 0 ______ 44 — **1.** ________________

2. 3.05 ______ 3.5 — **2.** ________________

3. $|-4|$ ______ $|-3|$ — **3.** ________________

4. $|-1|$ ______ -1 — **4.** ________________

5. The angles of a particular triangle are 90º, 60º, and 30º. Use an inequality symbol (≤ or ≥) to represent the relationship between the angles of the triangle from smallest to largest. — **5.** ________________

Tell whether each statement is true or false.

6. $15 \le 17$ — **6.** ________________

7. $-2.4 \ge -8.1$ — **7.** ________________

8. $\frac{3}{4} \le -\frac{3}{4}$ — **8.** ________________

9. $-\frac{5}{8} \ge -\frac{5}{8}$ — **9.** ________________

10. $0 \ge -7$ — **10.** ________________

Rewrite the following inequalities so that the inequality symbol points in the opposite direction and the resulting statement has the same meaning as the given one.

11. $\frac{1}{2} \ge -\frac{1}{2}$ — **11.** ________________

12. $7 > 2$ — **12.** ________________

Use integers to represent the values in each sentence.

13. Victoria wrote a check for $275. Then at the end of the week, she deposited $700. — **13.** ________________

14. Garrett was at the quarry practicing for his diving certification. During his dive, he descended 27 feet, and later descended another 20 feet. — **14** ________________

Additional Exercises 1.2 *(cont.)*

Name ________________________

Given the set $\left\{\sqrt{15}, \frac{3}{4}, 24, -6.\bar{1}, 0, -25, 7.5, -\sqrt{3}\right\}$, list the numbers in this set that belong to the set of:

15. natural numbers

16. whole numbers

17. integers

18. rational numbers

19. irrational numbers

20. real numbers

15. ____________________________

16. ____________________________

17. ____________________________

18. ____________________________

19. ____________________________

20. ____________________________

Additional Exercises 1.3

Name ______________________

Date ______________________

1. Write each number as a product of primes.

a. 27 **d.** 375

b. 24 **e.** 200

c. 180 **f.** 910

1a.__________ **1d.**__________

1b.__________ **1e.**__________

1c.__________ **1f.**__________

Write each fraction as an equivalent fraction with the given denominator.

2. $\frac{2}{3}$ with a denominator of 48

3. $\frac{4}{5}$ with a denominator of 50

4. $\frac{5}{4}$ with a denominator of 24

2. ______________________

3. ______________________

4. ______________________

Write each fraction in lowest terms.

5. $\frac{36}{9}$

6. $\frac{150}{300}$

7. $\frac{0}{28}$

8. $\frac{66}{0}$

9. $\frac{120}{510}$

10. $\frac{76}{1}$

5. ______________________

6. ______________________

7. ______________________

8. ______________________

9. ______________________

10. ______________________

Perform the indicated operations and simplify.

11. $\frac{2}{3} \cdot \frac{8}{9}$

12. $\frac{2}{3} \cdot \frac{21}{66}$

13. $1\frac{3}{7} \cdot 2\frac{4}{5}$

11. ______________________

12. ______________________

13. ______________________

Additional Exercises 1.3 *(cont.)*

Name ________________________

14. $6\frac{2}{5} \div 1\frac{1}{15}$

15. $\frac{13}{15} + \frac{7}{15}$

16. $\frac{4}{5} + \frac{3}{20}$

17. $16\frac{3}{4} + 12\frac{1}{2}$

18. $\frac{15}{16} - \frac{3}{16}$

19. $\frac{7}{8} - \frac{2}{3}$

20. $100 - 12\frac{3}{5}$

14. ________________________

15. ________________________

16. ________________________

17. ________________________

18. ________________________

19. ________________________

20. ________________________

Additional Exercises 1.4

Name ______________________

Date ______________________

Evaluate.

1. $\left(\frac{5}{4}\right)^3$ 1. ______________

2. 5^3 2. ______________

3. $(0.1)^3$ 3. ______________

Simplify each expression.

4. $3^2 + 4 \cdot 6$ 4. ______________

5. $|7-3|^3 - 2 \cdot 2^3$ 5. ______________

6. $5 + 2\{15 - 3(4-2) + 12\}$ 6. ______________

7. $\dfrac{10 + |10-2| + 2^3}{5^2 - 12}$ 7. ______________

Evaluate each expression if $x = 4, y = 3,$ and $z = 1$.

8. $5z - y$ 8. ______________

9. $\dfrac{x}{4y}$ 9. ______________

10. $|5y - x|$ 10. ______________

11. $xy + z^4$ 11. ______________

Decide whether the given number is a solution to the equation.

12. $\frac{1}{5}x = 30;\ 6$ 12. ______________

13. $x + 15 = x + 3;\ 0$ 13. ______________

Additional Exercises 1.4 *(cont.)*

Name ________________________

Write each phrase as an algebraic expression. Let *x* represent the unknown number.

14. Four added to a number

15 Three less than twice a number

Write each sentence as an equation. Use *x* to represent any unknown number.

16. The difference of a number and 6 is 12.

17. The sum of 14 and two times a number is 56.

18. Sixteen subtracted from a number is 23.

19. The quotient of a number and 4 is equal to three squared.

20. Three times a number increased by 15 is negative forty-five.

14. ________________________

15. ________________________

16. ________________________

17. ________________________

18. ________________________

19. ________________________

20. ________________________

Additional Exercises 1.5

Name ______________________

Date ______________________

Add.

1. $(-18)+12+(-4)$

2. $(-20)+(-8)+(-4)$

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

4. $-\frac{5}{12}+\left(-\frac{1}{4}\right)$

5. $-|-5+(-3)|+|-14|+(-2)$

6. $\frac{-50+|-6+(-14)|+|-3+8|}{5^5}$

7. $|6+(-14)|+|-3+(-8)|$

8. Find the sum of -40 and (-5.3).

9. Find the sum of –37 and 22.

Find the additive inverse or the opposite.

10. -0.45

11. $\left|-\frac{3}{4}\right|$

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

13. 0

Simplify the following.

14. $\left|-\frac{9}{10}\right|$

15. $-|-4|$

1. ______________________
2. ______________________
3. ______________________
4. ______________________
5. ______________________
6. ______________________
7. ______________________
8. ______________________
9. ______________________
10. ______________________
11. ______________________
12. ______________________
13. ______________________
14. ______________________
15. ______________________

Name ______________________

16. If p is a positive number and q is a negative number, will the sum of p and the opposite of q be a positive or negative number?

16. ______________________

17. If p is a positive number and q is a negative number, will the sum of the opposite of p added to q be a positive or negative number?

17. ______________________

18. Randall's stock was erratic for an entire week. Find the value of the stock at the end of the week.

18. ______________________

Prize Stock	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
$344	↑	↓	↓	↑	↓	↑
	$47	$70	$100	$33	$65	$150

19. If the decreases are added, what will be the total in decreases for the week?

19. ______________________

20. If the increases are added, what will be the total in increases for the week?

20. ______________________

Additional Exercises 1.6

Name ______________________

Date ______________________

Write each phrase as an expression and simplify.

1. Subtract 15 from negative 14.

2. Subtract negative nine from negative 24.

3. Find the difference between negative four and negative 13.

4. Decrease 25 by negative 22.

Decide whether the given number is a solution of the given equation.

5. $9 - x = 5;\ -4$

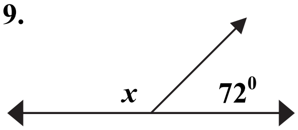
6. $-x + 3 = -2x - 3;\ -6$

7. $-2x + 5 = -2x - 1;\ 0$

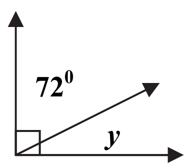
8. $-2x - 1 = -2x - 1;\ 0$

Find the measure of each unknown complementary and supplementary angle.

9.



10.



Simplify each expression. (Remember the order of operations.)

11. $-|-6-5| - 13 + (-5+15)$

12. $|-3|^3 + 5^2 - 4^2$

13. $\dfrac{|-2| + (6-3)^2}{7-(-4)}$

14. $4 - 8(4-9)$

1. ______________________

2. ______________________

3. ______________________

4. ______________________

5. ______________________

6. ______________________

7. ______________________

8. ______________________

9. ______________________

10. ______________________

11. ______________________

12. ______________________

13. ______________________

14. ______________________

Additional Exercises 1.6 *(cont.)*

Name ______________________

15. In 1943, the temperature in Spearhead was -4° at 7:30 am. Two minutes later the temperature was 45° above zero. What was this sudden rise in temperature that still holds a world record?

15. ______________________

16. The lowest temperature ever recorded in the contiguous 48 states was -69.7 degrees Fahrenheit on January 20, 1954. The highest temperature ever recorded in the contiguous 48 states was 134 degrees Fahrenheit recorded at Death Valley, California. What is the difference between the lowest and the highest recorded temperatures?

16. ______________________

If r is a positive number and s is a negative number, decide if each statement is true or false.

17. $|r|-|s|$ is always a negative number.

17. ______________________

18. $r-(-s)$ is always a positive number.

18. ______________________

Find the value of each expression when $x=4, y=-3,$ and $z=-5.$

19. $\dfrac{x-y}{z-2}$

19. ______________________

20. y^2-z^2-x

20. ______________________

Additional Exercises 1.7

Name ________________________

Date ________________________

Multiply.

1. $-5(-3)$

2. $-16(2)$

3. $-14(0)$

4. $-\frac{1}{5}\left(-\frac{5}{7}\right)$

5. $4.1(-2.2)(-1)$

Evaluate.

6. -4^2

7. $\left(-\frac{4}{7}\right)^2$

8. Find the reciprocal of -3.

9. Find the reciprocal of $\frac{5}{12}$.

Divide.

10. $-44 \div 11$

11. $\frac{25}{-15}$

12. $-\frac{5}{8} \div -\frac{3}{4}$

13. $\frac{-15}{0}$

14. $\frac{0 \cdot (-3)}{-5}$

1. ________________________
2. ________________________
3. ________________________
4. ________________________
5. ________________________
6. ________________________
7. ________________________
8. ________________________
9. ________________________
10. ________________________
11. ________________________
12. ________________________
13. ________________________
14. ________________________

Additional Exercises 1.7 *(cont.)*

Name ________________________

Use the order of operations to evaluate each expression.

15. $\dfrac{-14(-2)-(-23)(-1)}{\left|-10+(-3)^2\right|}$

15. ________________________

16. $(-4)^3 \div (-2)^3 - 3(-5)^2$

16. ________________________

Evaluate each expression when $x=-3, y=-5,$ and $z=2$.

17. $-5x+4y-3z$

17. ________________________

18. $\dfrac{x^2-y^2}{z^3}$

18. ________________________

19. A deck and a patio have a set of stairs connecting them. Each step is six inches high and there are 20 steps. Represent the drop in height from the deck to the patio as a product of signed numbers and find the total drop in height.

19. ________________________

20. A company is having financial difficulties. As a result of this, the price of the company's stock has gone down \$3 a day for five consecutive days. Represent the total amount the stock's price has gone down as a product of signed numbers and find the total amount.

20. ________________________

Additional Exercises 1.8

Name ______________________

Date ______________________

Use the commutative property to rewrite each statement.

1. $-4 \cdot a$

2. $4 + y$

Use the associative property to rewrite each statement.

3. $(xy) \cdot z$

4. $3x + (y + 4)$

Use the commutative and associative properties to simplify each expression.

5. $(12 + x) + 5$

6. $-\frac{7}{8}\left(\frac{8}{7}r\right)$

Use the distributive property to write each expression without parentheses. Then simplify the results.

7. $2(3x - 7)$

8. $-5(x - 4)$

9. $-\frac{1}{2}(10 - 16z)$

10. $-4(x + 3) - 14$

Use the distributive property to write the sum as a product.

11. $3x - 3y$

Find the additive inverse or opposite of each of the following numbers.

12. $\frac{2}{7}$

13. $-|-5|$

1. ______________________

2. ______________________

3. ______________________

4. ______________________

5. ______________________

6. ______________________

7. ______________________

8. ______________________

9. ______________________

10. ______________________

11. ______________________

12. ______________________

13. ______________________

Additional Exercises 1.8 *(cont.)*

Name ________________________

Name the multiplicative inverse or reciprocal of each of the following numbers.

14. $\frac{3}{14}$ **14.** ____________________

15. $-1\frac{2}{3}$ **15.** ____________________

Name the property illustrated by each true statement.

16. $\frac{1}{5}\cdot 1=\frac{1}{5}$ **16.** ____________________

17. $0\cdot\frac{1}{7}=0$ **17.** ____________________

18. $(ab)c=a(bc)$ **18.** ____________________

19. $(5+3)+10=5+(3+10)$ **19.** ____________________

20. $\frac{1}{3}(6x+1)=\frac{1}{3}\cdot 6x+\frac{1}{3}\cdot 1$ **20.** ____________________

Additional Exercises 2.1

Name ________________________

Date ________________________

1. Identify the numerical coefficient in the following term:
$-x^2y$

1. ________________________

2. Indicate whether the terms in the following list are like or unlike: $30a^2b,\ -6a^2b$

2. ________________________

Simplify each expression by combining any like terms.

3. $12k+4k$ **3.** ________________________

4. $9y-16y+2y$ **4.** ________________________

5. $15x-4-5x+17$ **5.** ________________________

6. $2.8w-0.8-1.9w-1.2$ **6.** ________________________

Simplify each expression. Use the distributive property to remove any parentheses.

7. $10(y+8)$ **7.** ________________________

8. $-5(x+7)-5(x+7)$ **8.** ________________________

9. $-(4m^2-n+7)$ **9.** ________________________

10. $-6(3x-6y-4)$ **10.** ________________________

Remove the parentheses and simplify each expression.

11. $8(x-5)+12$ **11.** ________________________

12. $-7(2y-6)+20y$ **12.** ________________________

13. $4(3x-2)-3(x-7)$ **13.** ________________________

14. $0.8(m+4)-0.3m$ **14.** ________________________

Write each of the following as an algebraic expression. Simplify if possible.

15. Add $5x-12$ to $7x+4$. **15.** ________________________

16. Subtract $4m-7$ from $16m-3$. **16.** ________________________

Additional Exercises 2.1 *(cont.)*

Name ______________________

Write each of the following phrases as an algebraic expression and simplify if possible. Let x represent the unknown number.

17. Five times a number decreased by eleven

17. ______________________

18. The sum of -6 and 8 times a number, subtracted from 7 times the number

18. ______________________

19. Six times the sum of a number and 9, added to 4 times the number

19. ______________________

20. Express the perimeter of a triangle if the three sides are represented by $(3x-8)$cm, $(2x-9)$cm, and 7cm.

20. ______________________

Additional Exercises 2.2

Name ______________________

Date ______________________

1. Is 14 a solution to $9(x-4)=10(x-5)$?

1. ______________________

Solve each equation.

2. $x+8=12$ **2.** ______________________

3. $y-14=12$ **3.** ______________________

4. $-x+0.8=1.2$ **4.** ______________________

5. $\frac{5}{8}+k=\frac{1}{2}$ **5.** ______________________

6. $13x-11=14x$ **6.** ______________________

7. $3x+1=2x-8$ **7.** ______________________

8. $3x-2=2x+7$ **8.** ______________________

9. $14x-1=13x-8$ **9.** ______________________

10. $3x-5+4x=8x-8$ **10.** ______________________

11. $-x+1-2x=-4x-8$ **11.** ______________________

12. $9y-\frac{1}{5}=8y+\frac{2}{5}$ **12.** ______________________

13. $1-(3x-4)=-2x+5$ **13.** ______________________

14. $4(x-5)=3x+5$ **14.** ______________________

15. $-\frac{1}{2}(2x-10)=-2x+4$ **15.** ______________________

16. $-(x-5)=-2x-3$ **16.** ______________________

17. $7y-\frac{1}{4}=6y+\frac{2}{5}$ **17.** ______________________

Additional Exercises 2.2 *(cont.)*

Name ________________________

18. Two angles have a sum of 150º. If one angle is xº, express the other angle in terms of xº.

18. ________________________

19. A 15-foot board is cut into two pieces. If one piece is x feet long, express the other length in terms of x.

19. ________________________

20. From Charlotte, it is 15 more miles to Lincolnton than it is to Gastonia. If it is m miles to Gastonia, express the distance to Lincolnton in terms of m.

20. ________________________

Additional Exercises 2.3

Name ______________________

Date ______________________

Solve each equation.

1. $2x-7-3x+1=-6+5x$ 1. ______________
2. $-\frac{1}{2}(4x-7)=-8x$ 2. ______________
3. $-15x-13=-11x-9$ 3. ______________
4. $-(-2x+5)-2(3x-4)=-14$ 4. ______________
5. $5-(4-2x)+3(8x)=2$ 5. ______________
6. $-3(x-2)=30$ 6. ______________
7. $8(x+1)-4=3(x-6)$ 7. ______________
8. $-(a-1)-a=11-a$ 8. ______________
9. $\frac{4}{9}x-\frac{2}{3}=\frac{2}{9}$ 9. ______________
10. $\frac{1}{4}(y-8)=y$ 10. ______________
11. $\frac{x}{2}-4=x-6$ 11. ______________
12. $4(k-3)+(k-3)=2(k-5)$ 12. ______________
13. $0.22x+0.11(80)=0.32(x-1)$ 13. ______________
14. $0.04(y-200)+0.02y=-0.02y$ 14. ______________
15. $\frac{5(y-2)}{4}+3y=\frac{2y-4}{3}$ 15. ______________
16. $\frac{5}{6}x-\frac{2}{3}=\frac{1}{2}x-\frac{3}{4}$ 16. ______________
17. $3(x-4)-5x=-2(1+x)+x$ 17. ______________

Name ______________________

18. $-5x+3-2(x-4)=-4(x+3)-1$

19. $t-3t=15+t-4t$

20. Find the sum of five consecutive integers if the first is x.

18. ______________________

19. ______________________

20. ______________________

Additional Exercises 2.4

Name ________________________

Date ________________________

Solve each equation.

1. $9-\frac{3}{2}x=15x-24$

2. $x+\frac{3}{5}=\frac{5}{3}x$

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

4. $-2(x-1)+(x-4)=-x-14$

5. $15-3x+4(x-20)=x+12$

6. $-2(x-1)=-2x+2$

7. $\frac{1}{7}x+\frac{1}{5}=\frac{1}{5}x-\frac{1}{7}$

8. $-\frac{1}{2}(3x+2)=\frac{3(-x-6)}{2}$

9. $4a-2(2a+3)=-6$

10. $-z+3(z-4)=4(z-1)$

11. $0.5h-2.2=0.25(h+1.1)$

12. $\frac{x}{3}+2=x-\frac{2}{3}(x-3)$

13. $3(3+x)-10=4x-(1+x)$

14. $6(1-x)+2=8-5x$

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

16. $\frac{3x}{2}+1=\frac{3x}{4}-2$

17. $\frac{5(1-z)}{3}=-z$

1. ____________________
2. ____________________
3. ____________________
4. ____________________
5. ____________________
6. ____________________
7. ____________________
8. ____________________
9. ____________________
10. ____________________
11. ____________________
12. ____________________
13. ____________________
14. ____________________
15. ____________________
16. ____________________
17. ____________________

Additional Exercises 2.4 *(cont.)*

Name ________________________

In the following equations, the answers are one of the following: all real numbers, no solution, or 0. In the answer blank, write the correct choice.

18. $-3(x-2)+6=2-3(x-4)$

19. $0.4(1-3x)=0.6(x+3)-1.2$.

20. $\frac{3}{4}(\frac{4}{3}x-8)=x+1$

18. ________________________

19. ________________________

20. ________________________

Additional Exercises 2.5

Name ______________________

Date ______________________

Write an equation for each example and then solve the equation and answer the question.

1. Four times a number subtracted from 28 is seven less than the number. Find the number.

2. The sum of three consecutive even integers is 276. Find the integers.

3. The sum of one-fourth a number and 17 is equal to the sum of one-fifth the number and 18. Find the number.

4. The sum of three times the smaller of two consecutive odd integers and four times the larger is 113. Find the integers.

5. Find three consecutive even integers such that one-fourth of the first plus one-seventh of the second plus one-half of the third is 13.

6. Find the measure of two supplementary angles such that one angle is four-fifths as large as the other.

7. A 67-inch piece of string is cut into three pieces such that the second piece is three times as large as the first, and the third piece is four more than five times as large as the first. Find the lengths of the three pieces of string.

8. Billie-Jean King won three fewer singles titles at Wimbledon than Martina Navratilova. If the sum of their single wins was fifteen, how many singles titles did each of these women win at Wimbledon?

9. Five sevenths of a number is one-tenth. Find the number.

10. The measures of the angles of a particular triangle are such that the second angle is 6 degrees less than the first, and the third angle is four times as large as the first. Find the measure of all three angles.

11. One-half of the integer is eight more than the integer. Find this integer.

1. ______________________

2. ______________________

3. ______________________

4. ______________________

5. ______________________

6. ______________________

7. ______________________

8. ______________________

9. ______________________

10. ______________________

11. ______________________

Additional Exercises 2.5 *(cont.)*

Name ________________________

Write an equation for each example and then solve the equation and answer the question.

12. If six is subtracted from eight times a number, the result is the sum of 10 times the number and twenty.

12. ________________________

13. If a number is subtracted from seven, the result is three times the difference of the number and 7.

13. ________________________

14. Find three consecutive integers such that the sum of five times the first, six times the second and seven times the third is 148.

14. ________________________

15. Find three consecutive even integers such that twice the first minus three times the second plus five times the third is 54.

15. ________________________

16. Find three consecutive even integers whose sum is zero.

16. ________________________

17. Find three consecutive odd integers such that if six times the first is subtracted from the sum of twice the second plus five times the third, the result is 53.

17. ________________________

Find the perimeter of the following geometric figures.

18. A rectangle has a perimeter of 98 inches. The width is two inches less that twice the width.

18. ________________________

19. A trapezoid has a perimeter of 63 meters. The two non-parallel sides have the same length; but the top base is twice as long as the side, and the bottom base is three times as long as the side. Find the length of each side.

19. ________________________

20. An isosceles triangle has two sides that have the same length. If a particular isosceles triangle has the two equal sides that are three more than twice the third side each, and the perimeter is 96 inches, find the length of each side.

20. ________________________

Additional Exercises 2.6

Name ________________________

Date ________________________

Substitute the given values into the formula and solve for the unknown variable.

1. $m = \dfrac{y_2 - y_1}{x_2 - x_1}$ when $m = \dfrac{1}{3}$, $y_1 = 3$, $x_2 = 7$, and $x_1 = -2$ **1.** ________________

2. $V = \dfrac{1}{3}\pi r^2 h$ when $V = 47.1$ and $r = 3$ (Use 3.14 for π.) **2.** ________________

3. $V = \dfrac{4}{3}\pi r^3$ when $r = 9$ (Use 3.14 for π.) **3.** ________________

4. $A = \dfrac{1}{2}h(B + b)$ when $A = 45.5$, $B = 8$, and $h = 7$ **4.** ________________

5. $I = PRT$ when $I = 1200$, $R = 4\%$, and P=10,000 **5.** ________________

6. $y = mx + b$ when $y = 4$, $x = 9$, and $b = 2$ **6.** ________________

7. $V = \dfrac{1}{3}\pi r^2 h$ when r=5.5, $h = 4.1$. (Use 3.14 for π.) Round to nearest hundredths place. **7.** ________________

8. $S = 2\pi rh + 2\pi r^2$ when $r = 6$, $h = 10$ (Use 3.14 for π.) **8.** ________________

Solve.

9. Convert 77° Fahrenheit to Celsius. Use the formula $C = \dfrac{5}{9}(F - 32)$. **9.** ________________

10. Convert 55° Celsius to Fahrenheit. Use the formula $F = \dfrac{9}{5}C + 32$. **10.** ________________

11. A lawn is in the shape of a rectangle with a length of 100 feet and a width of 45 feet. How many whole bags of fertilizer must be purchased to cover the lawn if each bag covers 2000 square feet? **11.** ________________

12. A family is planning their vacation to Myrtle Beach from their home just outside Charlotte, North Carolina, a distance of 240 miles. They plan to average 60 mph. How long will the trip take? **12.** ________________

Additional Exercises 2.6 *(cont.)*

Name ______________________

Solve the following applications.

13. The perimeter of a pentagon is 130 centimeters. The sides are x centimeters, $0.5x$ centimeters, $2x$ centimeters, and two sides are $1.5x$ centimeters. Find the length of each of the five sides.

13. ______________________

14. It is approximately 266 miles from San Antonio, Texas to Fort Worth, Texas. If Carlos and his family leave Fort Worth at 4:30 am, at approximately what time will they arrive in San Antonio if they travel 50 miles per hour?

14. ______________________

Solve each formula for the specified variable.

15. $P = a + b + c + d$ for d

15. ______________________

16. $x - 7y = 14$ for y

16. ______________________

17. $V = \frac{1}{3}Ah$ for A

17. ______________________

18. $S = 4lw + 2hw$ for l

18. ______________________

19. $Ax + By = C$ for y

19. ______________________

20. $Ax + By = C$ for x

20. ______________________

Additional Exercises 2.7

Name ________________________

Date ________________________

Substitute the given values into the formula and solve for the unknown variable.

1. What number is 88% of 340? 1. ____________

2. What number is 15% of 315? 2. ____________

3. The number 209 is what percent of 950? 3. ____________

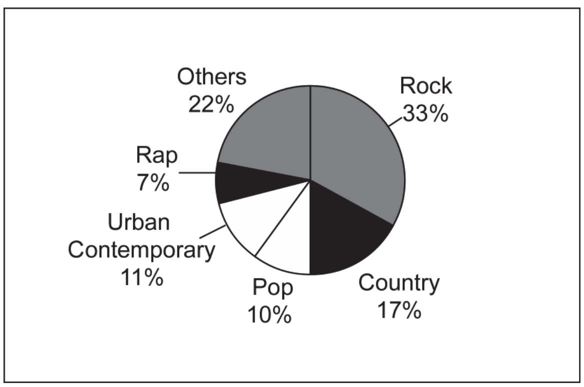
4. The number 211.2 is what percent of 320? 4. ____________

5. The number 3412.5 is 75% of what number? 5. ____________

6. The number 770 is 5% of what number? 6. ____________

Solve the following applications.

The circle graphs show sales of recorded music and music videos in 2005. Use it to answer the following questions.



7. What percent of the recorded music sold was pop? 7. ____________

8. If $12 billion in recorded music was sold in 1995, what was the value of rock music sold? 8. ____________

9. If $12 billion in recorded music was sold in 1995, what was the value of rap music sold? 9. ____________

Solve.

10. A popular clothing store advertised all coats reduced by 25%. If the price of a coat before the discount was $150, find the discount and new price. 10. ____________

11. The price for a pound of cheese rose from $1.70 per pound to $2.30 per pound. Find the percent of increase. Round to the nearest whole percent. 11. ____________

Name ________________________

Solve.

12. A recent dinner at a local restaurant cost $80.25 including tax. Find the total cost if a 15% tip is added to the cost.

12. ____________________

13. Hosea's salary increased 8% this year. If his salary was $44,000, find his new salary.

13. ____________________

14. Susanne received a 9% raise this year. Find her original salary if her new salary is $55,590.

14. ____________________

15. Find the raise and the old salary if, after a 6% pay raise, this year's salary is $53,000.

15. ____________________

16. How many liters of a 20% salt solution must be added to 30 liters of a 15% solution to get a solution that is 18% salt?

16. ____________________

17. Peanut Brittle can be made for $2.50 per pound and sold for $5.50 per pound. Find the percent increase.

17. ____________________

18. The cost of a textbook rose from $110 to $150. Find the percent of increase rounded to the nearest percent.

18. ____________________

19. Find the original price of a pair of jeans if the sale price is $56.25 after a 25% discount.

19. ____________________

20. How much water should be added to 60 gallons of a solution that is 80% antifreeze in order to get a mixture that is 60% antifreeze?

20. ____________________

Additional Exercises 2.8

Name ________________________

Date ________________________

Complete the table.

		Number of Coins or Bills	Value of Coins or Bills (in dollars)
1.	Pennies	x	
2.	Dimes	y	
3.	Quarters	z	
4.	$5 bills	5x	
5.	$20 bills	(30 - x)	
6.	$100 bills	(25 – z)	

1. ________________________
2. ________________________
3. ________________________
4. ________________________
5. ________________________
6. ________________________

Substitute the given values into the formula and solve for the unknown variable.

7. A train traveling 120 mph east from Paris passes the Midnight Special which was traveling the same direction at a speed of 80 mph. The slower train had a 1 hour head start. How far were the two trains from their starting points when the pass occurred?

7. ________________________

8. How long will it take a car traveling 65 mph to pass a car traveling 50 mph if the slower car has a 2 hour lead?

8. ________________________

9. A family drove from just south of Pittsburgh to Meadville, Pennsylvania at 55 miles per hour and returned the same route traveling only 40 miles an hour due to the icy conditions. The total travel time was 4.75 hours. Find the distance one way.

9. ________________________

10. Victoria is counting all of the quarters and dimes from the family piggy bank for the month. If there are 12 times as many dimes are there are quarters, and the total change is worth $21.75, how many quarters and how many dimes were in the piggy bank?

10. ________________________

11. Harrington received a $30,000 inheritance from his grandfather. For the first year, he invested part of the money in an account at 6% simple interest and the remainder of the money in an account at 9% simple interest. If he received $2100 in interest for the year, find the amount invested in each account.

11. ________________________

Additional Exercises 2.8 *(cont.)*

Name ______________________

Substitute the given values into the formula and solve for the unknown variable.

12. What number is 120% of 86? **12.** ______________

13. The number 650 is what percent of 130? **13.** ______________

14. The number 600 is what percent of 400? **14.** ______________

Solve.

15. The Myers Center Auditorium in Gastonia contains 500 seats. Ticket prices for a recent play were $50 for adults and $25 for children. If the proceeds totaled $19,250, how many adults and how many children were there? **15.** ______________

16. Jeff and Adrianna were 9 miles apart on the hiking trail Jeff walked twice as fast as Adrianna, and it took 1.5 hours to meet. Find the rate of each hiker. **16.** ______________

17. Mark drove his new hybrid 60 mph for part of the trip and 70 miles per hour for the rest of the trip home from Columbia, SC. If the entire trip was 310 miles and took 4.5 hours, how many miles was he able to travel at each rate? **17.** ______________

18. Part of the proceeds from the children's play was $2000 in $10 bills and $20 bills. If there were twice as many $20 bills, find the number of each denomination. **18.** ______________

19. A popular clothing store advertised all suits reduced by a certain percent. If the price of a suit before the discount was $400 and the price after the discount was $260, find the rate of discount and amount of discount. **19.** ______________

20. How many liters of a 3% saline solution must be added to an 8% saline solution to obtain 20 liters of a 6% saline solution? **20.** ______________

Additional Exercises 2.9

Name ______________________

Date ______________________

Graph each on a number line.

1. $x \geq -7$

2. $x < 2$

3. $4 < x \leq 8$

1. $\longleftrightarrow$

2. $\longleftrightarrow$

3. $\longleftrightarrow$

Solve each inequality.

4. $2x - 8 < 14$

5. $-x - 1 > 2x + 8$

6. $-3x \leq 15$

7. $2x + 10 > 4x - 6$

8. $7 - x < 7 + 3x$

9. $4(x + 3) \geq 2x - 8$

10. $-3(2x - 3) - 8 > -x + 3(x + 1)$

11. $0.2(x + 1.3) > 0.1(1 + x)$

12. $(x + \frac{1}{3}) - 2x \geq \frac{1}{2}x + \frac{5}{6}$

13. $5(2x - 1) - 8x \leq -2(3x - 2) - 5$

14. $-0.2(x + 3) + 0.6 > -\ 0.1(x + 0.3) + 1.6$

15. $-0.8(x - 0.6) \geq 0.2(x - 1)$

16. $\frac{1}{2}(x - \frac{1}{3}) < \frac{1}{3}(\frac{3}{4}x - \frac{1}{6})$

4. ______________________

5. ______________________

6. ______________________

7. ______________________

8. ______________________

9. ______________________

10. ______________________

11. ______________________

12. ______________________

13. ______________________

14. ______________________

15. ______________________

16. ______________________

Additional Exercises 2.9 *(cont.)*

Name ______________________

Solve the following.

17. One side of a triangle is three times as long as a second side, and the third side is 14 meters. If the perimeter can be no longer than 86 meters, find the maximum lengths of the other two sides.

17. ______________________

18. A 200-pound person uses 5.29 calories per minute when walking. If Julia, who weighs 200 pounds, walks 40 minutes each day, how many days will it take Julia to walk off at least 500 calories?

18. ______________________

19. James and Alexandra have \$1000 to spend on their 10th anniversary celebration. If the club charges \$150 cleanup fee and \$15 per person, find the greatest number of people that they can invite and stay within their budget.

19. ______________________

20. Sandra has test scores of 86, 82, 95, and 93 in her Introductory Algebra class. She wants to make an A average which at her college is 90 or above. What is the lowest score she can make on the final, if the final counts as two test grades?

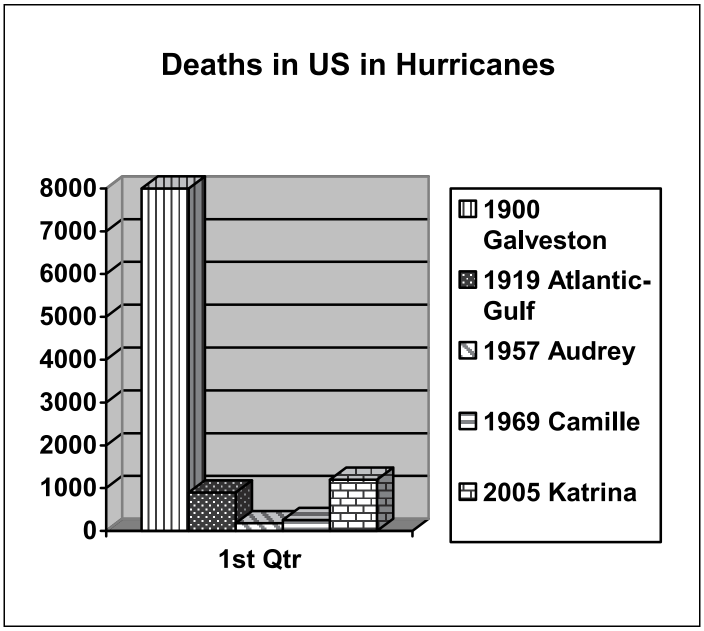
20. ______________________

Additional Exercises 3.1

Name ______________________

Date ______________________

The following bar graph shows some of the worst hurricanes in the history of the United States and the number of people killed in those hurricanes.



1. Which of these five hurricanes caused the most loss of life?

1. ______________________

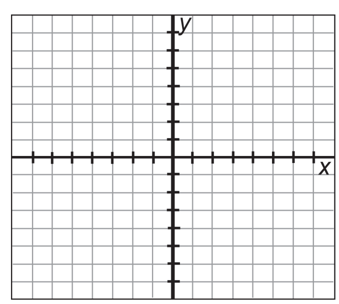
2. Approximately how many more people were killed in the Galveston hurricane in 1900 than were killed in the 1919 Atlantic Gulf hurricane?

2. ______________________

Plot and label each ordered pair. State in which quadrant, if any, each point lies.

3. $(-5,4)$

3.



Additional Exercises 3.1 *(cont.)*

Name ________________________

Plot and label each ordered pair. State in which quadrant, if any, each point lies.

4. $(0,0)$

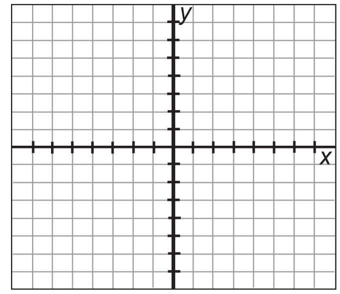
5. $(3,0)$

6. $(0,-4)$

7. $(2,6)$

8. $(-5,-3)$

4.



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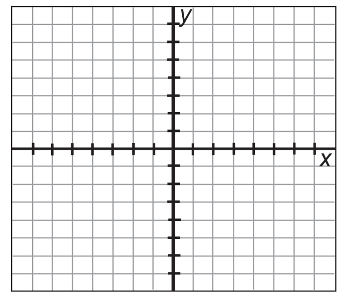

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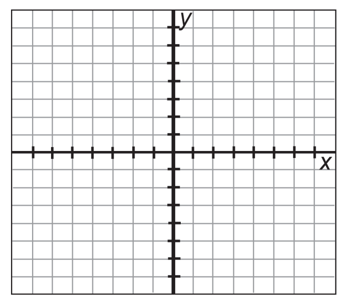

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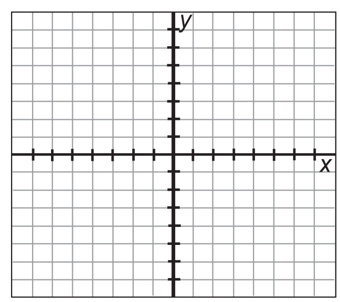

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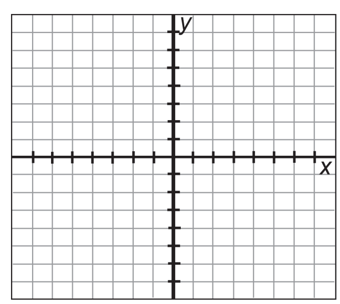
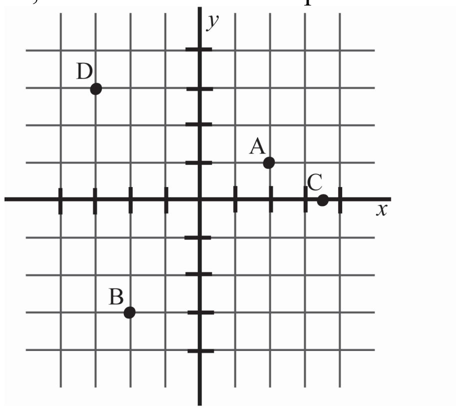


Additional Exercises 3.1 *(cont.)*

Name ______________________

Find the x- and y-coordinates of the following labeled points and state in which quadrant the point lies, if any. If the point is not in a quadrant, tell on which axis the point is located.



9. A

10. B

11. C

12. D

9. ______________________

10. ______________________

11. ______________________

12. ______________________

Complete the table of values for each given linear equation.

13. $7x - y = 2$

14. $y = -4$

15. $x - y = 8$

16. $2x - 3y = 12$

13.

x	y
0	
	0
	-1

14.

x	y
0	
- 4	
5	

15.

x	y
0	
	0
	6

16.

x	y
	0
0	
	- 3

Additional Exercises 3.1 *(cont.)*

Name ______________________

Complete the table of values for each given linear equation.

17. $-x = 2y$

17.

x	y
0	
	0
4	
	4

18. $y = \frac{1}{3}x - 2$

18.

x	y
	0
0	
	6
	9

19. $x = 0$

19.

x	y
	-5
	0
	2

20. $y = 0$

20.

x	y
-4	
0	
2	

Additional Exercises 3.2

Name ____________________

Date ____________________

Graph each equation on the same set of axes. Discuss how the graphs are similar and how they are different.

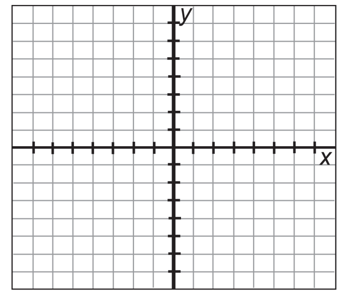
1. $y = -\frac{3}{4}x;\ y = -\frac{3}{4}x + 2$

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

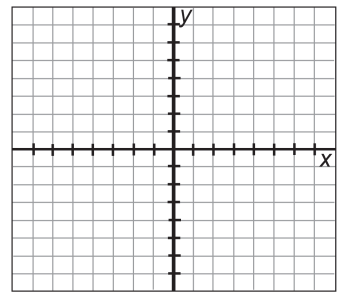
3. $y = -3x;\ y = -3x + 5$

4. $y = -\frac{1}{3}x;\ y = -\frac{1}{3}x + 3$

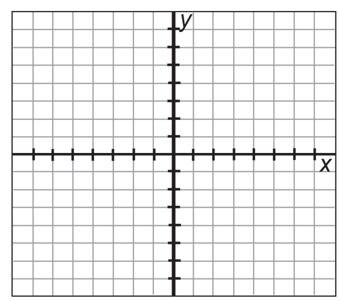
1.



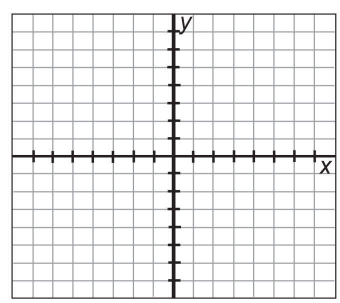
2.



3.



4.

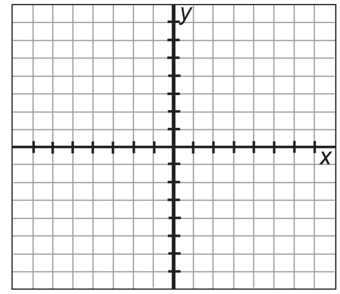


Name ________________________

Graph each linear equation.

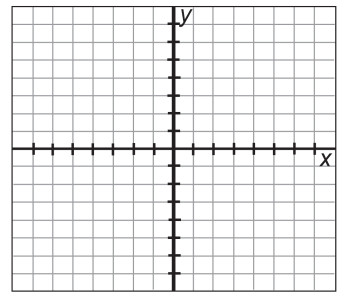
5. $y = 3$

5.



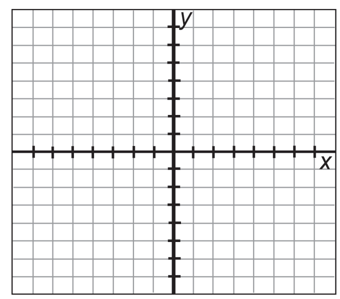
6. $x = -4$

6.



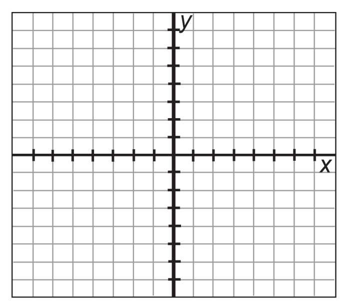
7. $x + y = -4$

7.



8. $x - y = 8$

8.



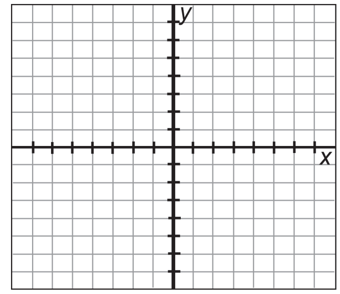
Additional Exercises 3.2 *(cont.)*

Name ______________________

Graph each linear equation.

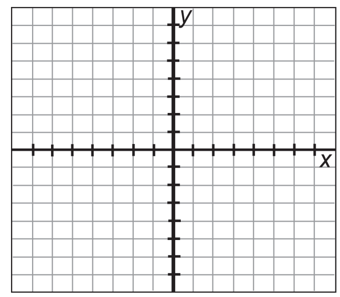
9. $-x + 2y = 6$

9.



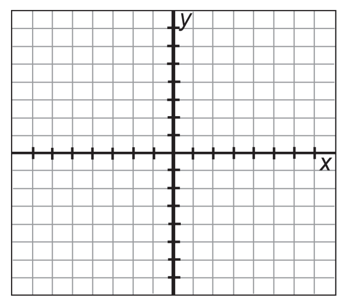
10. $y = -2x + 5$

10.



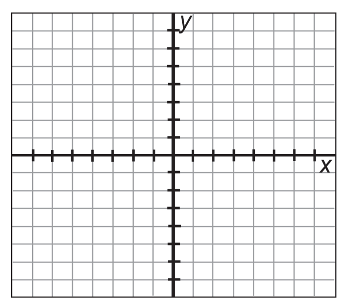
11. $y = 6x$

11.



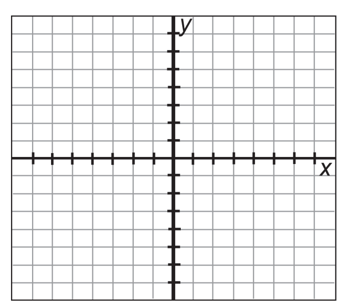
12. $y = -2x$

12.



13. $x + 2y = 8$

13.



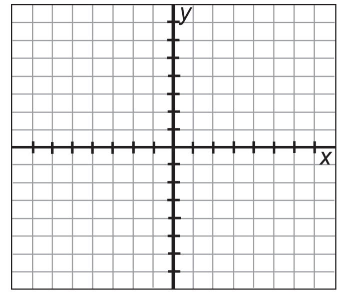
Additional Exercises 3.2 *(cont.)*

Name ___________________________

Graph each linear equation.

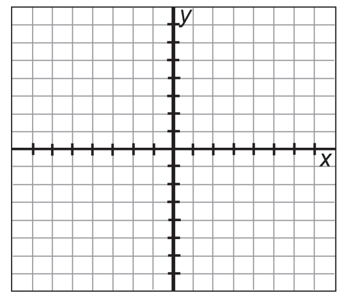
14. $y = \frac{2}{3}x - 2$

14.



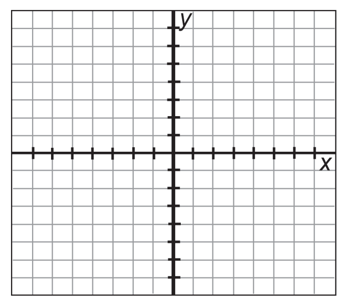
15. $y = 3x - 2$

15.



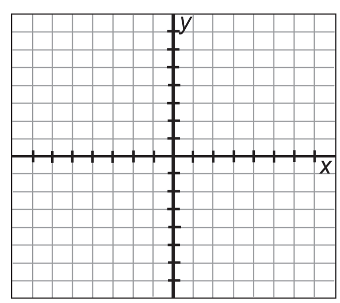
16. $x = -\frac{1}{2}y$

16.



17. $2x - y = 4$

17.



Additional Exercises 3.2 *(cont.)*

Name ____________________

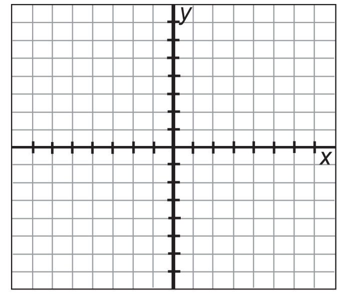
Graph each linear equation.

18. $x = -\frac{3}{4}y$

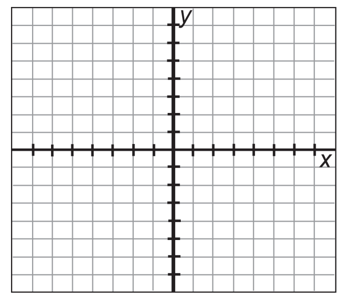
19. $y = x + 2$

20. $x + y = 4$

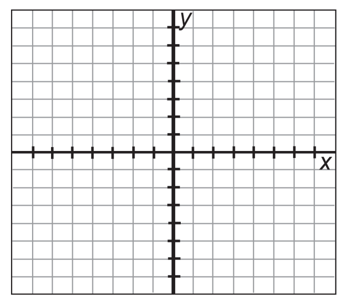
18.



19.



20.



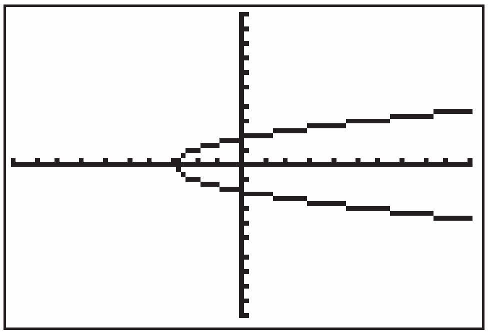
Additional Exercises 3.3

Name ___________________________

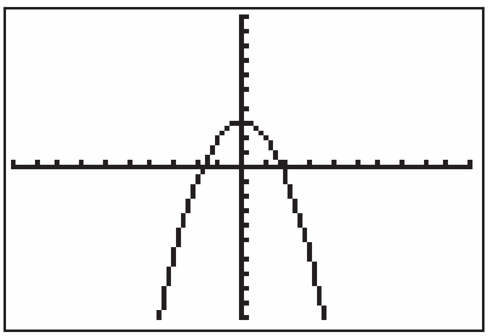
Date ___________________________

The following graphs are windows from a TI-84 graphing calculator. Identify the intercept points if each tick is one unit.

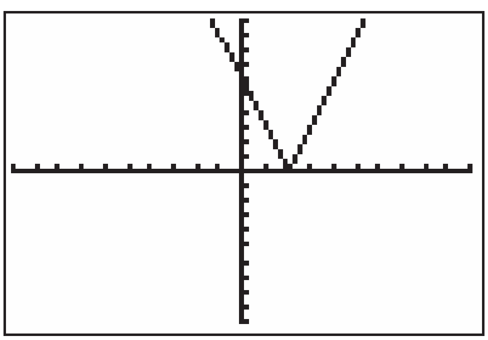
1.



2.



3.



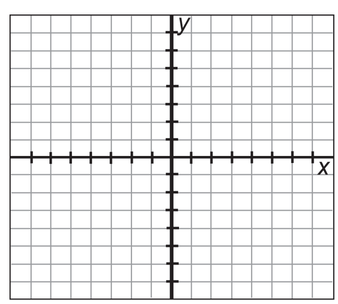
4. Graph the line with x-intercept at $(-4,0)$ and y-intercept at $(0,4)$.

1. ___________________________

2. ___________________________

3. ___________________________

4.



Additional Exercises 3.3 *(cont.)*

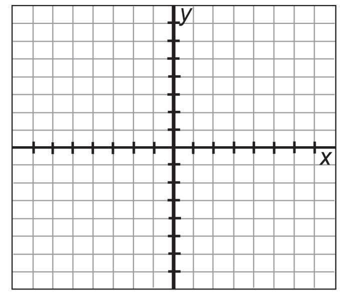
Name ________________________

Graph each linear equation by finding *x*- and *y*-intercepts. Check by finding a third point on the line.

5. $4x + y = -1$

x	y
0	
	0

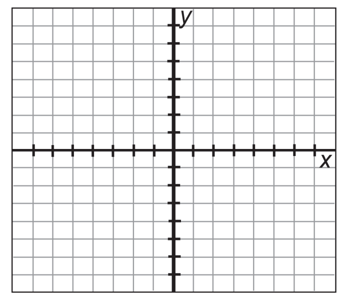
5.



6. $3y = x - 6$

x	y
0	
	0

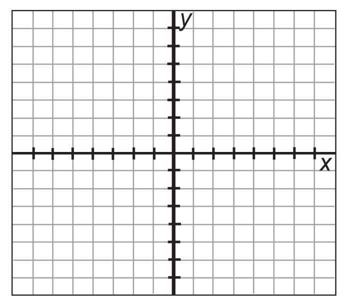
6.



7. $-x - 2y = 6$

x	y
0	
	0

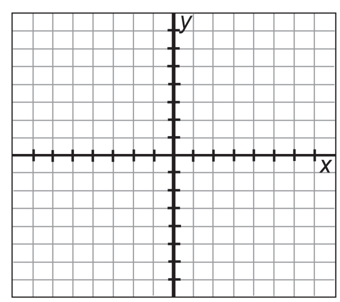
7.



8. $2x + 4y = 10$

x	y
0	
	0

8.



Additional Exercises 3.3 *(cont.)*

Name ________________________

Graph each linear equation.

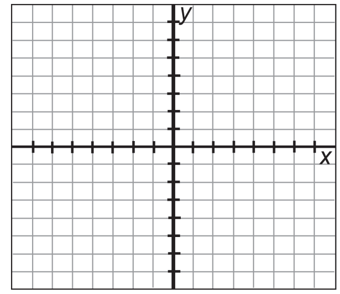
9. $2 - x = -3$

10. $-y - 4 = 2$

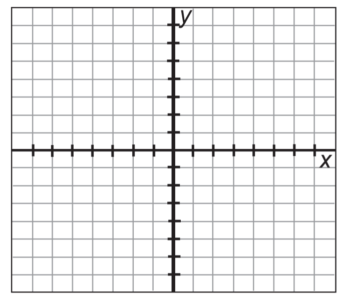
11. $3x + 6 = -6$

12. $2y + 8 = 12$

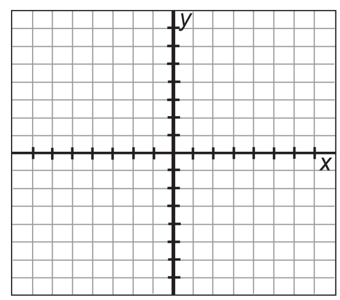
9.



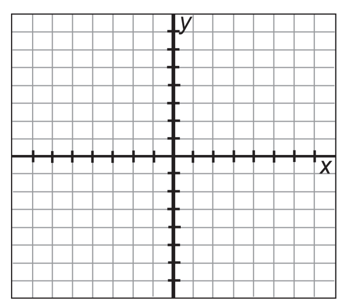
10.



11.



12.



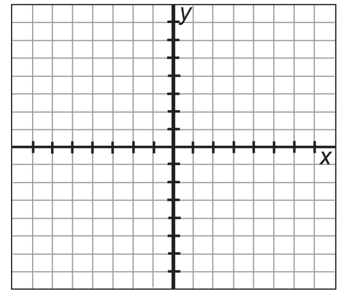
Additional Exercises 3.3 *(cont.)*

Name____________________________

Graph each pair of linear equations on the same set of axes.
Discuss how they are alike and how they are different.

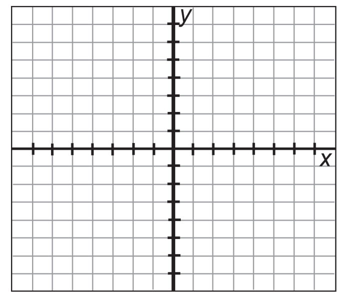
13. $y = -x; \;\; y = -x - 4$

13.



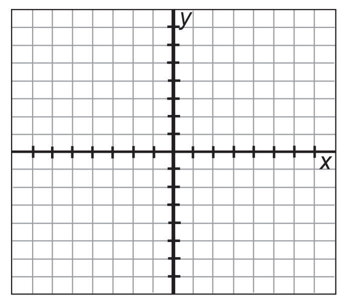
14. $3x = -6; \;\; -3x = -9$

14.



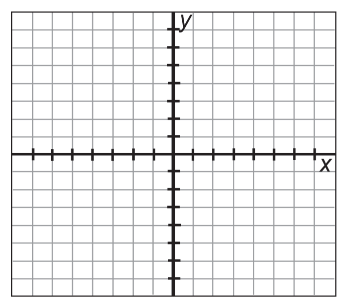
15. $-y + 2 = -1; \;\; -2y - 2 = 4$

15



16. Two lines in the same plane that do not intercept are called parallel lines. Graph the line $x = -2$. Then graph a line parallel to the line $x = -2$ that intersects the x-axis at 3. What is the equation of this line?

16.



Additional Exercises 3.3 *(cont.)*

Name ________________________

At Toni's Furniture Production, it takes 5 hours to manufacture a certain bed and 8 hours to manufacture a matching chest. If a total of 400 hours is available to manufacture these beds and chests, then the linear equation that models this situation is $5x + 8y = 400$

17. Complete the ordered pair solution, (0,   ) of this equation. Describe the manufacturing situation that corresponds to this solution.

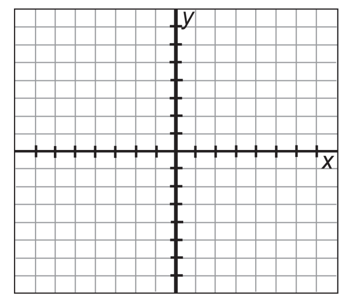
17. ____________________

18. Complete the ordered pair solution, (,0) of this equation. Describe the manufacturing situation that corresponds to this solution.

18. ____________________

19. Use the ordered pairs found in problems 18 and 19 to graph the equation $5x + 8y = 400$

19.



20. If 25 chests are manufactured, find the greatest number of beds that they can make.

20. ____________________

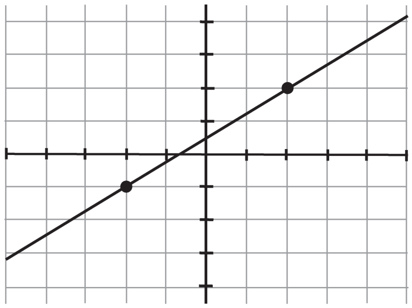
Additional Exercises 3.4

Name___________________________

Date ___________________________

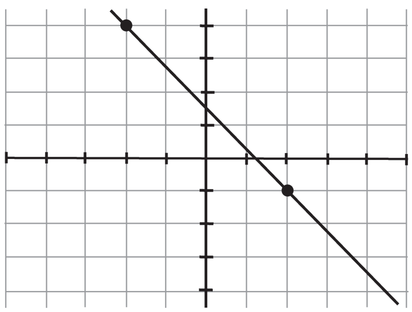
State the two points on each graph, and find the slope of the line.

1.



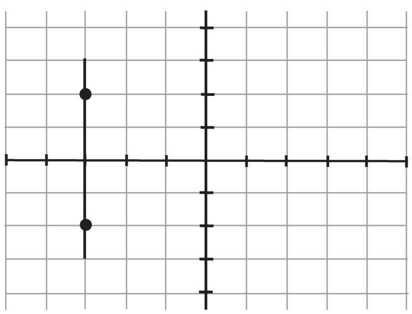
1. ___________________________

2.



2. ___________________________

3.



3. ___________________________

Find the slope of the line that goes through the given points.

4. $(4,2)$ and $(4,5)$

5. $(3,-7)$ and $(5,-7)$

6. $(7, 3)$ and $(5,-2)$

7. $(7,12)$ and $(8,10)$

8. $(-3,-5)$ and $(-6,-4)$

4. ___________________________

5. ___________________________

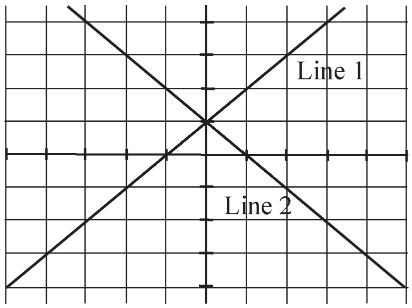
6. ___________________________

7. ___________________________

8. ___________________________

Name ______________________

9. Determine which line in the graph has the greater slope. **9.** ______________________



Find the slope of each line.

10. $y = -2x + 1$ **10.** ______________________

11. $2x - 6y = 8$ **11.** ______________________

12. $4 - y = 0$ **12.** ______________________

13. $-x = 2y$ **13.** ______________________

Determine whether the lines are parallel, perpendicular, or neither.

14. $3x + y = 6$
$x - 3y = 12$ **14.** ______________________

15. $x - 4y = 8$
$4y = x - 12$ **15.** ______________________

16. $x - 5y = 7$
$x + 5y = 9$ **16.** ______________________

Using the points given, (a) find the slope of the line parallel and (b) find the slope of the line perpendicular to the line through each pair of points.

17. (8, 3) and (14, 6) **17.** ______________________

18. (−5, −6) and (7, 9) **18.** ______________________

19. Find the slope of a ski run that rises 100 feet over a run of 280 feet. **19.** ______________________

20. The grade of a road is its slope written as a percent. Find the grade of a road that rises 7 feet over a run of 50 feet. **20.** ______________________

Additional Exercises 3.5

Name ___________________________

Date ___________________________

Write the equation of each line in slope-intercept form and standard form if possible.

1. Vertical line through the point (5,2) — 1. ______________
2. Horizontal line through the point (5,2) — 2. ______________
3. Line parallel to x = 4 through the point (0, 0) — 3. ______________
4. Line perpendicular to x = 5 through the point (2,-6) — 4. ______________
5. Through (0, 5) and (3, 4) — 5. ______________
6. Through $(\frac{1}{2}, 3)$ and $(2, -\frac{1}{2})$ — 6. ______________
7. With slope $-\frac{3}{5}$ through (1, 5) — 7. ______________
8. Through (2, 3) perpendicular to the *y*-axis — 8. ______________
9. Through (2, 3) and parallel to the *y*-axis — 9. ______________
10. Through (-5, -2) perpendicular to the *x*-axis — 10. ______________

Write the equation for the line and write your answer in $y = mx + b$ form and in standard form where possible.

11. Through (5, -3) parallel to the *x*-axis — 11. ______________
12. $m = -\frac{1}{5}$ through the point $(5, 3)$ — 12. ______________
13. $m = 2$ through the point $(\frac{1}{2}, \frac{1}{3})$ — 13. ______________
14. $m = -1$ through the point $(0, 4)$ — 14. ______________
15. Through $(-1, -4)$ and $(0, 5)$ — 15. ______________
16. (−9, 2) and (0, 0) — 16. ______________
17. (-3, 2) and (-5, -6) — 17. ______________
18. (10, 8) and (−6, −6) — 18. ______________
19. Through the origin and (4,2). — 19. ______________
20. Through the *y*-intercept -6 and the *x*-intercept -2. — 20. ______________

Additional Exercises 3.6

Name ___________________________

Date ___________________________

Find the domain and range of each relation.

1. $\{(-1,-4),(-1,-2),(-1,0),(-1,2)\}$

2. $\{(7,-1),(5,-1),(3,-1),(1,-1)\}$

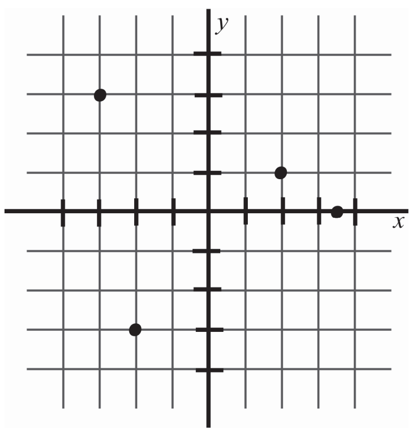
Determine if the set of points represents a function.

3. $\{(-1,-4),(-1,-2),(-1,0),(-1,2)\}$

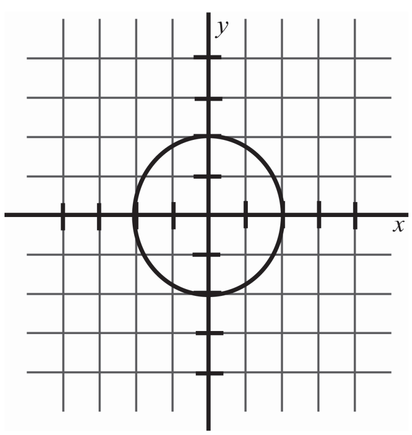
4. $\{(7,-1),(5,-1),(3,-1),(1,-1)\}$

Use the vertical line test to determine whether each graph is the graph of a function.

5.



6.



1. ___________________________

2. ___________________________

3. ___________________________

4. ___________________________

5. ___________________________

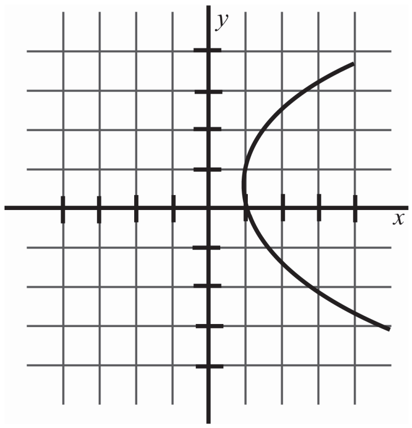
6. ___________________________

Additional Exercises 3.6 *(cont.)*

Name ________________________

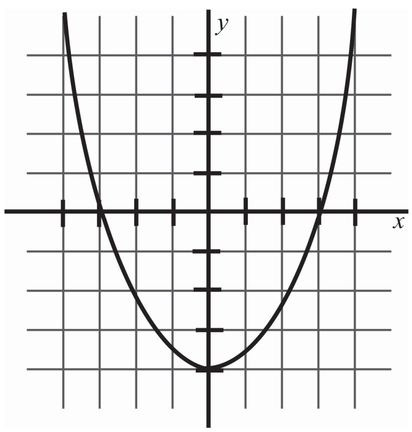
Use the vertical line test to determine whether each graph is the graph of a function.

7.



7. ________________________

8.



8. ________________________

Given the function $f(x) = x^2 - 4x$, find the indicated function values.

9. $f(-2)$

9. ________________________

10. $f(0)$

10. ________________________

11. $f(2)$

11. ________________________

Given the function $f(x) = -x^2 + 1$, find the indicated function values.

12. $f(0)$

12. ________________________

13. $f(-5)$

13. ________________________

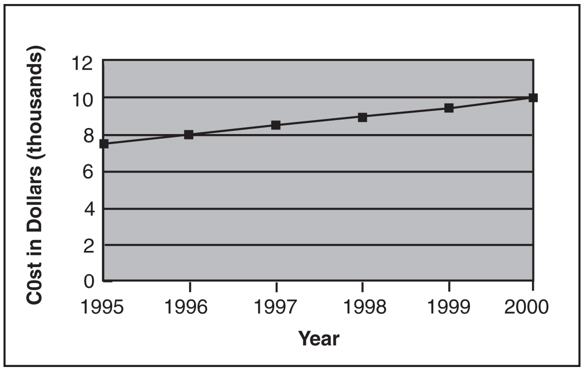
14. $f(3)$

14. ________________________

Additional Exercises 3.6 *(cont.)*

Name ________________________

The graph below shows the estimated cost of raising a child born between 1995 and 2000. Estimates are for the younger child in a two-parent, two child, middle income family.



15. Approximate the cost in the year 1998. **15.** ________________

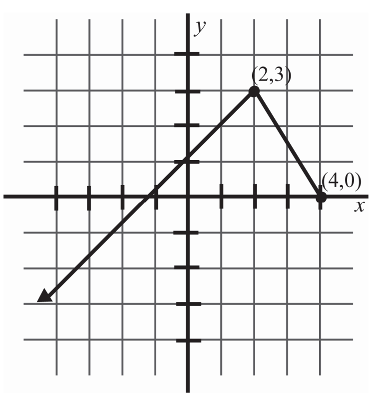
16. Approximate the cost in the year 2000. **16.** ________________

17. Is this the graph of a function? Why or why not? **17.** ________________

18. The profit a company makes when producing x units of a product is given by the equation $P(x) = 45x - 10{,}000$. Find the amount of profit the company makes by producing 500 units. **18.** ________________

Find the domain and the range of each relation graphed.

19. **19.** ________________



Solve.

20. If a certain linear function *f(x)* is evaluated at 0, the answer is 4. In other words, $f(0) = 4$. If the same function *f(x)* is evaluated at 3, the answer is 5. In other words, $f(3) = 5$. Use this information to find the equation of the function in $f(x) = mx + b$ form. **20.** ________________

Additional Exercises 4.1

Name ____________________

Date ____________________

Determine whether the ordered pair satisfies the system of linear equations.

1. $2x = y - 5$ (−2, 1)
$x + y = -1$

2. $2x - 3y = 6$ (0, −2)
$2x + y = 10$

3. $-x + 3y = -11$ (5, 2)
$3x - y = 17$

4. $\frac{3}{4}x + \frac{2}{3}y = \frac{-19}{6}$ (−6, 2)
$y = -\frac{1}{3}x$

1. ____________________

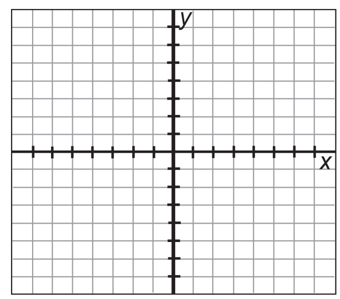
2. ____________________

3. ____________________

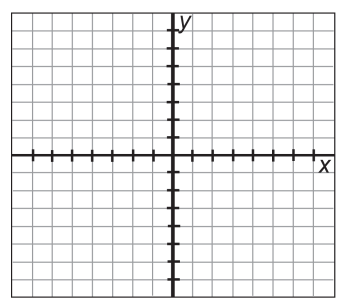
4. ____________________

Solve each system of equations by graphing.

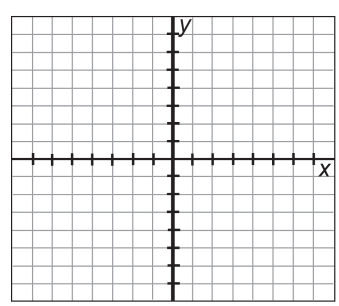
5. $y = \frac{2}{3}x - 1$
$y = -x + 4$

5.


6. $y = -2x + 1$
$y = x - 5$

6.


7. $y = \frac{1}{2}x - 3$
$y = \frac{3}{2}x - 1$

7.


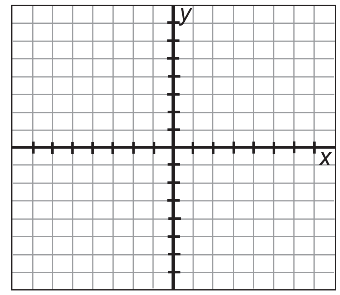
Additional Exercises 4.1 *(cont.)*

Name ______________________

Solve each system of equations by graphing.

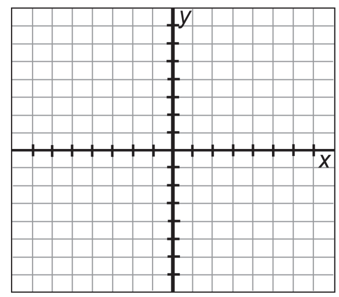
8. $2x - y = 3$
$x = -1$

8.



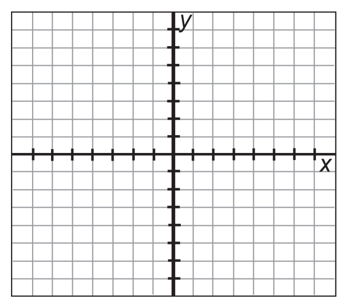
9. $2x + 3y = 6$
$x = 3$

9.



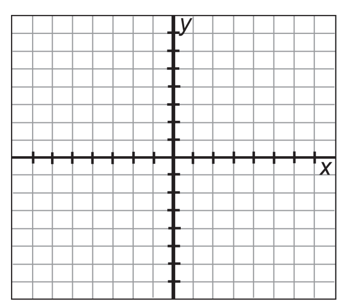
10. $3x - y = 1$
$y = -4$

10.



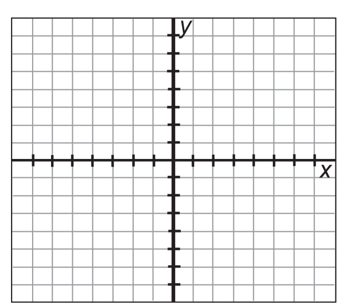
11. $4x + 6y = -2$
$y = 1$

11.



12. $3x + 2y = -4$
$3x - 2y = -8$

12.



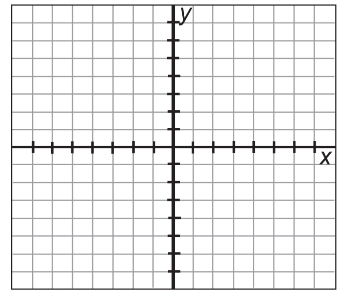
Additional Exercises 4.1 *(cont.)*

Name ________________________

Solve each system of equations by graphing.

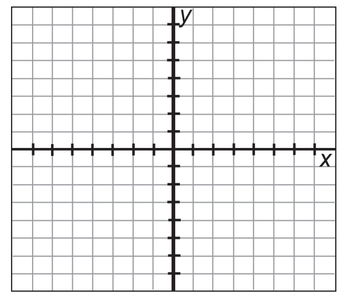
13. $3x - y = 1$
$4x + 3y = -3$

13.



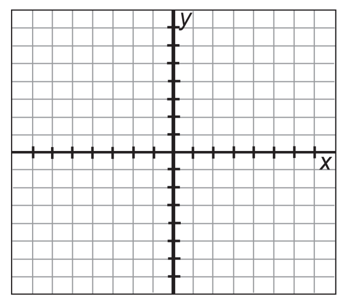
14. $x - y = 4$
$x + 2y = -2$

14.



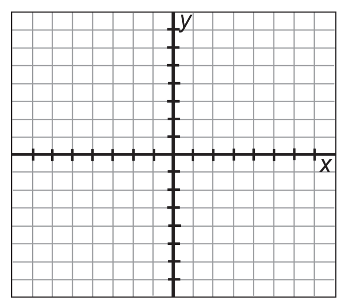
15. $x - 2y = 2$
$y = \frac{1}{2}x - 1$

15.



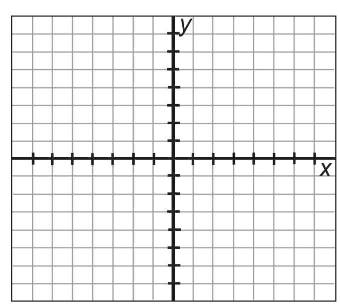
16. $3x - 2y = 7$
$4y + 14 = 6x$

16.



17. $y = 3x - 1$
$3x - y = 5$

17.



Additional Exercises 4.1 *(cont.)*

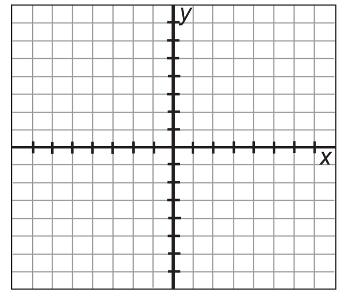
Name ______________________

Solve each system of equations by graphing.

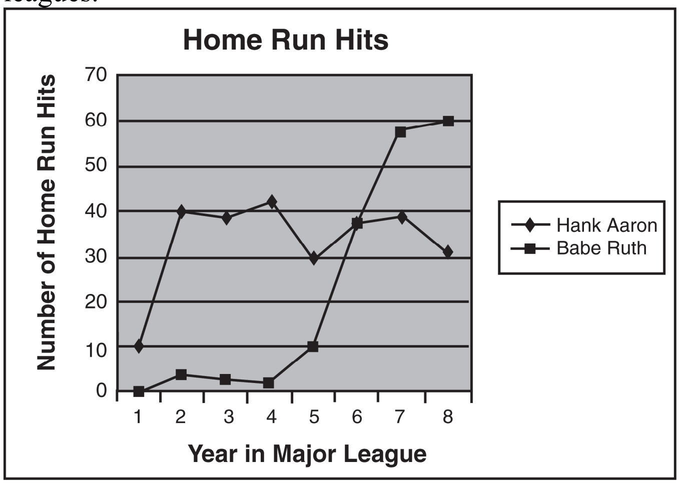
18. $\frac{2}{5}x = y + \frac{7}{5}$

$2x - 5y = 2$

18.



The following graph shows the number of home runs hit by Hank Aaron and Babe Ruth during their first 8 years in the major leagues.



19. In what year did Babe Ruth and Hank Aaron hit close to the same number of home runs?

19. ______________________

20. In which year did Hank Aaron hit the most home runs?

20. ______________________

Additional Exercises 4.2

Name ___________________________

Date ___________________________

Solve each system of equations by substitution.

1. $2x + y = 16$
$y = 2x$

1. ___________________________

2. $3x + y = 7$
$y = 4x$

2. ___________________________

3. $x = 3y - 1$
$x + 2y = 14$

3. ___________________________

4. $4x - y = 7$
$y = 2x - 3$

4. ___________________________

5. $2x - 3y = 16$
$x = 4y + 3$

5. ___________________________

6. $x + 6y = 6$
$3x - 4y = -4$

6. ___________________________

7. $2x + 3y = 14$
$x + 2y = 7$

7. ___________________________

8. $\frac{1}{2}x + \frac{1}{2}y = 5$
$x - y = 8$

8. ___________________________

9. $5x - 3y = -11$
$x - 2y = 2$

9. ___________________________

10. $5x - y = 4$
$10x - 2y = 10$

10. ___________________________

11. $5x + 2y = 4$
$3x + y = 9$

11. ___________________________

12. $4x + 3y = 9$
$3x + 4y = 12$

12. ___________________________

Additional Exercises 4.2 *(cont.)*

Name ________________________

Solve each system of equations by substitution.

13. $3x - 5y = 15$
$y = \frac{3}{5}x - 3$

13. ________________________

14. $2x - y = -7$
$4x - y = -27$

14. ________________________

15. $2x + 3y = 7$
$y = -\frac{2}{3}x + 3$

15. ________________________

16. $x - y = 3$
$6x + 4y = 13$

16. ________________________

17. $3x + 3y = 7$
$4x - y = 6$

17. ________________________

18. $3y + 1 = 7x$
$14x - 2 = 6y$

18. ________________________

Suppose that the demand and supply equations for coal in a certain marketing area are $y = -2x + 150$ and $y = 3x$, respectively, where x is the price per ton in dollars and y is the quantity of coal in thousands of tons. In economics, *market equilibrium* is said to occur when these equations are solved simultaneously. Solve the system using substitution to answer the following.

19. At what price per ton will the market reach equilibrium?

19. ________________________

20. How much coal needs to be sold to reach market equilibrium?

20. ________________________

Additional Exercises 4.3

Name ____________________

Date ____________________

Solve each system of equations by addition.

1. $2x + y = 3$
$-2x + 5y = -9$

2. $3x + 5y = 0$
$2x - 5y = -25$

3. $-4x - y = -6$
$4x - 3y = 18$

4. $12 = x + 4y$
$-36 = -5x + 4y$

5. $5x + y = 2$
$5x - 3y = 14$

6. $3x - y = 5$
$x - 2y = -5$

7. $5x - 2y = 4$
$3x + y = 9$

8. $x + 2y = 6$
$5x + 3y = 2$

9. $3a - 6b = 18$
$4a + 8b = 24$

10. $3x + 4y = 11$
$4x - 3y = 23$

11. $-7x + 8y = -16$
$2x - 5y = 10$

12. $x - y = 5$
$x = y + 3$

1. ____________________

2. ____________________

3. ____________________

4. ____________________

5. ____________________

6. ____________________

7. ____________________

8. ____________________

9. ____________________

10. ____________________

11. ____________________

12. ____________________

Additional Exercises 4.3 *(cont.)*

Name ________________________

Solve each system of equations by addition.

13. $2x + y = 5$
$\frac{1}{2y} = -x + \frac{5}{2}$

13. ________________________

14. $\frac{1}{3}x + \frac{1}{2}y = -4$
$\frac{1}{6}x - \frac{1}{2}y = 1$

14. ________________________

15. $2x - 3y = 6$
$3x + 4y = -2$

15. ________________________

16. $3x - 5y = 7$
$5x - 2y = -1$

16. ________________________

17. $5x + 2y = 7$
$10x + 4y = 13$

17. ________________________

18. $x + 2y = 8$
$y = -\frac{1}{2}x + 4$

18. ________________________

If the supermarket price of a certain cut of beef is p dollars per pound, then q million pounds will be sold according to the demand equation $p + q = 4$. When the price is p dollars per pound, the packing company will supply q million pounds of meat according to the supply equation $p - 4q = -6$. Use the addition method to find the point of market equilibrium to answer the following.

19. At market equilibrium, what is the price per pound?

19. ________________________

20. At market equilibrium, how many pounds of meat will be supplied?

20. ________________________

Additional Exercises 4.4

Name ______________________

Date ______________________

Solve each problem using systems of equations.

1. The sum of two numbers is 56. Their difference is 4. Find the two numbers.

2. The sum of two numbers is 44. The second number is 5 more than twice the first. Find the numbers.

3. The difference between two numbers is 16. Five times the smaller is the same as 8 less than twice the larger. Find the numbers.

4. Two records and three tapes cost $31. Three records and two tapes cost $29. Find the cost of each record and tape.

5. At school, two photography packages are available. Package A contains 1 class picture and 10 wallet-size pictures for $19. Package B contains 2 class pictures and 15 wallet-size pictures for $31. Find the cost of a class picture and the cost of a wallet-size picture.

6. A broker invested a total of $4500 in two different stocks. One stock earned 9% per year. The other earned 6% per year. If $360 was earned from the investment, how much money was invested in each?

7. The price of admission for a concert was $9 for adults and $4 for children. Altogether, 1770 tickets were sold, and the resulting revenue was $14,680. How many adults and how many children attended the concert?

8. Mike made a trip in 40 hours. Joe made the same trip in 30 hours because Joe was traveling 6 km per hour faster. How many km was the trip?

9. The hiking club hiked to a state park at 4 mph. They got a ride back to town in a truck that went 20 mph. If the round trip took 18 hours, how far was it from town to the park?

10. When Lucy swims with the current, she swims 18 km in 6 hours. Against the current, she can swim only 14 km in the same time. How fast can Lucy swim in still water? What is the rate of the current?

1. ______________________

2. ______________________

3. ______________________

4. ______________________

5. ______________________

6. ______________________

7. ______________________

8. ______________________

9. ______________________

10. ______________________

Name ______________________

11. A druggist has one solution that is 10% iodine and another solution that is 50% iodine. How much of each solution should the druggist use to get 100 ml of a mixture that is 20% iodine?

11. ______________________

12. A chemist has one solution that is 20% alcohol and another that is 60% alcohol. How much of each solution should the chemist use to get 100 ml of a solution that is 52% alcohol?

12. ______________________

13. The perimeter of a rectangle is 54 cm. Two times the height is 3 cm more than the base. Find the length of the height and length of the base.

13. ______________________

14. The perimeter of a rectangle is 58 inches. The base is 5 more than three times the height. Find the length of the height and the length of the base.

14. ______________________

15. The sum of the legs of a right triangle is 17 inches. The longer leg is 2 more than twice the shorter. The hypotenuse is 13 in. Find the length of each leg.

15. ______________________

16. Todd has 27 total coins in his bank, all dimes and quarters. The coins have a total value of $4.95. How many of each coin does he have?

16. ______________________

17. Two angles are complementary. The larger angle is 6 less than 5 times the smaller angle. Find the measure of each angle.

17. ______________________

18. The two acute angles of a right triangle are complementary. The larger angle is $1\frac{1}{2}$ times larger than the smaller angle. Find the measure of each angle.

18. ______________________

19. Two angles are supplementary. The larger angle is 15° less than twice the smaller angle. Find the measure of each angle.

19. ______________________

20. Brady spent $8.35 on four pretzels and five cokes. Two cokes cost $0.35 more than one pretzel. Find the cost of a pretzel and the cost of a coke.

20. ______________________

Additional Exercises 4.5

Name ____________________

Date ____________________

Determine which ordered pairs given are solutions of the linear inequality $x - 2y > 8$.

1. (2, −5)

2. (−2, 4)

3. (4, −2)

Determine which ordered pairs given are solutions of the linear inequality $x - y > 5$.

4. (1, −4)

5. (−4, −3)

6. (7, −1)

Determine which ordered pairs given are solutions of the linear inequality $3x - 4y \geq 2$.

7. (−1, −2)

8. (2, 1)

9. (3, 2)

Determine which ordered pairs given are solutions of the linear inequality $x > 2y$.

10. (−4, −3)

11. (−10, −5)

Graph each inequality.

12. $x + y \leq 6$

1. ____________________

2. ____________________

3. ____________________

4. ____________________

5. ____________________

6. ____________________

7. ____________________

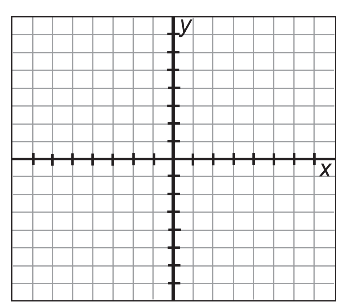
8. ____________________

9. ____________________

10. ____________________

11. ____________________

12.



Additional Exercises 4.5 *(cont.)*

Name ______________________

Graph each inequality.

13. $x - 4y > 4$

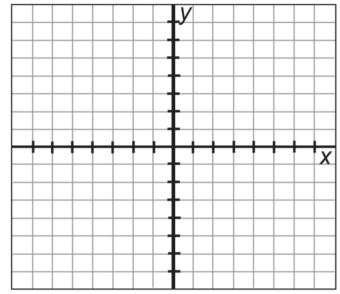
14. $y < 5x$

15. $x \leq -4y$

16. $y > x - 8$

17. $y < 6$

13.



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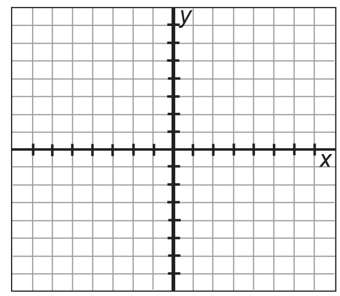

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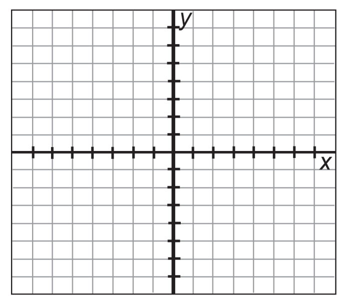

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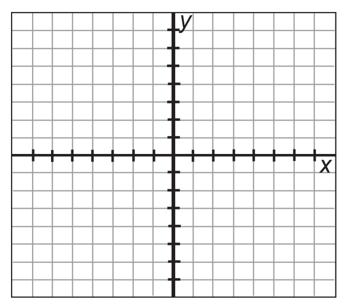

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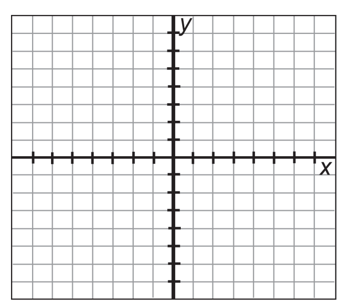


Additional Exercises 4.5 *(cont.)*

Name ____________________

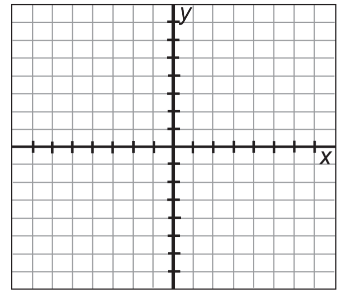
Graph each inequality.

18. $x \geq -7$

19. $x \leq 7y$

20. $x + 4 > 0$

18.



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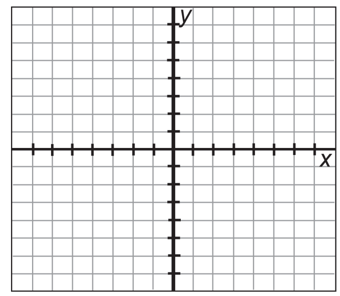

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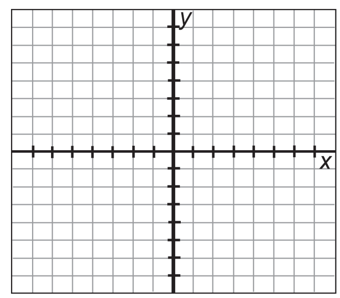


Additional Exercises 4.6

Name ____________________________

Date ____________________________

Graph the solution of each system of inequalities.

1. $\begin{cases} -4x < y \\ x + 2y < 3 \end{cases}$

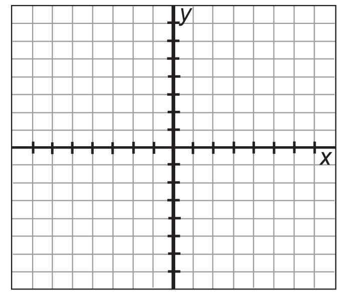
2. $\begin{cases} -3x < y \\ x + 3y < 4 \end{cases}$

3. $\begin{cases} 4x - 4y \geq -12 \\ 2x + y \leq 5 \end{cases}$

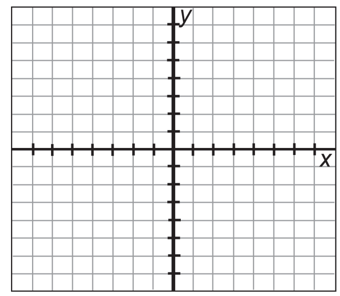
4. $\begin{cases} 3x - 4y \geq -9 \\ 2x + y \leq 4 \end{cases}$

5. $\begin{cases} 5x - 2y \geq -15 \\ 2x + y \leq 4 \end{cases}$

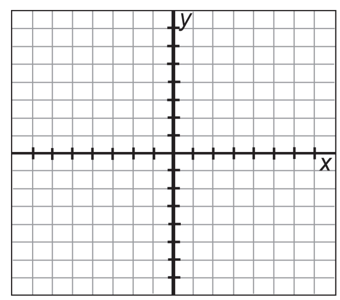
1.



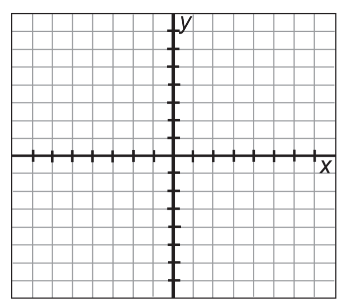
2.



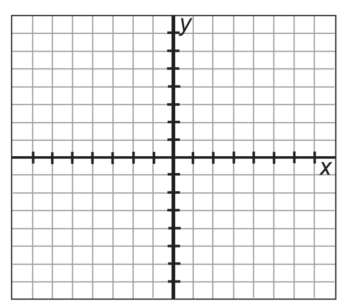
3.



4.



5.

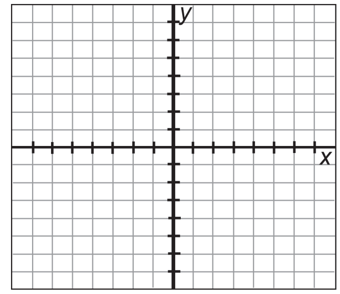


Additional Exercises 4.6 *(cont.)*

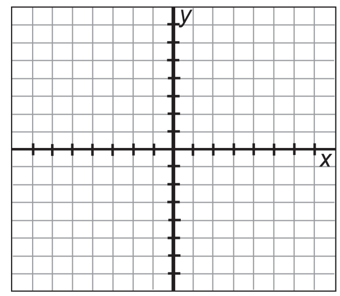
Name ____________________

Graph the solution of each system of inequalities.

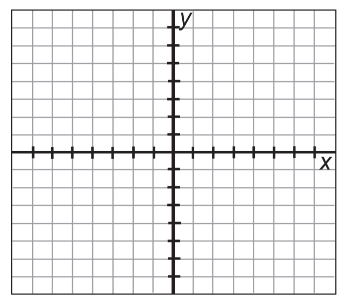
6. $\begin{cases} 2x - 5y \geq -4 \\ 3x + y \leq 5 \end{cases}$

6. 

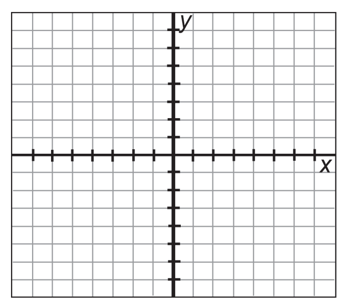
7. $\begin{cases} y \geq 3 \\ x < -4 \end{cases}$

7. 

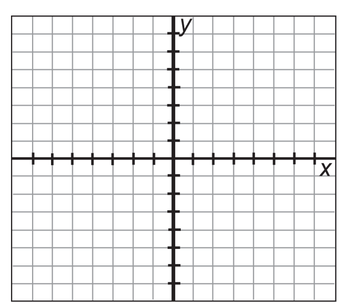
8. $\begin{cases} y \geq -5 \\ x < -5 \end{cases}$

8. 

9. $\begin{cases} y \leq 3 \\ x > -4 \end{cases}$

9. 

10. $\begin{cases} y \leq -4 \\ x > 4 \end{cases}$

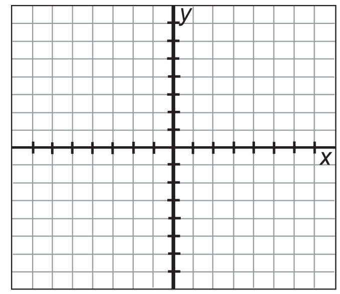
10. 

Additional Exercises 4.6 *(cont.)*

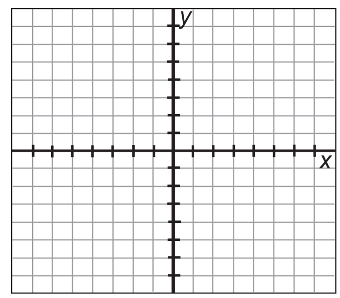
Name ______________________

Graph each inequality.

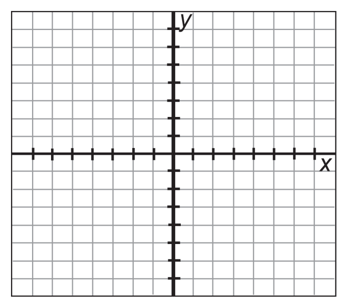
11. $\begin{cases} 2x + 4y \le 8 \\ x < 3 \end{cases}$

11. 

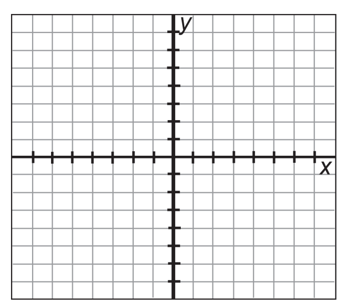
12. $\begin{cases} 3x + 2y \le 6 \\ x < 3 \end{cases}$

12. 

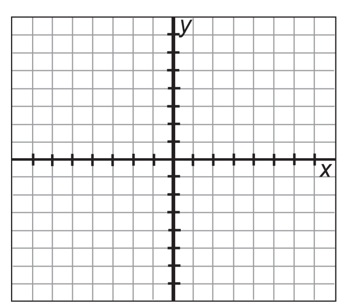
13. $\begin{cases} 2x + 4y \le 8 \\ x < 4 \end{cases}$

13. 

14. $\begin{cases} 2x + 2y \le 4 \\ x < -2 \end{cases}$

14. 

15. $\begin{cases} 3x - 3y \le 9 \\ y \le -2 \end{cases}$

15. 

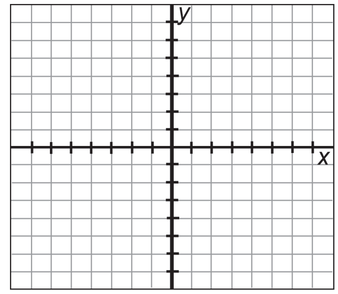
Additional Exercises 4.6 *(cont.)*

Name ______________________

Graph the solution of each system of inequalities.

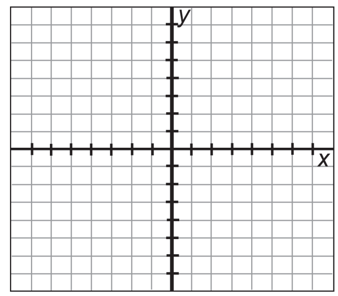
16. $\begin{cases} 4x - 2y \le 8 \\ y \le 2 \end{cases}$

16.



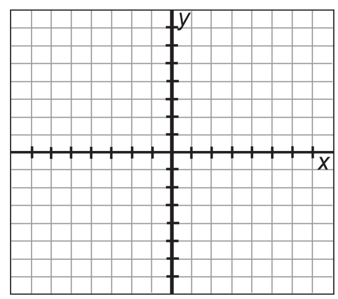
17. $\begin{cases} 2x - y > 4 \\ y < 3 \end{cases}$

17.



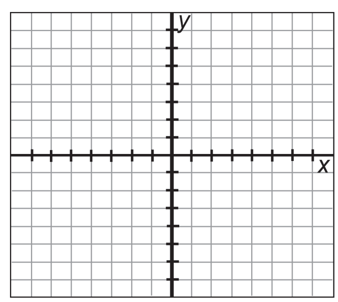
18. $\begin{cases} 3x - 3y \le 9 \\ y \le 5 \end{cases}$

18.



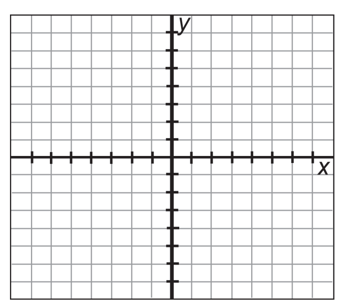
19. $\begin{cases} y \ge \dfrac{1}{2}x + 6 \\ y \le \dfrac{1}{2}x - 4 \end{cases}$

19.



20. $\begin{cases} y \ge \dfrac{1}{4}x + 1 \\ y \le \dfrac{1}{4}x - 7 \end{cases}$

20.



Additional Exercises 5.1

Name ______________________

Date ______________________

Evaluate each expression.

1. 7^3

2. $(-3)^4$

Evaluate each expression for the given value of x.

3. $4x^5$; x is 3

4. $\frac{10}{x^2}$; x is -5

Use the product rule to simplify.

5. $\left(m^5n^3\right)\left(-8mn^7\right)$

6. $\left(5x^4y^2\right)\left(x^3y^6\right)$

Use the power rule to simplify.

7. $\left(z^3\right)^8$

8. $\left[(-5)^7\right]^4$

Simplify each expression.

9. $\left(4x^3y^5z^2\right)^3$

10. $\left(\frac{3a^5}{b^2}\right)^4$

Simplify each quotient.

11. $\frac{x^9}{x^5}$

12. $\frac{7a^4b^8}{a^2b^6}$

1. ______________________

2. ______________________

3. ______________________

4. ______________________

5. ______________________

6. ______________________

7. ______________________

8. ______________________

9. ______________________

10. ______________________

11. ______________________

12. ______________________

Additional Exercises 5.1 *(cont.)*

Name ______________________

Simplify each expression.

13. $\left(7^0\right)^3 + \left(x^0\right)^4$ **13.** ______________________

14. $t^3t^5t^2$ **14.** ______________________

15. $(-4)^3$ **15.** ______________________

16. $\dfrac{9x^3y^7}{3xy^4}$ **16.** ______________________

17. $\left(3m^4n^6\right)^4$ **17.** ______________________

18. $\left(4x^3y^5\right)\left(-2x^3y^4\right)$ **18.** ______________________

19. $\left(\dfrac{2a^3}{b^4}\right)^5$ **19.** ______________________

20. $\dfrac{\left(3x^5y^3\right)^4}{-27x^{12}y^8}$ **20.** ______________________

Additional Exercises 5.2

Name ______________________

Date ______________________

1. Complete the table for the polynomial $5x^3 - 4x^2 - x - 7$.

1. ______________________

Term	Coefficient
$5x^3$	
	-4
x	
-7	

Find the degree of each of the following polynomials and determine whether it is a monomial, binomial, trinomial, or none of these.

2. $7x - 12$

2. ______________________

3. $5 - 3x + 4x^2$

3. ______________________

Find the value of each polynomial when (a) $x = 0$ and (b) $x = -1$.

4. $3x - 4$

4(a). ______________________

4(b). ______________________

5. $x^2 - 6x + 2$

5(a). ______________________

5(b). ______________________

Simplify each of the following by combining like terms.

6. $12x^3 + 9x^3$

6. ______________________

7. $7x^2 - 17x^2 + 6x$

7. ______________________

8. $10xy - 12xy + 2y - y$

8. ______________________

9. Identify the degree of each term and the degree of the polynomial $a^2b^4 - 7 + 3a^3b^3 + 5a^4$.

9. ______________________

Add or subtract as indicated.

10. $(15y + 7) - (-4y - 5)$

10. ______________________

11. $(3a^2 - 7a - 4) + (2a - 5a^2 - 7)$

11. ______________________

12. $(-x^2 + 3) - (x^2 - 4) + (3x^2 - 4x - 9)$

12. ______________________

Additional Exercises 5.2 *(cont.)*

Name ______________________

Add or subtract as indicated.

13. $(15a^2 - 4a + 7) + (a^2 - 6a - 4) - (3a^2 - 8)$

13. ______________________

14. $(5x - 7y + 4) - (-3x - y - 9)$

14. ______________________

15. $\left(\frac{1}{3}x^2 + \frac{3}{4}y^2 - 8\right) - \left(\frac{4}{9}x^2 + \frac{5}{6}y^2 - 2\right)$

15. ______________________

16. $(2x^2y - 7xy + x^2y^2 - 7) - (17x^2y^2 - 1 + 5yx^2)$

16. ______________________

Evaluate the following expressions by combining like terms.
Write the results in standard form.

17. Add $(7x^2 - 19x + 4)$ and $(-x^2 + 4x - 9)$.

17. ______________________

18. Subtract $(2y - 15)$ from $(3y^2 - 4y - 8)$.

18. ______________________

19. Find the perimeter of a triangle with sides $(4x - 3x^2)$ in., $(5x^2 + 7)$ in., and $(9 - 10x)$ in.

19. ______________________

20. A piece of gutter is $(6y^2 - 4y + 3)$ meters. A piece $(y^2 - 12)$ meters is cut off. Express the remaining length as a polynomial.

20. ______________________

Additional Exercises 5.3

Name ______________________

Date ______________________

Multiply.

1. $15x^2 \cdot 2x$ **1.** ______________________

2. $(-5.2x^3)(2x^4)$ **2.** ______________________

3. $\left(-\frac{5}{7}y^4\right)\left(-\frac{2}{35}y^2\right)$ **3.** ______________________

4. $(7x)(-5x^2)(x^7)$ **4.** ______________________

5. $5y(2y^2 - 7y - 3)$ **5.** ______________________

6. $-5a^2(ab - 7b + 6a)$ **6.** ______________________

7. $4ab^2(3a^3 - 9a^2b^2 - 10b^3)$ **7.** ______________________

8. $(y - 15)(y + 3)$ **8.** ______________________

9. $\left(x+\frac{1}{5}\right)\left(x-\frac{2}{9}\right)$ **9.** ______________________

10. $(5x - 3)(4x + 7)$ **10.** ______________________

11. $(2x^2 - 7)(5x^2 + 10)$ **11.** ______________________

12. $(6y - 11)^2$ **12.** ______________________

13. $(y - 8)(y^2 - 5y + 8)$ **13.** ______________________

14. $(7y - 2)^2$ **14.** ______________________

15. $(y - 7)(y^2 - 4y + 3)$ **15.** ______________________

16. $$\begin{array}{r} 2x^2 + 7x + 3 \\ \times \qquad\quad x - 5 \\ \hline \end{array}$$ **16.** ______________________

17. Write the expression for the area of a rectangle with sides $(3x + 5)$ and $(2x + 3)$. **17.** ______________________

18. Find the area of a triangle with height $8x$ in. and base $(3x + 8)$ in. **18.** ______________________

19. Find the area of a rectangle with sides $(4x + 3)$ ft. and $(2x - 7)$ ft. **19.** ______________________

20. Find the area of a square with sides $(3x - 5)$ m. **20.** ______________________

Additional Exercises 5.4

Name ______________________

Date ______________________

Multiply using the FOIL method.

1. $(x + 4)(x + 1)$ **1.** ______________________

2. $(3x - 11)(x + 2)$ **2.** ______________________

3. $(4x - 13)(x - 5)$ **3.** ______________________

4. $(y^2 + 7)(y - 8)$ **4.** ______________________

5. $(a^2 + b^2)(a + b)$ **5.** ______________________

6. $\left(x - \frac{7}{12}\right)\left(x + \frac{1}{12}\right)$ **6.** ______________________

7. $(5 - 8a)(2 - 5a)$ **7.** ______________________

8. $(x + 7y)(3x - 5y)$ **8.** ______________________

Multiply.

9. $(x + 100)^2$ **9.** ______________________

10. $(x + 10.5)^2$ **10.** ______________________

11. $(15a - 2)^2$ **11.** ______________________

12. $\left(y - \frac{5}{9}\right)^2$ **12.** ______________________

13. $(5y - 12)^2$ **13.** ______________________

14. $(x - 20)(x + 20)$ **14.** ______________________

15. $(6x - 1)(6x + 1)$ **15.** ______________________

16. $(3x - 15)(3x + 15)$ **16.** ______________________

17. $(8y^2 - 5)(8y^2 + 5)$ **17.** ______________________

18. $\left(7x - \frac{2}{7}\right)\left(7x + \frac{2}{7}\right)$ **18.** ______________________

Express the following as a product of polynomials in x. Then, multiply and simplify.

19. Find the area of a rectangular rug if its length is $(7x - 5)$ ft. and its width is $(x + 3)$ ft.   **19.** ______________________

20. Find the area of a square that has sides $(8x - 1)$ m.   **20.** ______________________

Additional Exercises 5.5

Name________________________

Date ________________________

Simplify each expression. Write results with positive exponents.

1. 5^{-2}

2. $\left(-\frac{1}{3}\right)^{-4}$

3. $4^{-1}+5^{-1}$

4. $7^{-1}+3^{-1}$

5. $\frac{1}{p^{-7}}$

6. $(4x)^{-3}$

7. $\frac{1}{(5x)^{-4}}$

8. $\left(\frac{x^{-5}y^{3}}{x^{2}y^{9}}\right)^{2}$

9. $(4)^{2}(3)(5)^{0}$

10. $\frac{(x^2)^4}{(x^5)^3}$

11. $\frac{(a^2b^3c)^4}{(3a^{-1}b)^{-2}}$

12. $\frac{(-5xy^{-4})^{-3}}{(xy^{-2})^{-1}}$

Write each number in scientific notation.

13. 0.00000871

14. 12,000,000,000

15. 0.00031

Write each number in standard notation.

16. 784×10^{-7}

17. 6.052×10^{6}

18. 8.072×10^{5}

Evaluate the following expressions using exponential rules.
Write the results in standard form.

19. $(6.1 \times 10^{3})(7 \times 10^{4})$

20. $\frac{2.7\times10^{-3}}{9\times10^{-7}}$

1. ______________________

2. ______________________

3. ______________________

4. ______________________

5. ______________________

6. ______________________

7. ______________________

8. ______________________

9. ______________________

10. ______________________

11. ______________________

12. ______________________

13. ______________________

14. ______________________

15. ______________________

16. ______________________

17. ______________________

18. ______________________

19. ______________________

20. ______________________

Additional Exercises 5.6

Name ________________________

Date ________________________

Divide.

1. $\dfrac{36x^2 - 24x - 18}{6}$

2. $\dfrac{a^3b - a^2b^4}{ab}$

3. $\dfrac{10x^2 - 15x - 55}{5}$

4. $\dfrac{42p^3 - 21p^2}{7p}$

5. $\dfrac{16a^3 - 12a^2 + 8a}{4a}$

6. $\dfrac{5x^7 - 10x^6 + 20x^5}{5x^5}$

7. $\dfrac{27x^2y^3 - 33xy^4 - 42x^2y}{3xy}$

8. $\dfrac{5x^3 - 37x - 24}{x - 8}$

9. $\dfrac{x^2 + 10x + 21}{x + 7}$

10. $\dfrac{x^2 - 3x - 40}{x + 5}$

11. $\dfrac{4x^2 - 11x - 3}{4x + 1}$

12. $\dfrac{12x^2 - 5x - 2}{3x - 2}$

13. $\dfrac{3a^3 + 20a^2 + 21a - 20}{a + 5}$

14. $\dfrac{21a^3 + 23a^2 - 9a - 10}{3a + 2}$

1. ________________________

2. ________________________

3. ________________________

4. ________________________

5. ________________________

6. ________________________

7. ________________________

8. ________________________

9. ________________________

10. ________________________

11. ________________________

12. ________________________

13. ________________________

14. ________________________

Additional Exercises 5.6 *(cont.)*

Name ________________________

Perform each division. Write the polynomials in descending order and fill in any missing terms.

15. $\dfrac{x^3+125}{x+5}$ **15.** ________________________

16. $\dfrac{x^3-8}{x-2}$ **16.** ________________________

17. $\dfrac{27x^3-64}{3x-4}$ **17.** ________________________

18. $\dfrac{-5b+6b^2+4}{3b-1}$ **18.** ________________________

Solve.

19. The area of the top of a pool table is $(24x^2 + 34x + 5)$ square inches. If its length is $(6x + 1)$ inches, find its width. **19** ________________________ _

20. The area of a rug is $(12x^2 + x - 6)$ square inches. If its length is $(3x - 2)$ inches, find its width. **20.** ________________________

Additional Exercises 6.1

Name ______________________

Date ______________________

Find the GCF for each list.

1. 18, 36, 96

2. x^3y^4, x^2y^2, xy

3. $-12x^3$, $36x^2$, 42

Factor out the GCF from each polynomial.

4. $3a^2 + 12a$

5. $5x^2y + 10xy^2 + 25x$

6. $3x^4y^2 + 9x^3y^2 + 30xy$

7. $4y^4 + 8y^3 + 12y^2 - 4y + 24$

8. $4a^5b^3 - 2a^4b^2 + 5a^3b^2$

9. $4x^2y + 8x + 4$

10. $12y^5 + 4y^3 - 16y^2$

11. $6x^5y^5 - 12x^3y - 18x^2y^2$

12. $4a^4 + 16a^2 - 12a + 12$

13. $x(y + 4) + 2(y + 4)$

14. $c(a^2 + 5) - 3(a^2 + 5)$

15. $x(y + 2) - 4(y + 2)$

Factor the following four-term polynomials by grouping.

16. $3x + 12 + xy + 4y$

17. $3y - 6 + xy - 2x$

18. $4x^2 - 16xy - 3x + 12y$

19. $3x^2 - 6xy - 5x + 10y$

20. $20x^3 + 45x^2 - 12x - 27$

1. ______________________

2. ______________________

3. ______________________

4. ______________________

5. ______________________

6. ______________________

7. ______________________

8. ______________________

9. ______________________

10. ______________________

11. ______________________

12. ______________________

13. ______________________

14. ______________________

15. ______________________

16. ______________________

17. ______________________

18. ______________________

19. ______________________

20. ______________________

Additional Exercises 6.2

Name ________________________

Date ________________________

Factor the following trinomials completely. Write "prime" if a polynomial can't be factored.

1. $x^2 + 11x - 42$

2. $x^2 - x + 56$

3. $x^2 - x - 30$

4. $x^2 + x - 20$

5. $x^2 + 8x + 9$

6. $x^2 - 7x - 10$

7. $x^2 + 2x - 24$

8. $x^2 - 3x - 28$

9. $x^2 + 7x - 18$

10. $x^2 - 2x - 63$

11. $x^2 + 15x + 16$

12. $x^2 + 14xy + 45y^2$

13. $5x^2 - 5x - 30$

14. $105 - 36x + 3x^2$

15. $2x^2 + 14x - 12$

16. $x^3 - 5x^2 - 6x$

17. $x^3 - 7x^2 - 44x$

18. $4x^5 + 28x^4 + 40x^3$

19. $x^3y - 6x^2y^2 + 5xy^3$

20. $-24y^3 + 10y^4 + 2y^5$

1. ________________________

2. ________________________

3. ________________________

4. ________________________

5. ________________________

6. ________________________

7. ________________________

8. ________________________

9. ________________________

10. ________________________

11. ________________________

12. ________________________

13. ________________________

14. ________________________

15. ________________________

16. ________________________

17. ________________________

18. ________________________

19. ________________________

20. ________________________

Additional Exercises 6.3

Name ______________________

Date ______________________

Complete the following.

1. $6y^2 - y - 1 = (3y + 1)(\quad)$

2. $4y^2 - 8y - 5 = (2y - 5)(\quad)$

3. $3y^2 - 13y - 10 = (3y + 2)(\quad)$

4. $15y^2 + y - 2 = (5y + 2)(\quad)$

1. ______________________

2. ______________________

3. ______________________

4. ______________________

Factor the following trinomials completely. Write "prime" if a polynomial can't be factored.

5. $15x^2 + 7x - 2$

6. $8x^2 - 10x + 3$

7. $6x^2 - 11x - 10$

8. $9x^2 + 18x + 8$

9. $21x^2 - 17x + 2$

10. $18a^2 - 3a - 10$

11. $12x^2 - 11x - 15$

12. $15a^2 - 4a - 4$

13. $14a^2 - 45a - 14$

14. $-4x^2 + 4x + 24$

15. $42x^2 + 91x + 35$

16. $50x^2 + 65xy - 15y^2$

17. $x^2 + 8x + 16$

18. $25n^2 + 30n + 9$

19. $2x^2 - 24x + 72$

20. $64x^2 + 16xy + y^2$

5. ______________________

6. ______________________

7. ______________________

8. ______________________

9. ______________________

10. ______________________

11. ______________________

12. ______________________

13. ______________________

14. ______________________

15. ______________________

16. ______________________

17. ______________________

18. ______________________

19. ______________________

20. ______________________

Additional Exercises 6.4

Name ______________________

Date ______________________

Factor by grouping.

1. $21x^2 + 14x + 3x + 2$
2. $3x^2 - 15x - x + 5$
3. $5n^2 - 5n + n - 1$
4. $6x^2 + 18x + x + 3$
5. $3x^2 + 7x + 2$
6. $7x^2 - 9x + 2$
7. $10n^2 + 17n + 3$
8. $5x^2 - 9x - 2$
9. $9n^2 + 15n + 4$
10. $4m^2 - 17m + 18$
11. $3m^2 - m - 30$
12. $10m^2 - 3m - 27$
13. $14m^2 - 39m + 10$
14. $63m^2 + 130m + 63$
15. $12x^3 + 22x^2 + 6x$
16. $15m^3 + 24m^2 + 9m$
17. $60m^3 - 42m^2 + 6m$
18. $18x^3 + 112x^2 - 98x$
19. $10x^3 + 65x^2 - 35x$
20. $6x^2y + 13xy - 5y$

1. ______________________
2. ______________________
3. ______________________
4. ______________________
5. ______________________
6. ______________________
7. ______________________
8. ______________________
9. ______________________
10. ______________________
11. ______________________
12. ______________________
13. ______________________
14. ______________________
15. ______________________
16. ______________________
17. ______________________
18. ______________________
19. ______________________
20. ______________________

Additional Exercises 6.5

Name ______________________

Date ______________________

Factor completely.

1. $1 - 9x^2$
2. $4x^2 - y^2$
3. $121 - a^2 b^2$
4. $x^2y^2 - 100$
5. $a^4b^2 - 9$
6. $a^6 - 144$
7. $16x^2 - 121$
8. $x^8 - 169$
9. $225x^2 - 841y^2$
10. $9x^3 - 36x$
11. $y^2 - \frac{16}{81}$
12. $16a^3b^3 - 49ab$
13. $\frac{4}{49}x^2 - \frac{1}{25}$
14. $-36x^2 + 1$
15. $x^3 + y^3$
16. $27x^3 - 8y^3$
17. $x^3y^3 + 216$
18. $a^3 - 343b^3$
19. $8a^3 + 512b^3$
20. $n^3 - \frac{8}{27}$

1. ______________________
2. ______________________
3. ______________________
4. ______________________
5. ______________________
6. ______________________
7. ______________________
8. ______________________
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17. ______________________
18. ______________________
19. ______________________
20. ______________________

Additional Exercises 6.6

Name ______________________

Date ______________________

Solve each equation.

1. $(x + 11)(x - 2) = 0$

2. $(5x - 2)(3x + 1) = 0$

3. $(3x - 2)(3x + 2) = 0$

4. $2x(5x - 1)(x + 2) = 0$

5. $5(x - 7)(2x - 5) = 0$

6. $6x^2(x - 5)(3x + 7) = 0$

7. $(x - 0.3)(x + 0.5) = 0$

8. $x^2 + 5x - 6 = 0$

9. $2x^2 - 3x - 5 = 0$

10. $4y^2 - 25 = 0$

11. $4x^2 + 20x + 25 = 0$

12. $3b^2 + b - 10 = 0$

13. $n^2 - 10n = -21$

14. $m^2 = 11m$

15. $x^2 = 32 - 4x$

16. $9y^2 = 16$

17. $5p^2 - 23p = -24$

18. $n^3 + 8n^2 + 12n = 0$

19. $8y^3 = 2y$

20. $5w^3 = 40w^2 - 80w$

1. ______________________

2. ______________________

3. ______________________

4. ______________________

5. ______________________

6. ______________________

7. ______________________

8. ______________________

9. ______________________

10. ______________________

11. ______________________

12. ______________________

13. ______________________

14. ______________________

15. ______________________

16. ______________________

17. ______________________

18. ______________________

19. ______________________

20. ______________________

Additional Exercises 6.7

Name ________________________

Date ________________________

Solve.

1. A rectangle has an area of 24 square inches. The width is represented by $x - 3$ and the length is $x + 2$. Find the dimensions.

1. ________________________

2. The length of a rectangle is 3 cm more than the width. The area is 70 cm^2. Find the dimensions of the rectangle.

2. ________________________

3. The length of a proposed rectangular flower garden is 6 m more that its width. The area of the proposed garden is 72 m^2. Find the dimensions of the proposed flower garden.

3. ________________________

4. The perimeter of a rectangle is 132 feet and its area is 1080 square feet. Find the dimensions of the rectangle.

4. ________________________

5. A student dropped a ball from the top of a 64-foot building. The height of the ball after t seconds is given by the quadratic equation $h = -16t^2 + 64$. How long will it take the ball to hit the ground?

5. ________________________

6. One leg of a right triangle measures 6 m while the length of the other leg measures x meters. The hypotenuse measures $(2x - 6)$ m. Find the length of all 3 sides.

6. ________________________

7. The longer leg of a right triangle measures two feet more than twice the length of the shorter leg. The hypotenuse measures 3 feet more than twice the shorter leg. Find the length of all three sides.

7. ________________________

8. Find the length of a ladder leaning against a building if the top of the ladder touches the building at a height of 12 feet. Also, the length of the ladder is 4 feet more than its distance from the base of the building.

8. ________________________

9. One leg of a right triangle is 14 meters longer than the other leg. The hypotenuse is 26 meters long. Find the length of each leg.

9. ________________________

10. Eight more than the square of a number is the same as six times the number. Find the number.

10. ________________________

11. Fifteen less than the square of a number is the same as twice the number. Find the numbers.

11. ________________________

Additional Exercises 6.7 *(cont.)*

Name ______________________

Solve.

12. Find two consecutive positive odd integers whose product is 35.

12. ______________________

13. Find three consecutive integers where the sum of twice the first and 4 times the second is equal to 20 more than twice the third.

13. ______________________

14. Find two consecutive odd integers such that the square of the first added to 3 times the second is 24.

14. ______________________

15. The altitude of a triangle is 2 cm shorter than its base. The area is 17.5 cm^2. Find the base of the triangle.

15. ______________________

16. The hypotenuse of a right triangle is 4 cm more than the longer leg. The shorter leg is 4 cm less than the longer leg. Find the length of each leg.

16. ______________________

17. Nine more than the cube of a number is the same as 81 times the number. Find the numbers.

17. ______________________

18. The difference between the square of a positive integer and the square of one-half the number is 243. Find the number.

18. ______________________

19. The base of a triangle is 3 cm longer than its altitude. The area of the triangle is 35 cm^2. Find the altitude.

19. ______________________

20. A 4 m by 6 m rug covers half the floor area of a room and leaves a uniform strip of base floor around the edges. What are the dimensions of the room?

20. ______________________

Additional Exercises 7.1

Name ____________________

Date ____________________

Find the value of the following rational expressions when $x = 3$ and $y = -2$.

1. $\dfrac{x+4}{2x-7}$ 1. ____________________

2. $\dfrac{y^2}{y^3-1}$ 2. ____________________

3. $\dfrac{y^2+7y+3}{y^2-y-8}$ 3. ____________________

Find any real number for which each rational expression is undefined.

4. $\dfrac{x+5}{7x}$ 4. ____________________

5. $\dfrac{5x^3+17}{3x-30}$ 5. ____________________

6. $\dfrac{x^2-7x+2}{19}$ 6. ____________________

Simplify each rational expression.

7. $\dfrac{6}{12x-18}$ 7. ____________________

8. $\dfrac{3x-12}{5x-20}$ 8. ____________________

9. $\dfrac{x+19}{19+x}$ 9. ____________________

10. $\dfrac{x-12}{12-x}$ 10. ____________________

11. $\dfrac{-8a-8b}{a+b}$ 11. ____________________

12. $\dfrac{x+3}{x^2-5x-24}$ 12. ____________________

Additional Exercises 7.1 *(cont.)*

Name ____________________

Simplify each rational expression.

13. $\dfrac{4x^2+19x-5}{4x-1}$

13. ____________________

14. $\dfrac{x^2-x-72}{x^2-18x+81}$

14. ____________________

15. $\dfrac{2x^2-72}{6x-36}$

15. ____________________

16. Simplify, factor by grouping: $\dfrac{4x-28+xy-7y}{x-7}$.

16. ____________________

17. List four equivalent forms for the following rational expression: $-\dfrac{y-2}{y+7}$.

17. ____________________

The cost C per machine of producing x computer printers is given by the equation:
$C = \dfrac{210x+12{,}000}{x}$.

18. Find the cost per machine when 200 printers are produced.

18. ____________________

19. Find the cost per machine when 2000 printers are produced.

19. ____________________

20. The formula for body-mass index B is $B = \dfrac{750w}{h^2}$ where w is weight in pounds and h is height in inches. Find the body-mass index for a person who is 5 feet 4 inches (64 inches) tall and weighs 104 pounds. If necessary, round to the nearest hundredth.

20. ____________________

Additional Exercises 7.2

Name ____________________

Date ____________________

1. Find the reciprocal of $-\dfrac{3x+7}{5}$ **1.** ____________

Find each product and simplify if possible.

2. $\dfrac{5x^2}{y} \cdot \dfrac{3y}{7x}$ **2.** ____________

3. $\dfrac{8x^3}{14x} \cdot \dfrac{7}{4x}$ **3.** ____________

4. $-\dfrac{9a^3b}{54a^2b^4} \cdot b^3$ **4.** ____________

5. $\dfrac{x}{7x-21} \cdot \dfrac{x^2-3x}{5}$ **5.** ____________

6. $\dfrac{x^2+8x}{11} \cdot \dfrac{44}{x+8}$ **6.** ____________

7. $\dfrac{y^2-11y+18}{y^2-5y-36} \cdot \dfrac{y+4}{y}$ **7.** ____________

8. Find the area of a rectangle whose width is $\dfrac{x+7}{7x}$ m and length is $\dfrac{2x}{x^2-49}$ m. **8.** ____________

9. Find the area of a square with sides of $\dfrac{3x}{4x^2-9x}$ ft. **9.** ____________

Find each quotient and simplify.

10. $\dfrac{12x^6}{11x^2} \div \dfrac{8x}{22x^4}$ **10.** ____________

11. $\dfrac{12x^3}{y^4} \div \dfrac{3x^2y}{2y^2}$ **11.** ____________

Additional Exercises 7.2 *(cont.)*

Name ______________________

Find each quotient and simplify.

12. $\dfrac{(x-9)(x+12)}{3x} \div \dfrac{2x-18}{9x^2}$

12. ______________________

13. $\dfrac{(x+4)}{(x+4)(3x-8)} \div \dfrac{26}{3x-8}$

13. ______________________

14. $\dfrac{a^2-b^2}{a+b} \div \dfrac{2a}{a^2-ab}$

14. ______________________

15. $\dfrac{x+2}{6-x} \div \dfrac{x^2-5x-14}{x^2-4x-12}$

15. ______________________

Multiply or divide as indicated.

16. $\dfrac{2x-24}{30} \div \dfrac{3x-36}{25}$

16. ______________________

17. $\dfrac{x^2-4y^2}{5x+20} \cdot \dfrac{x^2+4x}{5x^2-9xy-2y^2}$

17. ______________________

18. $\dfrac{x^2-10x+25}{8y} \div \dfrac{5-x}{12xy}$

18. ______________________

19. $\left(\dfrac{x^2-16}{x^2-36} \cdot \dfrac{x^2+2x-24}{3x^2+13x+4}\right) \div \dfrac{3x+1}{6-x}$

19. ______________________

20. A bullet leaves the barrel of a rifle traveling 1,500 feet/second. Convert 1,500 feet/second to miles/hour. (1 mile = 5,280 feet). Round to the nearest whole number.

20. ______________________

Additional Exercises 7.3

Name ______________________

Date ______________________

Add or subtract as indicated. Simplify the result if possible.

1. $\frac{a}{17}+\frac{11}{17}$ **1.** ______________________

2. $\frac{13m}{4n}+\frac{11m}{4n}$ **2.** ______________________

3. $\frac{5y}{y-8}-\frac{40}{y-8}$ **3.** ______________________

4. $\frac{7}{15+x}+\frac{x+3}{15+x}$ **4.** ______________________

5. $\frac{12x+7}{x-6}-\frac{10x+19}{x-6}$ **5.** ______________________

6. $\frac{x}{x^2-2x-48}-\frac{8}{x^2-2x-48}$ **6.** ______________________

7. $\frac{7x-2}{x^2+3x-28}-\frac{6x-9}{x^2+3x-28}$ **7.** ______________________

Find the LCD for the following lists of rational expressions.

8. $\frac{15}{5y^7},\frac{7x}{15y}$ **8.** ______________________

9. $\frac{1}{3y},\frac{2x}{9y-15}$ **9.** ______________________

10. $\frac{23x-14}{9x-18},\frac{7}{3x^2-12x+12}$ **10.** ______________________

11. $\frac{24}{x-y},\frac{31}{y-x}$ **11.** ______________________

12. $\frac{9}{x^2+12x+35},\frac{11x-12}{x^2+9x+20}$ **12.** ______________________

Additional Exercises 7.3 *(cont.)*

Name ____________________

Rewrite each rational expression as an equivalent rational expression whose denominator is the given polynomial.

13. $\dfrac{3}{6y^2} = \dfrac{\quad}{48y^5}$ **13.** ____________________

14. $\dfrac{7a+3}{9a+3} = \dfrac{\quad}{3b(3a+1)}$ **14.** ____________________

15. $\dfrac{11y-4}{12x^2-15} = \dfrac{\quad}{36x^2-45}$ **15.** ____________________

16. $\dfrac{10}{x^2+4x-32} = \dfrac{\quad}{(x+8)(x-4)(x+4)}$ **16.** ____________________

17. $\dfrac{x-7}{x^3-3x^2-18x} = \dfrac{\quad}{x(x+4)(x-6)(x+3)}$ **17.** ____________________

18. A square has a side of length $\dfrac{9}{x-15}$ feet. Express its perimeter as a rational expression. **18.** ____________________

19. The pentagon has sides $\dfrac{4}{x+6}$ m, $\dfrac{x+1}{x+6}$ m, $\dfrac{x+1}{x+6}$ m, $\dfrac{x+1}{x+6}$ m, and $\dfrac{4}{x+6}$ m. Find its perimeter. **19.** ____________________

20. The trapezoid has sides $\dfrac{4}{x+3}$ m, $\dfrac{x+2}{x+3}$ m, $\dfrac{x+5}{x+3}$ m, and $\dfrac{4}{x+3}$ m. Find its perimeter. **20.** ____________________

Additional Exercises 7.4

Name ____________________

Date ____________________

Add or subtract as indicated. Simplify the result if possible.

1. $\dfrac{7}{4x}+\dfrac{3}{5x}$ **1.** ____________________

2. $\dfrac{4n}{m}+\dfrac{3m}{8}$ **2.** ____________________

3. $\dfrac{4}{x}+\dfrac{2}{3x^2}$ **3.** ____________________

4. $\dfrac{5}{x-2}-\dfrac{3}{3x-6}$ **4.** ____________________

5. $\dfrac{9}{7x-28}+\dfrac{x}{x^2-16}$ **5.** ____________________

6. $\dfrac{2}{y^2}-\dfrac{y}{3y+1}$ **6.** ____________________

7. $\dfrac{11}{x-9}+\dfrac{3}{9-x}$ **7.** ____________________

8. $\dfrac{4}{x}+5$ **8.** ____________________

9. $\dfrac{10}{x-7}+3$ **9.** ____________________

10. $\dfrac{5x^4}{x}-\dfrac{2x^2}{x^3}$ **10.** ____________________

11. $\dfrac{1}{x+6}-\dfrac{1}{(x+6)^2}$ **11.** ____________________

12. $\dfrac{9}{(x-4)^2}+\dfrac{11}{(x-4)(x+10)}$ **12.** ____________________

13. $\dfrac{4}{x^2-8x-20}-\dfrac{2}{x^2+12x+20}+\dfrac{3}{x^2-100}$ **13.** ____________________

Additional Exercises 7.4 *(cont.)*

Name ______________________

Add or subtract as indicated. Simplify the result if possible.

14. $\dfrac{11}{x-7}+\dfrac{14}{7-x}$

14. ______________________

15. $\dfrac{1}{x+3}-\dfrac{1}{(x+3)^2}$

15. ______________________

16. $\dfrac{17}{x^2+x-56}-\dfrac{6}{x-7}$

16. ______________________

17. A company earns \$8 on each hammer it sells. The cost to produce each hammer is $\dfrac{5x+100}{x}$, where x is the number of hammers produced. Find the profit the company makes on each hammer by subtracting the cost to produce from the amount it earns. Then find the profit it makes on each hammer when it produces 2000 hammers.

17. ______________________

18. A piece of gutter was $\dfrac{5}{x+6}$ inches long before Allison used a piece $\dfrac{1}{x-6}$ inches long over her porch. How long is the piece that is left?

18. ______________________

19. The length of the rectangle is $\dfrac{8}{x-4}$ feet, while its width is $\dfrac{5}{x}$ feet. Find the perimeter.

19. ______________________

20. A board of length $\dfrac{2}{x+5}$ inches was cut into two pieces. If one piece is $\dfrac{4}{x-5}$ inches, express the length of the other board as a rational expression.

20. ______________________

Additional Exercises 7.5

Name ______________________

Date ______________________

Solve each equation.

1. $\dfrac{x}{7}+2=4$

2. $\dfrac{x}{9}+\dfrac{4x}{3}=\dfrac{26}{9}$

3. $\dfrac{5}{y}+\dfrac{1}{6}=\dfrac{23}{6y}$

4. $\dfrac{8}{x}+\dfrac{1}{4}=\dfrac{9}{2x}$

5. $3+\dfrac{2}{a-4}=\dfrac{a}{a-4}$

6. $\dfrac{x}{x-1}=\dfrac{6}{x+1}$

7. $\dfrac{3y}{y-5}+2=\dfrac{4y}{y-5}$

8. $\dfrac{2x}{x+3}-2=\dfrac{x+2}{x-3}$

9. $\dfrac{t}{t-6}=\dfrac{t+6}{9}$

10. $\dfrac{t+2}{4}-\dfrac{t-2}{8}=\dfrac{1}{8}$

11. $\dfrac{1}{3y+1}=\dfrac{2}{9y^2-1}-\dfrac{1}{3y-1}$

12. $\dfrac{5}{x+2}=\dfrac{11x+1}{x^2+7x+10}-\dfrac{12}{x+5}$

1. ______________________

2. ______________________

3. ______________________

4. ______________________

5. ______________________

6. ______________________

7. ______________________

8. ______________________

9. ______________________

10. ______________________

11. ______________________

12. ______________________

Additional Exercises 7.5 *(cont.)*

Name ________________________

Solve each equation for the indicated variable.

13. $\dfrac{A}{h}=\dfrac{b}{2}$ for h

13. ________________________

14. $\dfrac{A}{B+b}=\dfrac{h}{2}$ for B

14. ________________________

15. $N=R+\dfrac{V}{G}$ for V

15. ________________________

16. $P=\dfrac{A}{1+rt}$ for r

16. ________________________

Two angles are supplementary if the sum of their measures is 180°. Find the measures of the following supplementary angles.

17. $\left(\dfrac{21x}{6}\right)^{\circ}, \left(\dfrac{29x}{2}\right)^{\circ}$

17. ________________________

18. $\left(\dfrac{11x}{4}\right)^{\circ}, \left(\dfrac{7x}{4}\right)^{\circ}$

18. ________________________

Two angles are complementary if the sum of their measures is 90°. Find the measures of the following complementary angles.

19. $\left(\dfrac{180}{y}\right)^{\circ}, \left(\dfrac{630}{y}\right)^{\circ}$

19. ________________________

20. $\left(\dfrac{990}{y}\right)^{\circ}, \left(\dfrac{900}{y}\right)^{\circ}$

20. ________________________

Additional Exercises 7.6

Name ______________________

Date ______________________

Solve each proportion.

1. $\frac{x}{39} = \frac{4}{13}$

2. $\frac{y+4}{y} = \frac{9}{2}$

3. $\frac{5}{9} = \frac{z-8}{z-4}$

4. $\frac{x}{36} = \frac{5}{18}$

5. $\frac{2y+3}{y} = \frac{3}{2}$

6. $\frac{2}{5} = \frac{z-3}{z-8}$

1. ______________________

2. ______________________

3. ______________________

4. ______________________

5. ______________________

6. ______________________

Solve the following problems.

7. Twelve times the reciprocal of a number is equal to 8 times the reciprocal of 6. Find the number.

8. If one more than 3 times a number is divided by the number, the result is four thirds. Find the number.

9. If fifteen less than two times a number is divided by six more than the number, the result is four less than 9 times the reciprocal of the number. Find the number.

10. George can install new wiring for a computer in 3 hours. It takes Pete 4 hours. How long would it take if they worked together?

11. Marcus assembles crafts in his home. It takes him 2 hours to complete a package of napkin holders. His daughter takes 8 hours to do a package. How long would it take them if they work together?

12. One housekeeper can clean a hotel room twice as fast as another one. Working together, they can clean a room in 8 minutes. How long does it take for each housekeeper to clean a room?

7. ______________________

8. ______________________

9. ______________________

10. ______________________

11. ______________________

12. ______________________

Additional Exercises 7.6 *(cont.)*

Name ______________________

Solve the following problems.

13. A boat can travel 22 miles upstream in the same amount of time it can travel 42 miles downstream. The speed of the current is 5 miles per hour. Find the speed of the boat in still water.

13. ______________________

14. Olga walks 2 miles at one rate for half of her workout. In the same amount of time, she walks an additional 3 miles at a rate that is 2 miles per hour faster. Find both of Olga's rates.

14. ______________________

15. Karl walks 3 miles at one rate for half his workout. In the same amount of time, he walks an additional 4 miles at a rate that is 1 mile per hour faster. Find both of Karl's rates.

15. ______________________

16. Cameron and Whitney have a cabin in the mountains. To get there from home, they drive 36 miles on level ground and 20 miles on mountain roads. They can drive 28 miles per hour faster on the level roads than on the mountain ones. Each part of the trip takes the same amount of time. Find both their level and mountain road rates.

16. ______________________

17. For two similar triangles, two sides of the smaller triangle are x and 4. The corresponding sides of the larger triangle are 10 and 16, respectively. Find the length of side x.

17. ______________________

18. Maurice is building a city to go with his model train set. He wants to make a yield sign that is similar to an actual yield sign. An actual yield sign is a triangle that has a top that is 15 in. and two sides that are 12 in. each. If the model yield sign is to have a top that is 1.75 in. how long should the two sides be?

18. ______________________

19. One conveyor belt can move 1000 boxes in 6 minutes. Another can move 1000 boxes in 11 minutes. If another conveyor belt is added and all three are used, the boxes are moved in 3 minutes. If the third conveyor belt worked alone, how long would it take to do the same job?

19. ______________________

20. A car travels 400 miles on level terrain in the same amount of time it travels 160 miles on mountainous terrain. If the rate of the car is 30 miles per hour less in mountains than on level ground, find its rate in the mountains.

20. ______________________

Additional Exercises 7.7

Name ____________________

Date ____________________

State whether each equation is (a) direct or (b) inverse variation.

1. $y = 6x$ **1.** ____________________

2. $y = \frac{15}{x}$ **2.** ____________________

3. $y = 3x^3$ **3.** ____________________

4. $y = \frac{11}{x}$ **4.** ____________________

5. $y = 10x^2$ **5.** ____________________

Write a direct variation equation, $y = kx$, that satisfies the ordered pairs in each table.

6. **6.** ____________________

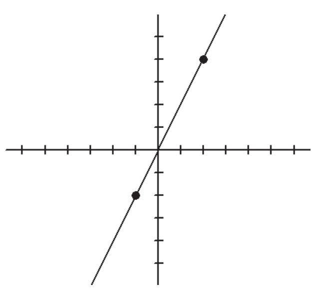
x	0	8	16
y	0	2	4

7. **7.** ____________________

x	0	3	-5	7
y	0	24	-40	56

Write a direct variation equation, $y = kx$, that describes each graph.

8. **8.** ____________________



Write an inverse variation equation, $y = \frac{k}{x}$, that satisfies the ordered pairs in each table.

9. **9.** ____________________

x	1	3	-6	12
y	12	4	-2	1

Additional Exercises 7.7 *(cont.)*

Name________________________

Write an inverse variation equation, $y = \frac{k}{x}$, that satisfies the ordered pairs in each table.

10.

x	3	-10	0.5	0.01
y	0.1	-0.3	0.6	30

10. ________________________

Write an equation to describe each variation. Use k for the constant of proportionality.

11. s varies directly as t.

12. t varies directly as $\sqrt{x}$.

13. p varies inversely as x^3.

11. ________________________

12. ________________________

13. ________________________

Solve.

14. y varies directly as x. When y is 12, x is 4. Find y when x is 9.

14. ________________________

15. a varies directly as b^2. When a is 4, b is 32. Find a when b is 50.

15. ________________________

16. a varies inversely as x. If $a = 4$ when $x = 3$, find a when x is 6.

16. ________________________

17. p varies inversely as x^2. If $p = 5$ when $x = 2$, find p when x is 6.

17. ________________________

Solve.

18. Ray's paycheck varies directly as the number of hours he works. If he earns \$21.75 for 3 hours, how much will he earn for 23 hours of work?

18. ________________________

19. The fixed voltage current in an electrical circuit varies inversely with the resistance in the circuit. If a particular circuit has a current of 2.5 amps when the resistance is 150 ohms, find the current in the circuit when the resistance is 300 ohms.

19. ________________________

20. The amount of gas that a helicopter uses varies directly as the number of hours spent flying. The helicopter flies for 3 hours and uses 30 gallons of fuel. Find the number of gallons of fuel that the helicopter uses to fly for 5 hours.

20. ________________________

Additional Exercises 7.8

Name ____________________

Date ____________________

Simplify each complex fraction.

1. $\dfrac{\frac{1}{9}}{-\frac{4}{15}}$

2. $\dfrac{\frac{7y}{20}}{\frac{3y}{4}}$

3. $\dfrac{\frac{3}{8}}{\frac{1}{8}-\frac{3}{4}}$

4. $\dfrac{1-\frac{8}{9}}{2-\frac{3}{4}}$

5. $\dfrac{\frac{2x+8}{2}}{\frac{4x+16}{4}}$

6. $\dfrac{\frac{1}{6}-\frac{1}{x}}{\frac{2}{3}+\frac{1}{x^2}}$

7. $\dfrac{2+\frac{2}{y-3}}{y+\frac{2}{y-3}}$

8. $\dfrac{\frac{2x+2y}{x^2-y^2}}{\frac{x+y}{x-y}}$

9. $\dfrac{\frac{5}{2y}+7}{\frac{5}{2y}-7}$

1. ____________________

2. ____________________

3. ____________________

4. ____________________

5. ____________________

6. ____________________

7. ____________________

8. ____________________

9. ____________________

Additional Exercises 7.8 *(cont.)*

Name ______________________

Simplify each complex fraction.

10. $\dfrac{\dfrac{3x-21}{12}}{\dfrac{2x-14}{4}}$

10. ______________________

11. $\dfrac{a-\dfrac{4}{a}}{\dfrac{1}{a^2}+\dfrac{1}{2a}}$

11. ______________________

12. $\dfrac{5+\dfrac{1}{x^2}}{5-\dfrac{1}{x}}$

12. ______________________

13. $\dfrac{\dfrac{5}{x+1}+6}{\dfrac{10}{x+1}-6}$

13. ______________________

14. $\dfrac{\dfrac{x}{2}+\dfrac{1}{2}}{\dfrac{x^2}{3}+\dfrac{x}{3}}$

14. ______________________

15. $\dfrac{\dfrac{3}{a}+3}{\dfrac{3}{a}-3}$

15. ______________________

To find the average of two numbers, we find their sum and divide by 2.

16. Find the average of $\dfrac{3}{5}$ and $\dfrac{1}{4}$.

16. ______________________

17. Write the average of $\dfrac{7}{n}$ and $\dfrac{4}{n^2}$ as a simplified rational expression.

17. ______________________

Name ____________________

18. Find the average of $\frac{2}{3}$ and $\frac{5}{8}$.

18. ____________________

19. Write the average of $\frac{12}{n}$ and $\frac{8}{n^2}$ as a simplified rational expression.

19. ____________________

20. In optics, a single lens can be equivalent to two thin lines with focal lengths of f_1 and f_2. If the two thin lenses are touching, the focal length of the single lens is given by the complex fraction $\dfrac{1}{\dfrac{1}{f_1}+\dfrac{1}{f_2}}$. Simplify this expression.

20. ____________________

Additional Exercises 8.1

Name ______________________

Date ______________________

Find each square root. Indicate if the number is not real.

1. $\sqrt{81}$ **1.** ______________________

2. $\sqrt{\dfrac{1}{49}}$ **2.** ______________________

3. $-\sqrt{144}$ **3.** ______________________

4. $\sqrt{-9}$ **4.** ______________________

5. $\sqrt{\dfrac{121}{4}}$ **5.** ______________________

Find the cube root.

6. $\sqrt[3]{8000}$ **6.** ______________________

7. $\sqrt[3]{216}$ **7.** ______________________

8. $\sqrt[3]{-64}$ **8.** ______________________

Find each root. Indicate if the number is not real.

9. $\sqrt[5]{-1024}$ **9.** ______________________

10. $\sqrt[5]{243}$ **10.** ______________________

11. $\sqrt[4]{-81}$ **11.** ______________________

12. $-\sqrt[4]{16}$ **12.** ______________________

Approximate each square root to three decimal places.

13. $\sqrt{46}$ **13.** ______________________

14. $\sqrt{178}$ **14.** ______________________

15. The total area of a roof is exactly $160\sqrt{29}$ square feet. Approximate this area to the nearest whole number. **15.** ______________________

Additional Exercises 8.1 *(cont.)*

Name ________________________

Find each root. Assume that each variable represents a non-negative real number.

16. $\sqrt{n^4}$

17. $\sqrt{16y^6}$

18. $\sqrt{81z^{20}}$

19. $\sqrt[3]{-125x^3y^{15}}$

20. Complete the table, plot the points, and draw a smooth curve to graph $y=\sqrt{x-1}$.

x	y
1	
2	
5	
7	
10	

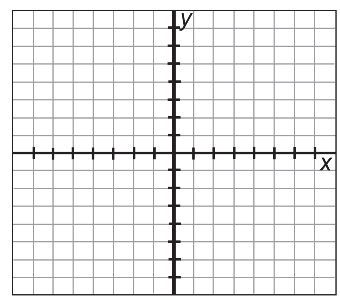
16. ________________________

17. ________________________

18. ________________________

19. ________________________

20.



Additional Exercises 8.2

Name ______________________

Date ______________________

Use the product rule to simplify each expression.

1. $\sqrt{75}$ **1.** ______________________

2. $\sqrt{99}$ **2.** ______________________

3. $\sqrt{72}$ **3.** ______________________

Use the product rule and the quotient rule to simplify each expression.

4. $\sqrt{\frac{45}{64}}$ **4.** ______________________

5. $-\sqrt{\frac{84}{25}}$ **5.** ______________________

6. $\sqrt{\frac{75}{81}}$ **6.** ______________________

7. $\sqrt{\frac{48}{225}}$ **7.** ______________________

Simplify each expression. Assume all variables represent positive real numbers.

8. $\sqrt{x^{11}}$ **8.** ______________________

9. $\sqrt{25y^3}$ **9.** ______________________

10. $\sqrt{45x^6y^8}$ **10.** ______________________

11. $\sqrt{\frac{56}{y^4}}$ **11.** ______________________

12. $\sqrt{\frac{98y^2}{x^{10}}}$ **12.** ______________________

13. $\sqrt{\frac{x^9}{y^{20}}}$ **13.** ______________________

Additional Exercises 8.2 *(cont.)*

Name ______________________

Simplify each radical.

14. $6\sqrt{25}$

14. ______________________

15. $\sqrt[3]{56}$

15. ______________________

16. $\sqrt[3]{\dfrac{14}{125}}$

16. ______________________

17. $\sqrt[4]{\dfrac{810}{x^{24}}}$

17. ______________________

Simplify each expression. Assume all variables represent positive real numbers.

18. $\sqrt{117x^7y^6}$

18. ______________________

19. The length of each side of a cube with a volume of 270 cubic inches is $\sqrt[3]{270}$. Simplify this radical.

19. ______________________

20. The length of a path across a garden is $\sqrt{1300}$ feet. Simplify this radical.

20. ______________________

Additional Exercises 8.3

Name ________________________

Date ________________________

Add or subtract.

1. $6\sqrt{7}-9\sqrt{7}$ **1.** ____________

2. $\sqrt{10}+6\sqrt{10}-5\sqrt{10}$ **2.** ____________

3. $8\sqrt{19}-5\sqrt{19}-10\sqrt{19}$ **3.** ____________

Add or subtract, first simplifying each radical and then combining any like radical terms. Assume that all variables represent positive real numbers.

4. $\sqrt{98}+\sqrt{8}$ **4.** ____________

5. $\sqrt{80}-\sqrt{180}$ **5.** ____________

6. $3\sqrt{96}+2\sqrt{50}-\sqrt{600}-\sqrt{242}$ **6.** ____________

7. $y-7\sqrt{y^2}+3\sqrt{y}$ **7.** ____________

8. $\sqrt{144x}-\sqrt{64x}-4\sqrt{x}$ **8.** ____________

9. $5\sqrt{x^3}-x\sqrt{9}$ **9.** ____________

10. $\sqrt{\dfrac{13}{25}}+\sqrt{\dfrac{13}{100}}$ **10.** ____________

11. $\sqrt{121x}-8\sqrt{x}-\sqrt{16x}$ **11.** ____________

12. $6\sqrt{10yz^2}+z\sqrt{810y}$ **12.** ____________

13. $\sqrt{48x^2}-x\sqrt{245x}-x\sqrt{300}+\sqrt{500x^3}$ **13.** ____________

14. $\sqrt{32x^3}+\sqrt{49x}+x\sqrt{72x}$ **14.** ____________

15. $2\sqrt[3]{25}+4\sqrt[3]{25}-\sqrt[3]{4}$ **15.** ____________

16. $\sqrt[3]{16y}+\sqrt[3]{128y}$ **16.** ____________

17. $2\sqrt[3]{64x}+2\sqrt[3]{8x}$ **17.** ____________

Additional Exercises 8.3 *(cont.)*

Name ______________________

18. Find the perimeter of a rectangular door if the width is $2\sqrt{5}$ ft. and the length is 8 ft.

18. ______________________

19. Find the perimeter of a triangle whose sides are $3\sqrt{7}$ m, $5\sqrt{7}$ m, and $4\sqrt{7}$ m.

19. ______________________

20. Find the perimeter of a four sided piece of land with sides of $3\sqrt{75}$ ft., $4\sqrt{108}$ ft., $6\sqrt{27}$ ft., and $2\sqrt{147}$ ft.

20. ______________________

Additional Exercises 8.4

Name ____________________________

Date ____________________________

Multiply and simplify. Assume that all variables represent positive real numbers.

1. $\sqrt{5} \cdot \sqrt{20}$ 1. ____________________
2. $\sqrt{14} \cdot \sqrt{14}$ 2. ____________________
3. $\sqrt{33} \cdot \sqrt{3}$ 3. ____________________
4. $\sqrt{17x} \cdot \sqrt{17x}$ 4. ____________________
5. $\left(7\sqrt{x}\right)^2$ 5. ____________________
6. $\sqrt{5y} \cdot \sqrt{10x}$ 6. ____________________
7. $\sqrt{2xy^2}\sqrt{6xy}$ 7. ____________________
8. $\sqrt{5}\left(\sqrt{7}+1\right)$ 8. ____________________
9. $\left(\sqrt{11}+4\right)\left(\sqrt{11}-4\right)$ 9. ____________________
10. $\left(\sqrt{7}+\sqrt{6}\right)\left(\sqrt{5}-\sqrt{6}\right)$ 10. ____________________
11. $\left(\sqrt{x}-4\right)^2$ 11. ____________________
12. $\left(\sqrt{3y}+2\right)^2$ 12. ____________________

Divide and simplify. Assume that all variables represent positive real numbers.

13. $\dfrac{\sqrt{44}}{\sqrt{11}}$ 13. ____________________
14. $\dfrac{\sqrt{90}}{\sqrt{5}}$ 14. ____________________
15. $\dfrac{\sqrt{84x^5y^3}}{\sqrt{7x^2y}}$ 15. ____________________

Additional Exercises 8.4 *(cont.)*

Name ______________________

Rationalize each denominator and simplify. Assume that all variables represent positive real numbers.

16. $\dfrac{\sqrt{10}}{\sqrt{7}}$

16. ______________________

17. $\dfrac{\sqrt{2}}{\sqrt{12y}}$

17. ______________________

18. $\dfrac{9}{\sqrt{x}-6}$

18. ______________________

19. $\dfrac{\sqrt{6}+1}{\sqrt{3}+\sqrt{2}}$

19. ______________________

20. A television is a rectangle with a length of $3\sqrt{65}$ in. and a width of $3\sqrt{35}$ in. Find the area of the screen.

20. ______________________

Additional Exercises 8.5

Name ______________________

Date ______________________

Solve each equation. Be sure to check for extraneous solutions.

1. $\sqrt{x} = 7$ 1. ______________
2. $\sqrt{x+2} = 9$ 2. ______________
3. $\sqrt{3x-2} = 5$ 3. ______________
4. $\sqrt{x} - 1 = 3$ 4. ______________
5. $2\sqrt{x} + 5 = 15$ 5. ______________
6. $\sqrt{3x+1} + 16 = 7$ 6. ______________
7. $\sqrt{5x+1} - 7 = -1$ 7. ______________
8. $\sqrt{x} = \sqrt{3x-18}$ 8. ______________
9. $\sqrt{3x} = \sqrt{2x+3}$ 9. ______________
10. $\sqrt{5x-1} = \sqrt{4x+1}$ 10. ______________
11. $\sqrt{2x+8} = \sqrt{5x-4}$ 11. ______________
12. $\sqrt{25x^2 - 2x + 10} = 5x$ 12. ______________
13. $\sqrt{9x^2 - 3x + 21} = 3x$ 13. ______________
14. $\sqrt{3x^2 + 12x + 16} = 4$ 14. ______________
15. $\sqrt{x} = x - 12$ 15. ______________
16. $\sqrt{x} = x - 2$ 16. ______________
17. $\sqrt{4x+13} = x + 2$ 17. ______________
18. $\sqrt{x-5} = \sqrt{x} - 1$ 18. ______________
19. $7\sqrt{x} + 12 = 5$ 19. ______________
20. $\sqrt{5x+2} + 9 = 11$ 20. ______________

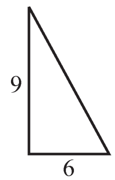
Additional Exercises 8.6

Name ____________________

Date ____________________

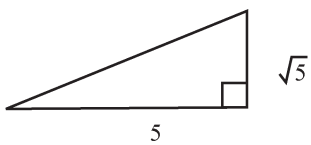
Use the Pythagorean theorem to find the unknown side of each right triangle. Give an exact answer and a two-decimal-place approximation.

1.



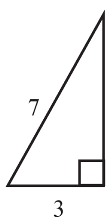
1. ____________________

2.



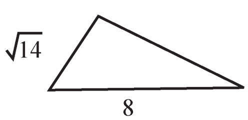
2. ____________________

3.



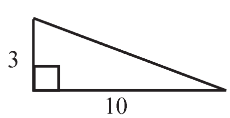
3. ____________________

4.



4. ____________________

5.



5. ____________________

Additional Exercises 8.6 *(cont.)*

Name ________________________

Find the length of the unknown side of each right triangle with sides a, b, and c, where c is the hypotenuse. Give an exact answer and a two-decimal-place approximation.

6. $a = 3, b = 6$

7. $a = \sqrt{20}, c = 10$

8. $b = \sqrt{22}, \; c = \sqrt{76}$

9. $a = \sqrt{5}, \; c = 6$

6. ________________________

7. ________________________

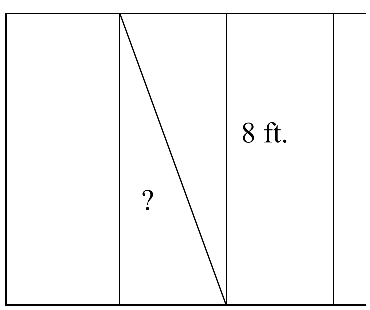
8. ________________________

9. ________________________

Solve the following.

10. The diagram shows the framing for a wall of a house. Find how long the brace needs to be to the nearest hundredth of a foot.

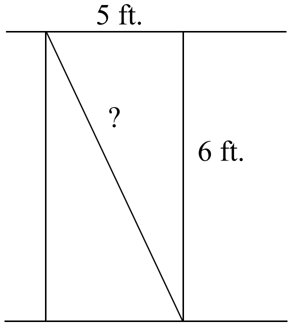
3ft.



10. ________________________

11. The diagram shows the framing for a wall of a house. Find how long the brace needs to be to the nearest hundredth of a foot.

5 ft.



11. ________________________

12. You want to stake a small tree. The cord will be attached to the tree 2.5 feet off the ground and each of the two stakes will be 3 feet from the base of the tree. How much cord do you need to buy, in whole feet, so you have enough?

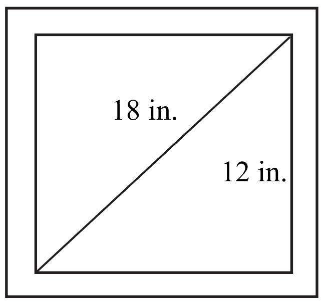
12. ________________________

Name ______________________

13. You need to brace a flagpole until it can be reset in the ground. There are rings you can use to attach twine to the pole. The rings are 8 feet off the ground. You plan to drive 2 stakes in the ground each 5 feet from the base of the pole. How much cord do you need to buy, in whole feet, so you have enough?

13. ______________________

14. An 18-inch diagonal computer monitor screen is 12 inches high. Find its width to the nearest tenth of an inch.



14. ______________________

Police use the formula $s = \sqrt{30fd}$ to estimate the speed s of a car in miles per hour, given the distance d the car skidded, and the type of road surface f. For wet concrete, f is 0.35.

15. Find how fast a car is going if it skidded 193 feet on wet concrete.

15. ______________________

Use the distance formula to find the distance between the points.

16. (1, 6), (−3, −7)

16. ______________________

17. (−2, −5), (5, −4)

17. ______________________

18. (−4, −6), (−2, 4)

18. ______________________

19. (−1, −4), (2, 2)

19. ______________________

20. (6, −4), (2, −6)

20. ______________________

Additional Exercises 8.7

Name ______________________

Date ______________________

Simplify each expression.

1. $144^{1/2}$
2. $256^{1/4}$
3. $-32^{1/5}$
4. $(-243)^{1/5}$
5. $\left(\frac{4}{9}\right)^{1/2}$
6. $-\left(\frac{16}{81}\right)^{1/4}$
7. $64^{4/3}$
8. $81^{5/4}$
9. $\left(\frac{8}{64}\right)^{2/3}$
10. $64^{-3/2}$
11. $\left(\frac{8}{1000}\right)^{-2/3}$
12. $9^{-1/2}$
13. $2^{2/5}\cdot 2^{3/5}$
14. $\left(4^{1/3}\right)^{9/4}$
15. $\frac{5^{-3/4}}{5}$
16. $\left(y^{-1/3}\right)^{3/2}$
17. $\left(\frac{3m^{1/6}n^{1/3}}{4n^{-2/3}}\right)^{2}$

1. ______________________
2. ______________________
3. ______________________
4. ______________________
5. ______________________
6. ______________________
7. ______________________
8. ______________________
9. ______________________
10. ______________________
11. ______________________
12. ______________________
13. ______________________
14. ______________________
15. ______________________
16. ______________________
17. ______________________

Additional Exercises 8.7 *(cont.)*

Name ________________________

Simplify each expression.

18. $\left(25x^2y^4z^6\right)^{1/2}$

19. $\dfrac{y^{5/3}}{y^{1/3}}$

20. $\left(\dfrac{16w^{-2}z}{2wz^{-8}}\right)^{1/3}$

18. ________________________

19. ________________________

20. ________________________

Additional Exercises 9.1

Name ______________________

Date ______________________

Solve each equation by factoring.

1. $h^2 - 121 = 0$ **1.** ______________

2. $7a^2 - 112 = 0$ **2.** ______________

Use the square root property to solve each quadratic equation.

3. $x^2 = 25$ **3.** ______________

4. $x^2 = 98$ **4.** ______________

5. $x^2 = \frac{1}{64}$ **5.** ______________

6. $x^2 = -49$ **6.** ______________

7. $10x^2 = 3$ **7.** ______________

8. $6x^2 = 25$ **8.** ______________

9. $x^2 - 11 = 0$ **9.** ______________

10. $\frac{1}{7}x^2 = 4$ **10.** ______________

11. $(x - 4)^2 = 36$ **11.** ______________

12. $(x + 8)^2 = 9$ **12.** ______________

13. $(x - 12)^2 = 3$ **13.** ______________

14. $\left(m - \frac{1}{4}\right)^2 = \frac{1}{16}$ **14.** ______________

15. $(2y - 11)^2 = 25$ **15.** ______________

16. $(5x - 6)^2 = 54$ **16.** ______________

17. $(5x + 2)^2 = 45$ **17.** ______________

18. $(4x - 7)^2 = 80$ **18.** ______________

19. The area of a circle is found by the equation $A = \pi r^2$. If the area of a certain circle is 20π square meters, find its radius to the nearest hundredth of a meter. **19.** ______________

20. A square gymnastics mat has a diagonal of 35 feet. Find the length of each side to the nearest hundredth of a foot. **20.** ______________

Additional Exercises 9.2

Name ______________________

Date ______________________

Solve each quadratic equation by completing the square.

1. $x^2 + 12x = -27$
2. $x^2 - 6x = 16$
3. $x^2 + 4x - 7 = 0$
4. $x^2 + 8x - 12 = 0$
5. $x^2 - 10x = 0$
6. $z^2 + 3z = 6$
7. $x^2 - 9x = 4$
8. $x^2 - 7x + 3 = 0$
9. $y^2 + 11y + 18 = 0$
10. $y^2 + 9y + 30 = 0$
11. $x(x + 5) = 6$
12. $x(x - 7) = 30$
13. $3x^2 - 12x = 36$
14. $7x^2 + 14x + 3 = 0$
15. $2x^2 = 10x + 7$
16. $4x^2 = 12x + 5$
17. $2x^2 + 4x + 17 = 8$
18. $2x^2 - 5x - 7 = 0$
19. $36x^2 + 36x = 7$
20. Find the value of h that will make $x^2 - hx + 49$ a perfect square trinomial.

1. ______________________
2. ______________________
3. ______________________
4. ______________________
5. ______________________
6. ______________________
7. ______________________
8. ______________________
9. ______________________
10. ______________________
11. ______________________
12. ______________________
13. ______________________
14. ______________________
15. ______________________
16. ______________________
17. ______________________
18. ______________________
19. ______________________
20. ______________________

Additional Exercises 9.3

Name ______________________

Date ______________________

Use the quadratic formula to solve each quadratic equation.

1. $x^2 - 6x - 7 = 0$ **1.** ______________________

2. $x^2 - x - 6 = 0$ **2.** ______________________

3. $5h^2 + 7h + 2 = 0$ **3.** ______________________

4. $2h^2 + 10h + 3 = 0$ **4.** ______________________

5. $36x^2 - 1 = 0$ **5.** ______________________

6. $m^2 - 56 = m$ **6.** ______________________

7. $a^2 - 9a + 1 = 0$ **7.** ______________________

8. $a^2 - 8a + 11 = 0$ **8.** ______________________

9. $x^2 - 5x + 8 = 0$ **9.** ______________________

10. $2x^2 = 8 - x$ **10.** ______________________

11. $7x^2 = 14$ **11.** ______________________

12. $3x^2 = 2x - 2$ **12.** ______________________

13. $4x^2 = 1 - x$ **13.** ______________________

14. $\frac{15}{7}p^2 - p = \frac{2}{7}$ **14.** ______________________

15. $4z^2 - 3z = \frac{1}{4}$ **15.** ______________________

16. $2x^2 = 16$ **16.** ______________________

17. $15x^2 = 6 + 13x$ **17.** ______________________

18. $5 - x^2 = 2x$ **18.** ______________________

19. $\frac{x^2}{18} - \frac{x}{9} = 1$ **19.** ______________________

20. $4z^2 + \frac{1}{2} = -3z$ **20.** ______________________

Additional Exercises 9.4

Name ________________________

Date ________________________

Write each expression in i notation.

1. $\sqrt{-81}$

2. $\sqrt{-144}$

3. $\sqrt{-112}$

Add or subtract as indicated.

4. $(4+5i)+(2-4i)$

5. $(-6+12i)-(3+11i)$

6. $(5+2i)-(12-5i)$

7. $(-14-7i)-(-5-7i)$

8. Subtract $-8-6i$ from $-8-9i$.

Multiply.

9. $4i(-7+7i)$

10. $(3+7i)(9-6i)$

11. $(5+8i)(5-8i)$

12. $(8+9i)^2$

13. $(7+8i)^2$

Divide.

14. $\dfrac{15-15i}{5}$

15. $\dfrac{1+3i}{6+8i}$

16. $(x+6)^2=-16$

17. $(3k-1)^2=-27$

18. $x^2+4x+13=0$

19. $4x^2=-16$

20. $2x^2-x+3=0$

1. ________________________

2. ________________________

3. ________________________

4. ________________________

5. ________________________

6. ________________________

7. ________________________

8. ________________________

9. ________________________

10. ________________________

11. ________________________

12. ________________________

13. ________________________

14. ________________________

15. ________________________

16. ________________________

17. ________________________

18. ________________________

19. ________________________

20. ________________________

Additional Exercises 9.5

Name ______________________

Date ______________________

Graph each quadratic equation by finding and plotting ordered pair solutions.

1. $y = 4x^2$

x	y
-1	
0	
1	

2. $y = -2x^2$

x	y
-2	
-1	
0	
1	
2	

3. $y = \frac{2}{3}x^2$

x	y
-3	
0	
3	

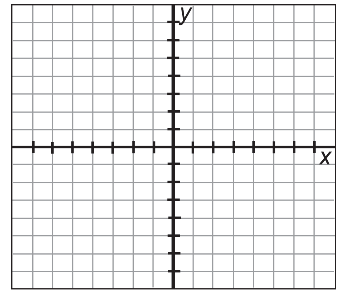
4. $y = -x^2$

x	y
-2	
-1	
0	
1	
2	

5. $y = -\frac{2}{5}x^2$

x	y
-5	
0	
5	

1.



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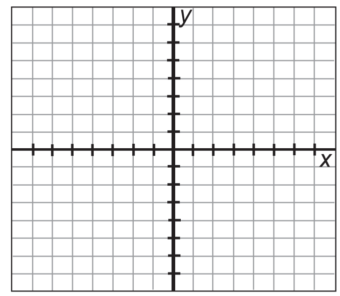

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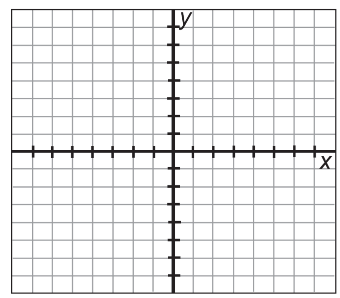

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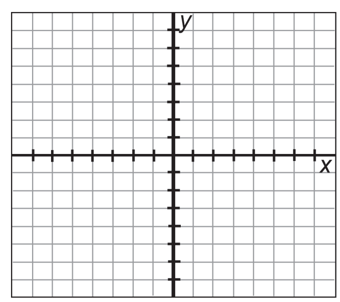

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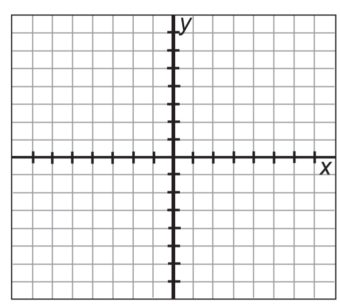


Additional Exercises 9.5 *(cont.)*

Name ______________________

Sketch the graph of each equation. Identify the vertex and the intercepts.

6. $y = 9 - x^2$

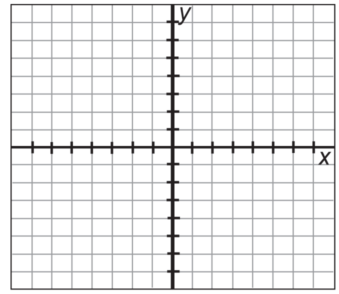
7. $y = x^2 + 3$

8. $y = x^2 - 6x$

9. $y = x^2 + 8x + 7$

10. $y = x^2 - 2x - 3$

6.



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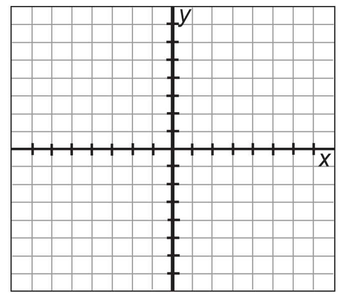

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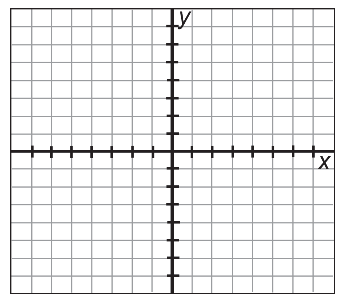

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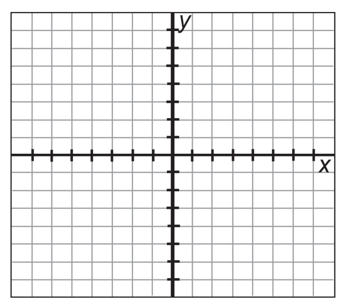

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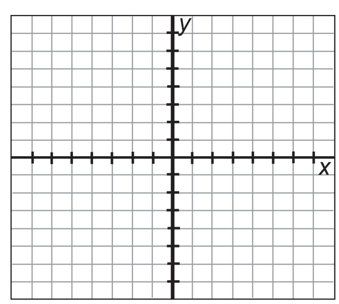


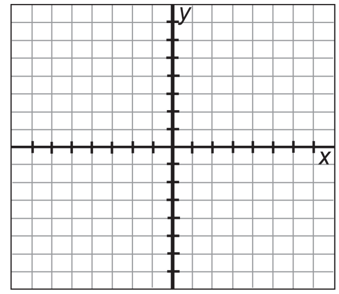
Additional Exercises 9.5 *(cont.)*

Name ______________________

Sketch the graph of each equation. Identify the vertex and the intercepts.

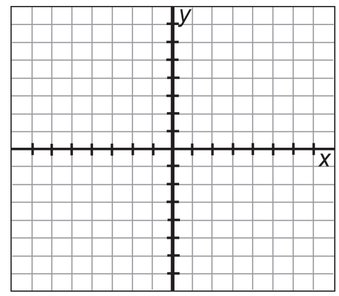
11. $y = -x^2 + 6x - 8$

11.



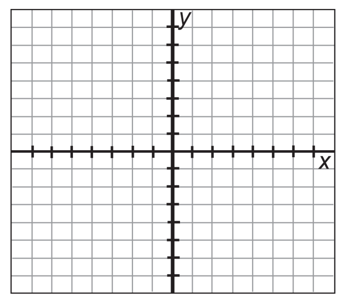
12. $y = x^2 - 4x - 5$

12.



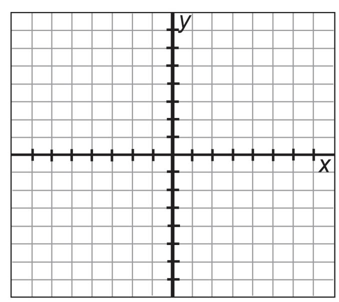
13. $y = -x^2 + 4x - 4$

13.



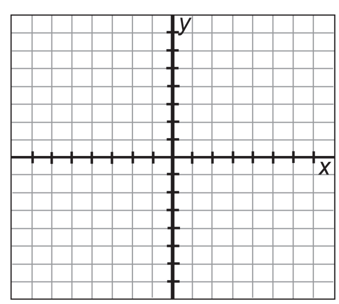
14. $y = x^2 + 5x + 6$

14.



15. $y = x^2 - 3x - 4$

15.



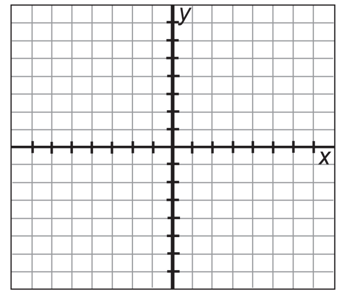
Additional Exercises 9.5 *(cont.)*

Name ________________________

Sketch the graph of each equation. Identify the vertex and the intercepts.

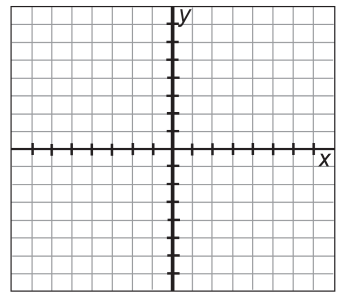
16. $y = -x^2 + 2x + 8$

16.



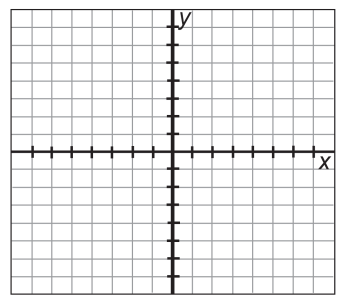
17. $y = x^2 + 4x + 1$

17.



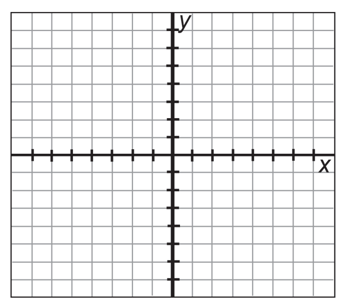
18. $y = -x^2 + 2x - 7$

18.



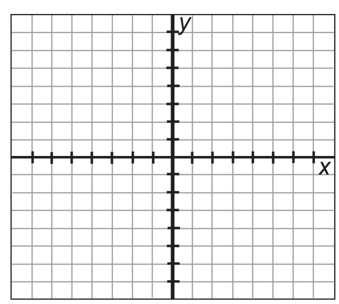
19. $y = x^2 + 4x + 6$

19.



20. $y = x^2 + 2x - 4$

20.



Additional Exercises Answers

Chapter 1 Answers

Additional Exercises, 1.2

1. $<$
2. $<$
3. $>$
4. $>$
5. $30^{o} \le 60^{o} \le 90^{o}$
6. True
7. True
8. False
9. True
10. True.
11 $-\frac{1}{2} \le \frac{1}{2}$
12. $2 < 7$
13. $-275,700$
14. $-27, -20$
15. $\{24\}$
16. $\{24, 0\}$
17. $\{24, 0, -25\}$
18. $\left\{\frac{3}{4}, 24, 6.\bar{1}, 0, -25, 7.5\right\}$
19. $\left\{\sqrt{15}, -\sqrt{3}\right\}$
20. $\{\sqrt{15}, \frac{3}{4}, 24, 6.\bar{1},$
    $0, -25, 7.5 - \sqrt{3}\}$

Additional Exercises, 1.3

1. a. $3 \cdot 3 \cdot 3$
   b. $2 \cdot 2 \cdot 2 \cdot 3$
   c. $2 \cdot 2 \cdot 3 \cdot 3 \cdot 5$
   d. $3 \cdot 5 \cdot 5 \cdot 5$
   e. $2 \cdot 2 \cdot 2 \cdot 5 \cdot 5$
   f. $2 \cdot 5 \cdot 7 \cdot 13$
2. $\frac{2}{3} = \frac{32}{48}$
3. $\frac{4}{5} = \frac{40}{50}$
4. $\frac{5}{4} = \frac{30}{24}$
5. 4
6. $\frac{1}{2}$
7. 0
8. Undefined
9. $\frac{4}{17}$
10. 76
11. $\frac{16}{27}$
12. $\frac{7}{33}$
13. 4
14. 6
15. $\frac{4}{3} = 1\frac{1}{3}$
16. $\frac{19}{20}$
17. $29\frac{1}{4}$
18. $\frac{3}{4}$
19. $\frac{5}{24}$
20. $87\frac{2}{5}$

Additional Exercises, 1.4

1. $\frac{125}{64}$
2. 125
3. 0.001
4. 33
5. 48
6. 47
7. 2
8. 2
9. $\frac{1}{3}$
10. 11
11. 13
12. F
13. F
14. $x + 4$
15. $2x - 3$
16. $x - 6 = 12$
17. $2x + 14 = 56$
18. $x - 16 = 23$
19. $\frac{x}{4} = 3^2$
20. $3x + 15 = -45$

Additional Exercises, 1.5

1. -10
2. -32
3. $-6\frac{5}{7}$
4. $-\frac{2}{3}$
5. 4
6. $-\frac{1}{125}$
7. 19
8. -45.3
9. -15
10. 0.45
11. $-\left|-\frac{3}{4}\right|$
12. $\frac{3}{4}$

13.0

14. $\frac{9}{10}$
15. 4
16. Positive number
17. Negative number
18. \$339
18. \$235
20. 230

Additional Exercises, 1.6

1. -29
2. -15
3. 9
4. -47
5. No
6. Yes
7. No
8. Yes
9. 108°
10. 18°

11 -14

12. 36
13. 1
14. 44
15. 49°
16. 203.7°
17. False
18. False
19. -1
20. -20

Additional Exercises, 1.7

1. 15
2. -32
3. 0
4. $\frac{1}{7}$
5. 9.02
6. -16
7. $\frac{16}{49}$
8. $-\frac{1}{3}$
9. $\frac{12}{5}$
10. -4
11. $-\frac{5}{3}$
12. $\frac{5}{6}$
13. Undefined
14. 0
15. 5
16. -67
17. -11
18. -2
19. $20\bullet(-6)=-120$, 120 in. (or 10 ft.) lower
20. $5\bullet(-3)=-15$, a loss of \$15

Additional Exercises, 1.8

1. $a \cdot (-4)$
2. $y+4$
3. $x \cdot (yz)$
4. $(3x+y)+4$
5. $(5+12)+x$

   $x+(5+12)$
6. $\left(-\frac{8}{7} \cdot \frac{7}{8}\right) \cdot r$

   $\left(-\frac{7}{8} \cdot r\right) \cdot \frac{8}{7}$
7. $=2 \cdot 3x+2(-7)$

   $=6x-14$
8. $=-5 \cdot x+(-5)(-4)$

   $=-5x+20$
9. $=-\frac{1}{2} \cdot 10+(-\frac{1}{2})(-16z)$

   $=-5-8z$
10. $=-4 \cdot x+(-4) \cdot 3-14$

    $=-4x-12-14$

    $=-4x-26$
11. $3(x+y)$
12. $-\frac{2}{7}$
13. $|-5|$
14. $\frac{14}{3}$
15. $-\frac{3}{5}$
16. Multiplicative identity
17. Zero product property
18. Associative property for multiplication
19. Associative property for addition
20. Distributive property of multiplication over addition

Chapter 2 Answers

Additional Exercises, 2.1

1. -1
2. Alike
3. $16k$
4. $-5y$
5. $10x+13$
6. $0.9w-2.0$
7. $10y+80$
8. $-50x-70$
9. $-4m^2+n-7$
10. $-18x+36y+27$

11 $8x-28$

12. $6y+42$
13. $9x+13$
14. $0.5m+3.2$
15. $12x-8$
16. $12m+4$
17. $5x-11$
18. $7x-(-6+8x)$
 $=7x+6-8x$
 $=-x+6$
19. $6(x+9)+4x$
 $=6x+54+4x$
 $=10x+54$
20. $(3x-8)+(2x-9)+7$
 $=3x-8+2x-9+7$
 $=5x-10$

Additional Exercises, 2.2

1. Yes
2. $x=4$
3. $y=26$
4. $x=-0.4$
5. $k=-\frac{1}{8}$
6. $x=-11$
7. $x=-9$
8. $x=9$
9. $x=-7$
10. $3=x$
11. $x=-9$
12. $y=\frac{3}{5}$
13. $x=0$
14. $x=25$
15. $x=-1$
16. $x=-8$
17. $y=\frac{3}{5}$
18. 1st = $x°$
 2nd = $(150-x)°$
19. 1st = x ft.
 2nd = $(15-x)$ ft.
20. $m=$ mi to Gastonia
 $m+15=$ mi to Charlotte

Additional Exercises, 2.3

1. $x=0$
2. $x=-\frac{7}{12}$
3. $x=-1$
4. $x=4$
5. $x=\frac{1}{26}$
6. $x=-8$
7. $x=-4$
8. $a=-10$
9. $x=-\frac{15}{2}$

10 $y=-\frac{8}{3}$

11. $x=4$
12. $k=\frac{5}{3}$
13. $x=91.2$
14. $y=100$
15. $y=\frac{14}{43}$
16. $x=-\frac{1}{4}$
17. $x=-10$
18. $x=8$
19. $t=15$
20. $5x+10$

Additional Exercises, 2.4

1. $x = 2$
2. $x = \frac{9}{10}$
3. $y = -\frac{1}{5}$
4. No Solution
5. No Solution
6. All Real Numbers
7. $x = 6$
8. No Solution
9. All Real Numbers

10 $z = -4$

11. $h = 9.9$
12. All Real Numbers
13. All Real Numbers
14. $x = 0$
15. $x = -\frac{3}{4}$
16. $x = -4$
17. $z = \frac{5}{2}$
18. No Solution
19. $x = -\frac{1}{9}$
20. No Solution

Additional Exercises, 2.5

1. The number is 7.
2. The three consecutive even integers are 90, 92, and 94 feet.
3. The number is 20.
4. The numbers are 15 and 17.
5. The numbers are 32, 34, and 36.
6. The two supplementary angles have measures 100° and 80°.
7. The string is cut into pieces that are 7 inches, 21 inches, and 39 inches.
8. Martina Navratilova won 9 singles titles at Wimbledon, and Billie Jean King won 6 singles titles at Wimbledon.
9. The number is $\frac{7}{50}$.
10. The measures of the angles of the triangles are 31°, 25°, and 124°.
11. The integer is -16.
12. The number is -13.
13. The number is 7.
14. The consecutive even integers are 6, 8, and 10.
15. The consecutive even integers are 10, 12, and 14.
16. The three consecutive even integers are $-2, 0,$ and 2.
17. The three consecutive odd integers are 29, 31, and 33.
18. The width of the rectangle is 17 inches, and the length of the rectangle is 32 inches.
19. The two non-parallel sides of the trapezoid are 9 meters. The top base is 18 meters, and the bottom base is 27 meters.
20. The two equal sides of the isosceles triangle are 37 inches long, and the third side is 18 inches in length.

Additional Exercises, 2.6

1. $y_2 = 0$
2. $h = 5$
3. $V = 3052.08$
4. $b = 5$
5. $t = 3$ years
6. $m = \frac{2}{9}$
7. $V \approx 129.81$
8. $S = 602.88$
9. 25° C
10. 131° F
11. They must purchase 3 bags.
12. 4 hours
13. The sides are 20 cm, 10 cm, 40 cm, 30 cm, and 30 cm.
14. 9:49 am
15. $d = P - a - b - c$
16. $y = \frac{1}{7}x - 2$
17. $A = \frac{3V}{h}$
18. $l = \frac{S - 2hw}{4w}$
19. $y = \frac{-Ax + C}{B}$
20. $x = \frac{-By + C}{A}$

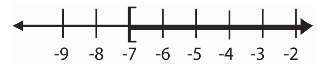
Additional Exercises, 2.7

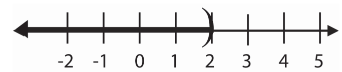
1. 299.2
2. 47.25
3. 22%
4. 66%
5. 4550
6. 15,400
7. 10%
8. $3.96 billion
9. $840 million
10. Discount was $37.50; sale price was $112.50.
11. 35%
12. $92.29
13. $47,520
14. $51,000
15. Old salary was $50,000; raise was $3000.
16. 45 liters
17. 120%
18. 36%
19. $75.00
20. 20 gallons

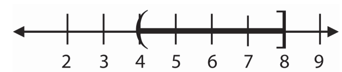
Additional Exercises, 2.8

1. $0.01x$
2. $0.10y$
3. $0.25z$
4. $5(5x)$
5. $20(30-x)$
6. $100(25-z)$
7. 240 miles
8. $6\frac{2}{3}$ hours
9. 110 miles
10. 15 quarters and 180 dimes
11. $20,000 at 6% and $10,000 at 9%
12. 103.2
13. 500%
14. 150%
15. 270 adults and 230 children
16. Jeff was hiking at 4 mph and Adrianna was hiking at 2 mph.
17. 280 miles at 70 miles per hour and 30 miles at 60 miles per hour.
18. Forty $10 bills and eighty $20 bills.
19. Amount of discount $140 Percent of discount 35%.
20. 8 liters of 3% saline solution; 12 liters of 8% saline solution.

Additional Exercises, 2.9

1. 

2. 

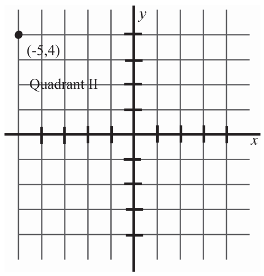
3. 

4. $x<11$
5. $x<-3$
6. $x\geq -5$
7. $x<8$
8. $x>0$
9. $x\geq -10$
10. $x<-\frac{1}{4}$
11. $y>-1.6$
12. $x\leq -\frac{1}{3}$
13. $x\leq \frac{1}{2}$
14. $x<-3.7$
15. $x\leq 0.68$
16. $x<\frac{4}{9}$
17. The maximum lengths are 18 meters and 54 meters.
18. It would take three days – two days at the full 40 minutes and the third day 21.6 minutes.
19. They could invite 170 people.
20. She would need to have a score of 94 or above.

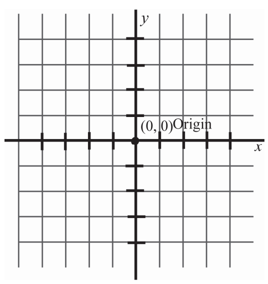
Chapter 3 Answers

Additional Exercises, 3.1

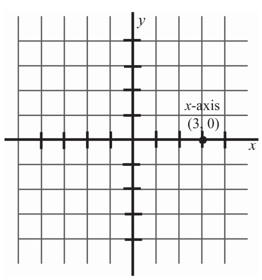
1. 1900 Galveston
2. More than 7000 people
3.



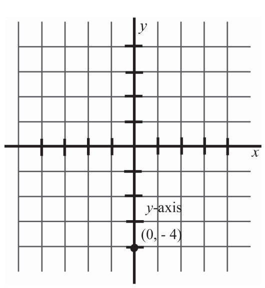
4.



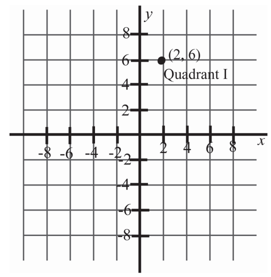
5.



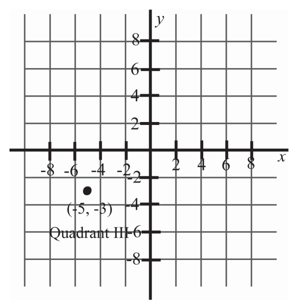
6.



7.



8.



9. A $(2,1)$ Quadrant I
10. B $(-2,-3)$ Quadrant III
11 $(3.5,0)$ x-axis
12. $(-3,3)$ Quadrant II
13.

x	y
0	-2
$\frac{2}{7}$	0
$\frac{1}{7}$	-1

14.

x	y
0	-4
-4	-4
5	-4

15.

x	y
0	-8
8	0
14	6

16.

x	y
6	0
0	-4
$\frac{3}{2}$	-3

17.

x	y
0	0
0	0
4	-2
-8	4

18.

x	y
6	0
0	-2
24	6
33	9

19.

x	y
0	-5
0	0
0	2

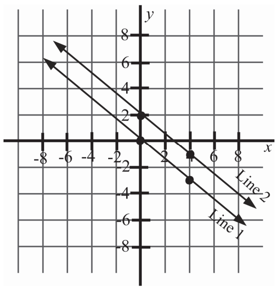
20.

x	y
-4	0
0	0
2	0

Additional Exercises, 3.2

1. Line 1: $y=-\frac{3}{4}x$

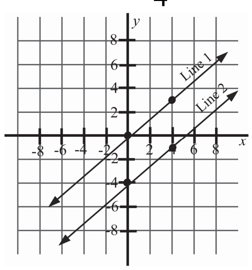
   Line 2: $y=-\frac{3}{4}x+2$



   Alike: Line 1 and Line 2 appear to be parallel; Different: Line 2 goes through the y-axis at 2, Line 1 goes through the y-axis at 0.

2. Line 1: $y=\frac{3}{4}x$

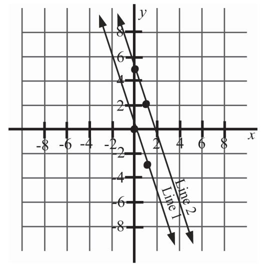
   Line 2: $y=\frac{3}{4}x-4$



   Alike: Line 1 and Line 2 appear to be parallel; Different: Line 2 goes through the y-axis at -4, Line 1 goes through the y-axis at 0.

3. Line 1: $y=-3x$

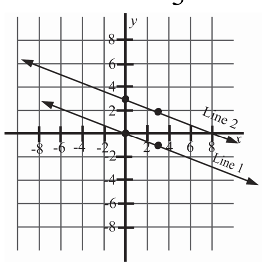
   Line 2: $y=-3x+5$



   Alike: Line 1 and Line 2 appear to be parallel; Different: Line 2 goes through the y-axis at 5, Line 1 goes through the y-axis at 0.

4. Line 1: $y=-\frac{1}{3}x$

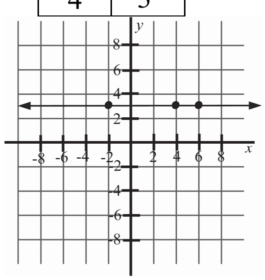
   Line 2: $y=-\frac{1}{3}x+3$



   Alike: Line 1 and Line 2 appear to be parallel; Different: Line 1 goes through the y-axis at the origin, and Line 2 goes through at 3.

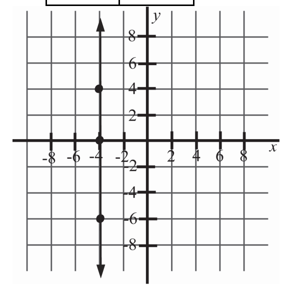
5. $y=3$

x	y
–2	3
6	3
4	3



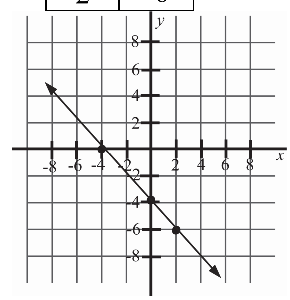
6. $x=-4$

x	y
–4	–4
–4	0
–4	6



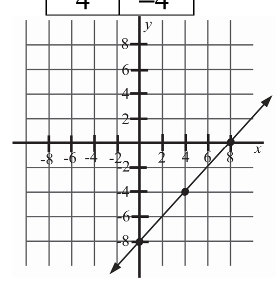
7. $x+y=-4$

x	y
0	–4
–4	0
2	–6



8. $x-y=8$

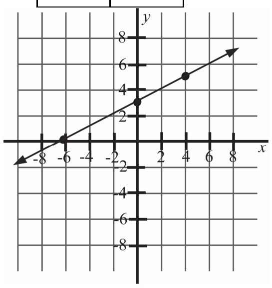
x	y
0	–8
8	0
4	–4



Additional Exercises, 3.2 (continued)

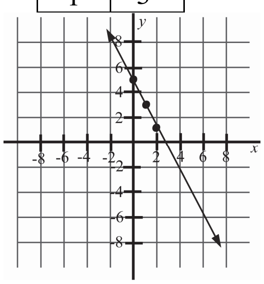
9. $-x+2y=6$

x	y
0	3
–6	0
4	5



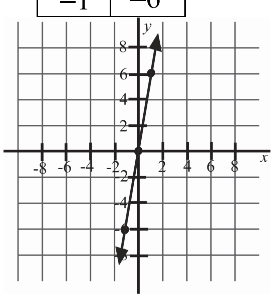
10. $y=-2x+5$

x	y
0	5
2	1
1	3



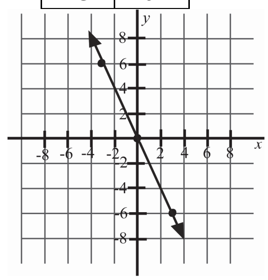
11. $y=6x$

x	y
0	0
1	6
–1	–6



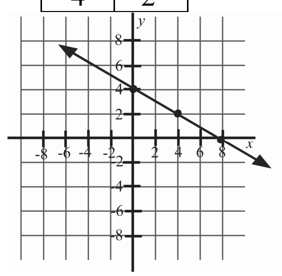
12. $y=-2x$

x	y
0	0
3	–6
–3	6



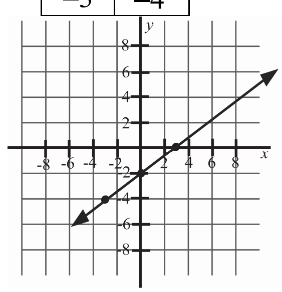
13. $x+2y=8$

x	y
0	4
8	0
4	2



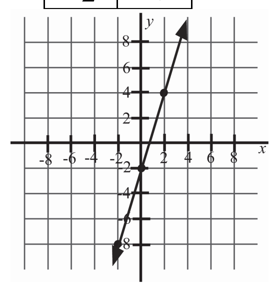
14. $y=\frac{2}{3}x-2$

x	y
0	–2
3	0
–3	–4



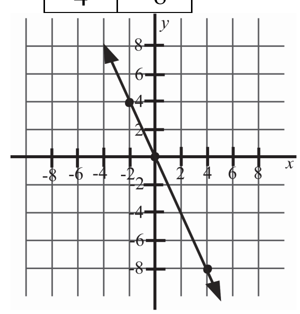
15. $y=3x-2$

x	y
0	–2
2	4
–2	–8



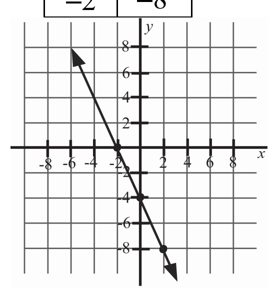
16. $x=-\frac{1}{2}y$

x	y
0	0
–2	4
4	–8



17. $2x-y=4$

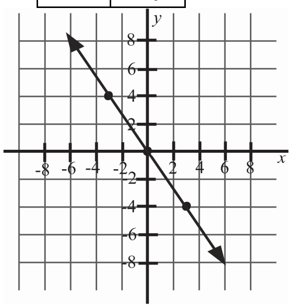
x	y
0	–4
2	0
–2	–8



Additional Exercises 3.2 (continued)

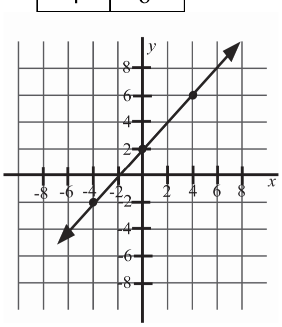
18. $x = -\frac{3}{4}y$

x	y
0	0
–3	4
3	–4



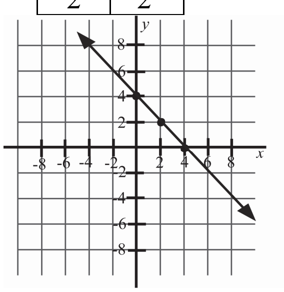
19. $y = x + 2$

x	y
0	2
–4	–2
4	6



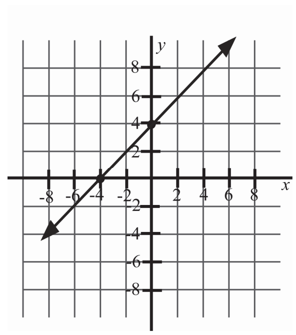
20. $x + y = 4$

x	y
0	4
4	0
2	2



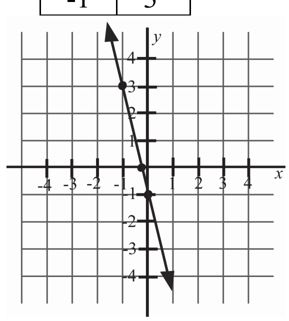
Additional Exercises, 3.3

1. x-intercept: $(-3,0)$
   y-intercepts: $(0,-2)$ and $(0,2)$
2. x-intercept: $(-1.5,0)$ and $(1.5,0)$
   y-intercept: $(0,3)$
3. x-intercepts: $(2,0)$
   y-intercept: $(0,6)$
4.



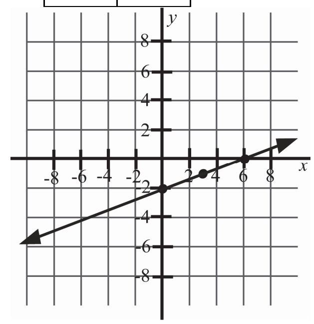
5. $4x + y = -1$

x	y
0	-1
$-\frac{1}{4}$	0
-1	3



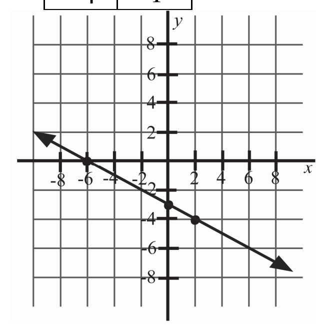
6. $3y = x - 6$

x	y
0	-2
6	0
3	-1



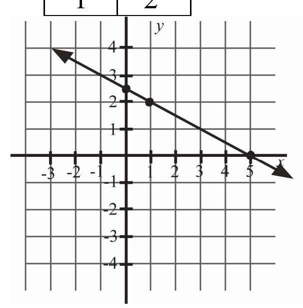
7. $-x - 2y = 6$

x	y
0	–3
–6	0
–4	-1



8. $2x + 4y = 10$

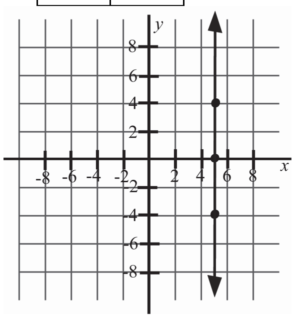
x	y
0	$\frac{5}{2}$
5	0
1	2



Additional Exercises, 3.3 (continued)

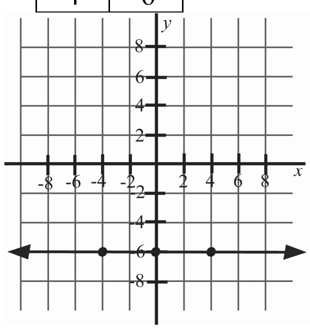
9. $2 - x = -3$

x	y
5	-4
5	0
5	4



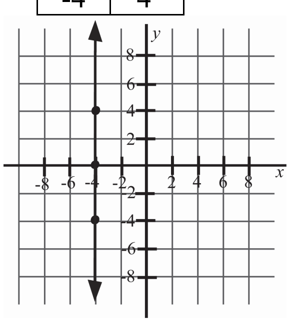
10. $-y - 4 = 2$

x	y
-4	-6
0	-6
4	-6



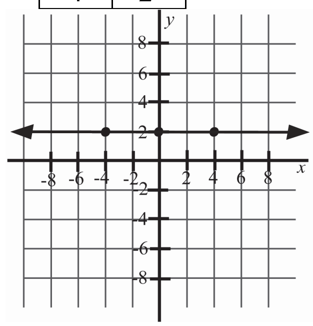
11. $3x + 6 = -6$

x	y
-4	-4
-4	0
-4	4



12. $2y + 8 = 12$

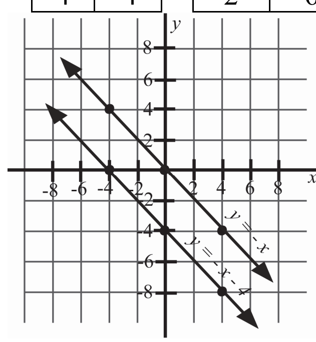
x	y
-4	2
0	2
4	2



13.

$y = -x$	
x	y
0	0
-4	4
4	-4

$y = -x - 4$	
x	y
0	-4
-4	0
2	-6

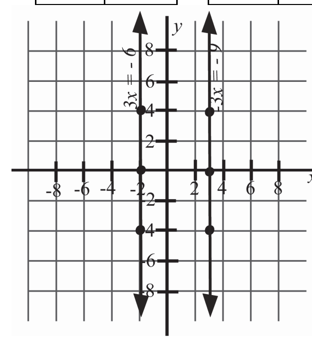


The lines are alike because they both fall from left to right, and appear to be parallel. The lines are different because they have different y-intercepts and x-intercepts.

14.

$3x = -6$	
x	y
-2	-4
-2	0
-2	4

$-3x = -9$	
x	y
3	-4
3	0
3	-4

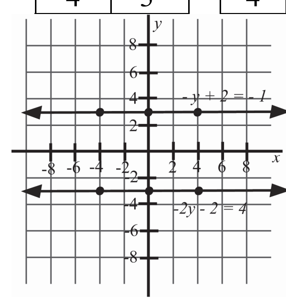


The lines are alike because they are both horizontal and appear to be parallel. Neither lines cross the x-axis. The lines are different because they cross the y-axis at different points.

15.

$-y + 2 = -1$	
x	y
-4	3
0	3
4	3

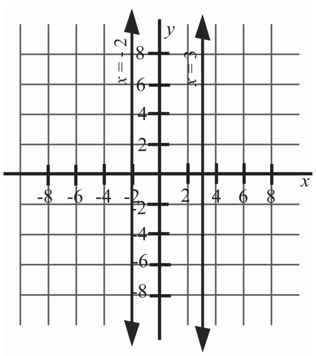
$-2y - 2 = 4$	
x	y
-4	-3
0	-3
4	-3



The lines are alike because they are both vertical and appear to be parallel. Neither lines cross the y-axis. The lines are different because they cross the x-axis at different points.

Additional Exercises, 3.3 (continued)

16.

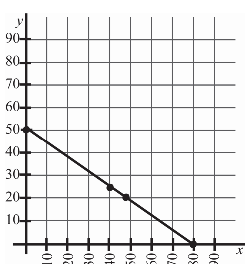


$x = 3$

17. $(0,50)$ If no beds are manufactured during the five hours, then they can produce 50 chests.

18. $(80,0)$ If no chests are manufactured during the five hours, then they can manufacture 80 beds.

19.



20. 40 beds

Additional Exercises, 3.4

1. (-2,-1) and (2,2)
   $m = \frac{3}{4}$
2. (-2,4) and (2,-1)
   $m = -\frac{5}{4}$
3. (-3,2) and (-3,-2)
   $m =$ undefined
4. $m =$ undefined
5. $m = 0$
6. $m = \frac{5}{2}$
7. $m = -2$
8. $m = -\frac{1}{3}$
9. The slope of line 1 is positive, and the slope of line 2 is negative. Since any positive number is greater than a negative number, the slope of line 1 is greater than the slope of line 2.
10. $m = -2$
11. $m = \frac{1}{3}$
12. $m = 0$
13. $m = -\frac{1}{2}$
14. $m_{\text{line 1}} = -3$
    $m_{\text{line 2}} = \frac{1}{3}$
    The lines are perpendicular.
15. $m_{\text{line 1}} = \frac{1}{4}$
    $m_{\text{line 2}} = \frac{1}{4}$
    The lines are parallel.
16. $m_{\text{line 1}} = -\frac{1}{5}$
    $m_{\text{line 2}} = \frac{1}{5}$
    The lines are neither parallel nor perpendicular.
17. $m = \frac{1}{2}$
    a. The slope of a line parallel to the line containing these points is $m = \frac{1}{2}$.
    b. The slope of the line perpendicular is $m = -2$.
18. $m = \frac{5}{4}$
    a. The slope of a line parallel to the line containing these points is $m = \frac{5}{4}$.
    b. The slope of the line perpendicular is $m = -\frac{4}{5}$.
19. $m = \frac{5}{14}$
20. $m = \frac{7}{50}$
    $= 14\%$

Additional Exercises, 3.5

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

   $x + 3y = 15$
6. $y = -\frac{7}{3}x + \frac{25}{6}$

   $14x + 6y = 25$
7. $y = -\frac{3}{5}x + \frac{28}{5}$

   $3x + 5y = 28$
8. $y = 3$
9. $x = 2$
10. $y = -2$
11. $x = -5$
12. $y = -\frac{1}{5}x + 4$

    $x + 5y = 20$
13. $y = 2x - \frac{2}{3}$

    $-6x + 3y = -2$
14. $y = -x + 4$

    $x + y = 4$
15. $y = 9x + 5$

    $-9x + y = 5$
16. $y = -\frac{2}{9}x$

    $2x + 9y = 0$
17. $y = 4x + 14$

    $-4x + y = 14$
18. $y = \frac{7}{8}x - \frac{3}{4}$

    $-7x + 8y = -6$
19. $y = \frac{1}{2}x$

    $-x + 2y = 0$
20. $y = -3x - 6$

    $3x + y = -6$

Additional Exercises, 3.6

1. Domain = $\{-1\}$

   Range = $\{-4, -2, 0, 2\}$
2. Domain = $\{1, 3, 5, 7\}$

   Range = $\{-1\}$
3. Not a function
4. Function
5. Function
6. Not a function
7. Not a function
8. Function
9. $f(-2) = 12$
10. $f(0) = 0$
11. $f(2) = -4$
12. $g(0) = 1$
13. $g(-5) = -24$
14. $g(3) = -8$
15. \$9000
16. \$10,000
17. Yes, vertical line test
18. \$12,500
19. Domain = $(-\infty, 4]$

    Range = $(-\infty, 3]$
20. $y = \frac{1}{3}x + 4$

Chapter 4 Answers

Additional Exercises, 4.1

1. Yes
2. No
3. No
4. Yes
5. {(3,1)}
6. {(2,-3)}
7. {(-2,-4)}
8. {(-1,-5)}
9. {(3,0)}
10. {(-1,-4)}
11. {(-2,1)}
12. {(-2,1)}
13. {(0,-1)}
14. {(2,-2)}
15. Infinite solutions
16. Infinite solutions
17. No solutions
18. No solutions
19. 6^{th} year
20. 4^{th} year

Additional Exercises, 4.2

1. {(4,8)}
2. {(1,4)}
3. {(8,3)}
4. {(2,1)}
5. {(11,2)}
6. {(0,1)}
7. {(7,0)}
8. {(9,1)}
9. {(-4,-3)}
10. No solution
11. {(14,-33)}
12. {(0,3)}
13. Infinite solutions
14. {(-10,-13)}
15. No solution
16. $\left\{\left(\frac{5}{2},-\frac{1}{2}\right)\right\}$
17. $\left\{\left(\frac{5}{3},\frac{2}{3}\right)\right\}$
18. Infinite solutions
19. $30.00
20. 90 tons

Additional Exercises, 4.3

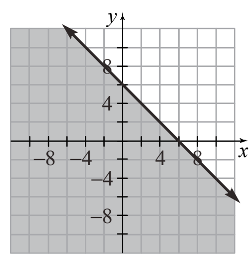
1. {(2,-1)}
2. {(-5,3)}
3. {(0,6)}
4. {(8,1)}
5. {(1,-3)}
6. {(3,4)}
7. {(2,3)}
8. {(-2,4)}
9. {(6,0)}
10. {(5,-1)}
11. {(0,-2)}
12. No solution
13. Infinite solutions
14. {(-6,-4)}
15. $\left\{\left(\frac{18}{17},-\frac{22}{17}\right)\right\}$
16. {(-1,-2)}
17. No solution
18. Infinite solutions
19. $2.00
20. 2 million pounds

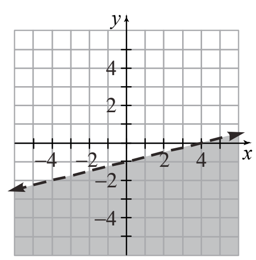
Additional Exercises, 4.4

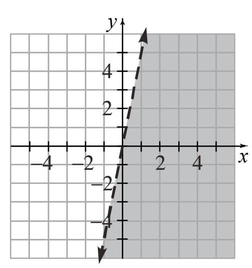
1. 30, 26
2. 13, 31
3. 24, 8
4. Records cost $5,
   Tapes cost $7.
5. Class picture $5,
   Wallets $1.40
6. $3000 in 9% stock,
   $1500 in 6% stock
7. Adult 1520, Child 250
8. 720 km
9. 60 miles
10. Lucy swims 8 km/hr in
    still water, the current
    runs 1km/hr.
11. 75 ml of 10%,
    25 ml of 50%
12. 20 ml of 20%,
    80 ml of 60%
13. 10 cm, 17 cm
14. 6 in, 23 in
15. 5 in, 12 in
16. 12 dimes, 15 quarters
17. 16°, 74°
18. 36°, 54°
19. 65°, 115°
20. Pretzel cost $1.15
    Coke cost $0.75

Additional Exercises, 4.5

1. Yes
2. No
3. No
4. No
5. No
6. Yes
7. Yes
8. Yes
9. No
10. Yes
11. No

12.


13.


14.


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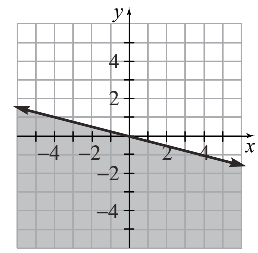
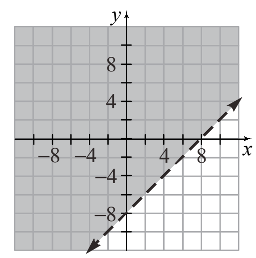


16.


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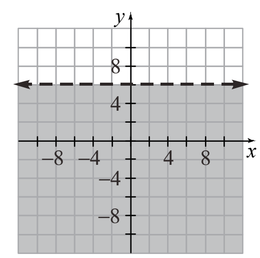
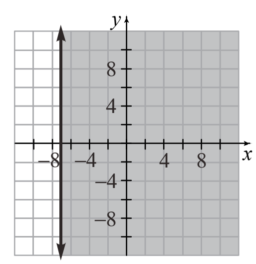
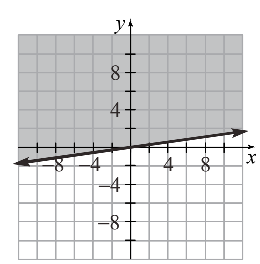
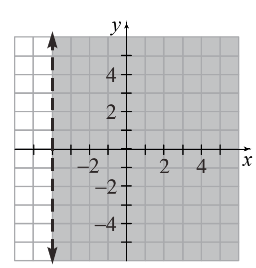


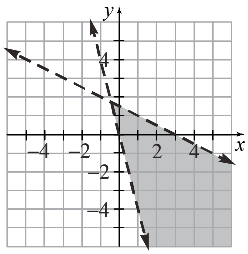
18.


19.


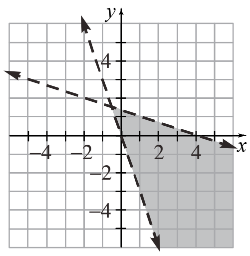
20.


Additional Exercises, 4.6

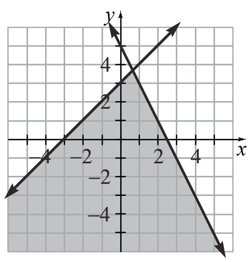
1.



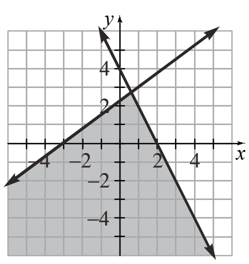
2.



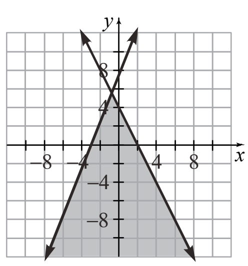
3.



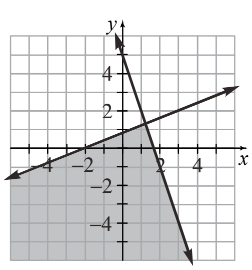
4.



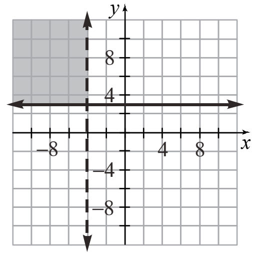
5.



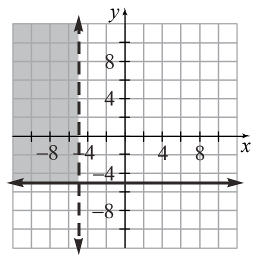
6.



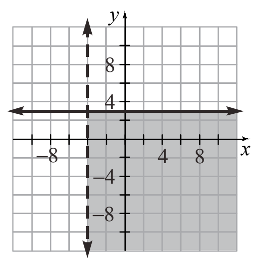
7.



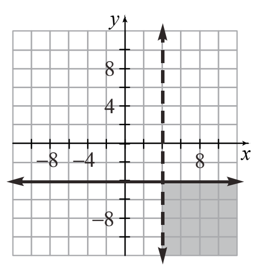
8.



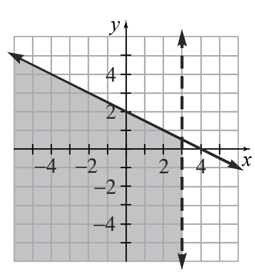
9.



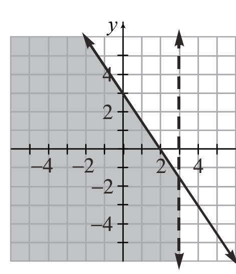
10.



11.



12.



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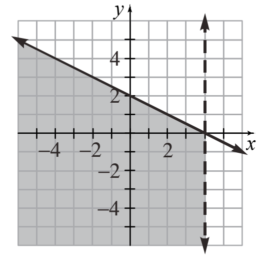

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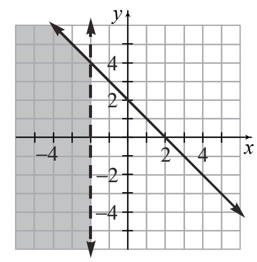

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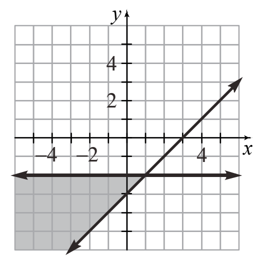
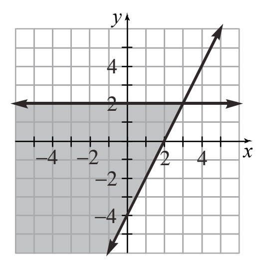


16.



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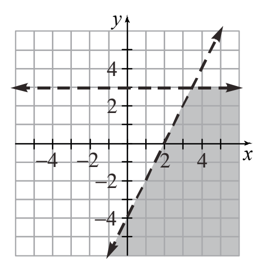

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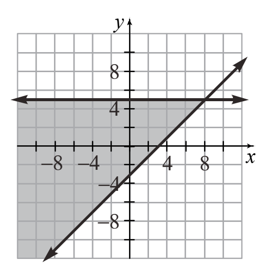
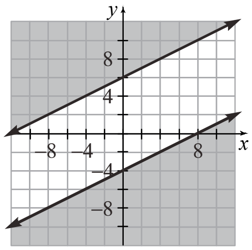
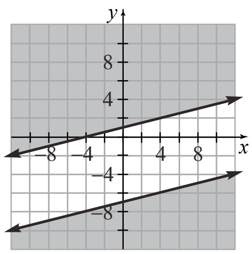


Additional Exercises, 4.6 (continued)

19. $\varnothing$; inconsistent; no shaded region in common



20. $\varnothing$; inconsistent; no shaded region in common



Chapter 5 Answers

Additional Exercises, 5.1

1. 343
2. 81
3. 972
4. $\frac{2}{5}$ or .4
5. $-8m^6n^{10}$
6. $5x^7y^8$
7. z^{24}
8. $(-5)^{28}$
9. $64x^9y^{15}z^6$
10. $\frac{81a^{20}}{b^8}$
11. x^4
12. $7a^2b^2$
13. 2
14. t^{10}
15. -64
16. $3x^2y^3$
17. $81m^{16}n^{24}$
18. $-8x^6y^9$
19. $\frac{32a^{15}}{b^{20}}$
20. $-3x^8y^4$

Additional Exercises, 5.2

1. 5;$-4x^2$;-1;-7
2. First degree; Binomial
3. second degree; Trinomial

4a. -4

4b. -7

5a. 2

5b. 9

6. $21x^3$
7. $-10x^2+6x$
8. $-2xy+y$
9. 6; 0; 6; 4; 6th degree
10. $19y+12$
11. $-2a^2-5a-11$
12. x^2-4x-2
13. $13a^2-10a+11$
14. $8x-6y+13$
15. $-\frac{1}{9}x^2-\frac{1}{12}y^2-6$
16. $-3x^2y-7xy-16x^2y^2-6$
17. $6x^2-15x-5$
18. $3y^2-6y+7$
19. $(2x^2-6x+16)$ inches
20. $(5y^2-4y+15)$ meters

Additional Exercises, 5.3

1. $30x^3$
2. $-10.4x^7$
3. $\frac{2}{49}y^6$
4. $-35x^{10}$
5. $10y^3-35y^2-15y$
6. $-5a^3b+35a^2b-30a^3$
7. $12a^4b^2-36a^3b^4-40ab^5$
8. $y^2-12y-45$
9. $x^2-\frac{1}{45}x-\frac{2}{45}$
10. $20x^2+23x-21$
11. $10x^4-15x^2-70$
12. $36y^2-132y+121$
13. $y^3-13y^2+48y-64$
14. $49y^2-28y+4$
15. $y^3-11y^2+31y-21$
16. $2x^3-3x^2-32x-15$
17. $6x^2+19x+15$
18. $(12x^2+32x)$ sq. in.
19. $(8x^2-22x-21)$ sq. ft.
20. $(9x^2-30x+25)$ sq. m

Additional Exercises, 5.4

1. x^2+5x+4
2. $3x^2-5x-22$
3. $4x^2-33x+65$
4. $y^3-8y^2+7y-56$
5. $a^3+a^2b+ab^2+b^3$
6. $x^2-\frac{1}{2}x-\frac{7}{144}$
7. $10-41a+40a^2$
8. $3x^2+16xy-35y^2$
9. $x^2+200x+10{,}000$
10. $x^2+21x+110.25$
11. $225a^2-60a+4$
12. $y^2-\frac{10}{9}y+\frac{25}{81}$
13. $25y^2-120y+144$
14. x^2-400
15. $36x^2-1$
16. $9x^2-225$
17. $64y^4-25$
18. $49x^2-\frac{4}{49}$
19. $(7x^2+16x-15)$ sq. ft.
20. $(64x^2-16x+1)$ sq. m

Additional Exercises, 5.5

1. $\frac{1}{25}$
2. 81
3. $\frac{9}{20}$
4. $\frac{10}{21}$
5. p^7
6. $\frac{1}{64x^3}$
7. $625x^4$
8. $\frac{1}{x^{14}y^{12}}$
9. 48
10. $\frac{1}{x^7}$
11. $9a^6b^{14}c^4$
12. $-\frac{y^{10}}{125x^2}$
13. 8.71×10^{-6}
14. 1.2×10^{10}
15. 3.1×10^{-4}
16. 0.000000784
17. 6,052,000
18. 807,200
19. 427,000,000
20. 3000

Additional Exercises, 5.6

1. $6x^2-4x-3$
2. a^2-ab^3
3. $2x^2-3x-11$
4. $6p^2-3p$
5. $4a^2-3a+2$
6. x^2-2x+4
7. $9xy^2-11y^3-14x$
8. $5x+3$
9. $x+3$
10. $x-8$
11. $x-3$
12. $4x+1$
13. $3a^2+5a-4$
14. $7a^2+3a-5$
15. $x^2-5x+25$
16. x^2+2x+4
17. $9x^2+12x+16$
18. $2b-1+\frac{3}{3b-1}$
19. $4x+5$ inches
20. $4x+3$ inches

Chapter 6 Answers

Additional Exercises, 6.1

1. 6
2. xy
3. 6
4. $3a(a+4)$
5. $5x(xy+2y+5)$
6. $3xy(x^3y+3x^2y+10)$
7. $4(y^4+2y^3+3y^2-y+6)$
8. $a^3b^2(3a-2b+5)$
9. $4(x^2y+2x+1)$
10. $4y^2(3y^3+y-4)$
11. $6x^2y(x^3y^4-2x-3y)$
12. $4(a^4+4a^2-3a+3)$
13. $(x+2)(y+4)$
14. $(c-3)(a^2+5)$
15. $(x-4)(y+2)$
16. $(x+4)(3+y)$
17. $(y-2)(3+x)$
18. $(x-4y)(4x-3)$
19. $(x-2y)(3x-5)$
20. $(4x+9)(5x^2-3)$

Additional Exercises, 6.2

1. $(x+14)(x-3)$
2. $(x+7)(x-8)$
3. $(x+5)(x-6)$
4. $(x+5)(x-4)$
5. $(x+1)(x+9)$
6. Prime
7. $(x+6)(x-4)$
8. $(x+4)(x-7)$
9. $(x-2)(x+9)$
10. $(x-9)(x+7)$
11. Prime
12. $(x+5y)(x+9y)$
13. $5(x+2)(x-3)$
14. $3(7-x)(5-x)$
15. $2(x+6)(x+1)$
16. $x(x-6)(x+1)$
17. $x(x-11)(x+4)$
18. $4x^3(x+2)(x+5)$
19. $xy(x-5y)(x-y)$
20. $2y^3(-8+5y+y^2)$

Additional Exercises, 6.3

1. $(2y-1)$
2. $(2y+1)$
3. $(y-5)$
4. $(3y-1)$
5. $(5x-1)(3x+2)$
6. $(4x-3)(2x-1)$
7. $(2x-5)(3x+2)$
8. $(3x+2)(3x+4)$
9. $(7x-1)(3x-2)$
10. $(6a-5)(3a+2)$
11. $(4x+3)(3x-5)$
12. $(3a-2)(5a+2)$
13. $(7a+2)(2a-7)$
14. $-4(x-3)(x+2)$
15. $7(2x+1)(3x+5)$
16. $5(5x-y)(2x+3y)$
17. $(x+4)^2$
18. $(5n+3)^2$
19. $2(x-6)^2$
20. $(8x+y)^2$

Additional Exercises, 6.4

1. $(7x+1)(3x+2)$
2. $(3x-1)(x-5)$
3. $(n-1)(5n+1)$
4. $(6x+1)(x+3)$
5. $(3x+1)(x+2)$
6. $(7x-2)(x-1)$
7. $(5n+1)(2n+3)$
8. $(5x+1)(x-2)$
9. $(3n+1)(3n+4)$
10. $(4m-9)(m-2)$
11. $(3m-10)(m+3)$
12. $(5m-9)(2m+3)$
13. $(7m-2)(2m-5)$
14. $(9m+7)(7m+9)$
15. $2x(2x+3)(3x+1)$
16. $3m(5m+3)(m+1)$
17. $6m(5m-1)(2m-1)$
18. $2x(9x-7)(x+7)$
19. $5x(2x-1)(x+7)$
20. $y(3x-1)(2x+5)$

Additional Exercises, 6.5

1. $(1-3x)(1+3x)$
2. $(2x-y)(2x+y)$
3. $(11-ab)(11+ab)$
4. $(xy-10)(xy+10)$
5. $(a^2b-3)(a^2b+3)$
6. $(a^3-12)(a^3+12)$
7. $(4x-11)(4x+11)$
8. $(x^4-13)(x^4+13)$
9. $(15x-29y)(15x+29y)$
10. $9x(x-2)(x+2)$
11. $\left(y-\frac{4}{9}\right)\left(y+\frac{4}{9}\right)$
12. $ab(4ab-7)(4ab+7)$
13. $\left(\frac{2}{7}x-\frac{1}{5}\right)\left(\frac{2}{7}x+\frac{1}{5}\right)$
14. $(1-6x)(1+6x)$
15. $(x+y)(x^2-xy+y^2)$
16. $(3x-2y)(9x^2+6xy+4y^2)$
17. $(xy+6)(x^2y^2-6xy+36)$
18. $(a-7b)(a^2+7ab+49b^2)$
19. $(2a+8b)(4a^2-16ab+64b^2)$
20. $\left(n-\frac{2}{3}\right)\left(n^2+\frac{2}{3}n+\frac{4}{9}\right)$

Additional Exercises, 6.6

1. $x = -11, 2$
2. $x = \frac{2}{5}, -\frac{1}{3}$
3. $x = \frac{2}{3}, -\frac{2}{3}$
4. $x = -2, 0, \frac{1}{5}$
5. $x = 7, \frac{5}{2}$
6. $x = -\frac{7}{3}, 0, 5$
7. $x = -0.5, 0.3$
8. $x = -6, 1$
9. $x = -1, \frac{5}{2}$
10. $y = -\frac{5}{2}, \frac{5}{2}$
11. $x = -\frac{5}{2}$
12. $b = -2, \frac{5}{3}$
13. $n = 3, 7$
14. $m = 0, 11$
15. $x = -8, 4$
16. $y = -\frac{4}{3}, \frac{4}{3}$
17. $p = \frac{8}{5}, 3$
18. $n = -6, -2, 0$
19. $y = -\frac{1}{2}, 0, \frac{1}{2}$
20. $w = 0, 4$

Additional Exercises, 6.7

1. 8, 3
2. 10, 7
3. 12, 6
4. 30 ft., 36 ft.
5. 2 sec
6. 6m, 8m, 10m
7. 5 ft., 12 ft., 13 ft.
8. 20 ft.
9. 10 m, 24 m
10. 2 or 4
11. 5 or -3
12. 5 and 7
13. 5, 6, 7
14. 3 and 5
15. 7 in.
16. 12 cm, 16 cm
17. -3, 3
18. 18
19. 7 cm
20. 6m by 8m

Chapter 7 Answers

Additional Exercises, 7.1

1. -7
2. $-\frac{4}{9}$
3. $\frac{7}{2}$
4. 0
5. 10
6. none
7. $\frac{1}{2x-3}$
8. $\frac{3}{5}$
9. 1
10. -1
11. -8
12. $\frac{1}{x-8}$
13. $x+5$
14. $\frac{x+8}{x-9}$
15. $\frac{x+6}{3}$
16. $4+y$
17. $\frac{-y+2}{y+7}, \frac{-(y-2)}{y+7}, \frac{y-2}{-y-7}, \frac{y-2}{-(y+7)}$
18. $270
19. $216
20. 19.04

Additional Exercises, 7.2

1. $\frac{-5}{3x+7}$
2. $\frac{15x}{7}$
3. x
4. $\frac{-a}{6}$
5. $\frac{x^2}{35}$
6. $4x$
7. $\frac{y-2}{y}$
8. $\frac{2}{7(x-7)}\text{ m}^2$
9. $\frac{9}{(4x-9)}\text{ ft}^2$
10. $\frac{3x^7}{2}$
11. $\frac{8x}{y^3}$
12. $\frac{3x(x+12)}{2}$
13. $\frac{1}{26}$
14. $\frac{(a-b)^2}{2}$
15. $-\frac{x+2}{x-7}$
16. $\frac{5}{9}$
17. $\frac{x(x+2y)}{5(5x+y)}$
18. $-\frac{3x(x-5)}{2}$
19. $-\frac{(x-4)^2}{(3x+1)^2}$
20. 0.1023 mph

Additional Exercises, 7.3

1. $\dfrac{a+11}{17}$

2. $\dfrac{6m}{n}$

3. 5

4. $\dfrac{x+10}{15+x}$

5. 2

6. $\dfrac{1}{x+6}$

7. $\dfrac{1}{x-4}$

8. $15y^7$

9. $3y(3y-5)$

10. $9(x-2)^2$

11. $x-y$

12. $(x+7)(x+5)(x+4)$

13. $\dfrac{24y^3}{48y^5}$

14. $\dfrac{b(7a+3)}{3b(3a+1)}$

15. $\dfrac{3(11y-4)}{36x^2-45}$

16. $\dfrac{10(x+4)}{(x+8)(x-4)(x+4)}$

17. $\dfrac{(x-7)(x+4)}{x(x+4)(x-6)(x+3)}$

18. $\dfrac{36}{x-15}$ ft

19. $\dfrac{3x+11}{x+6}$ m

20. $\dfrac{2x+15}{x+5}$ in.

Additional Exercises, 7.4

1. $\dfrac{47}{20x}$

2. $\dfrac{32n+3m^2}{8m}$

3. $\dfrac{12x+2}{3x^2}$

4. $\dfrac{4}{x-2}$

5. $\dfrac{16x+36}{7(x+4)(x-4)}$

6. $\dfrac{6y+2-y^3}{y^2(3y+1)}$

7. $\dfrac{8}{x-9}$

8. $\dfrac{4+5x}{x}$

9. $\dfrac{3x-11}{x-7}$

10. $\dfrac{5x^4-2}{x}$

11. $\dfrac{(x+5)}{(x+6)^2}$

12. $\dfrac{20x+46}{(x-4)^2(x+10)}$

13. $\dfrac{5x+66}{(x+2)(x-10)(x+10)}$

14. $-\dfrac{3}{x-7}$

15. $\dfrac{(x+2)}{(x+3)^2}$

16. $-\dfrac{6x+31}{(x-7)(x+8)}$

Additional Exercises, 7.4 (continued)

17. $\frac{8x^2-5x-100}{x}$, \$15,994.95

18. $\frac{4x-36}{(x+6)(x-6)}$ in.

19. $\frac{26x-40}{x(x-4)}$ ft.

20. $\frac{-2x-30}{(x+5)(x-5)}$ in.

Additional Exercises, 7.5

1. 14
2. 2
3. -7
4. -14
5. 5
6. 2, 3
7. 10
8. 1, -12
9. 12, -3
10. $\frac{1}{3}$
11. No solution
12. -8
13. $\frac{2A}{b}$
14. $\frac{2A-bh}{h}$
15. $V = NG - RG$
16. $\frac{A-P}{Pt}$
17. $35^\circ, 145^\circ$
18. $70^\circ, 110^\circ$
19. $20^\circ, 70^\circ$
20. $\frac{330^\circ}{7}, \frac{300^\circ}{7}$

Additional Exercises, 7.6

1. 12
2. $\frac{8}{7}$
3. 13
4. 10
5. -6
6. $-\frac{1}{3}$
7. 9
8. 1
9. 3, -3
10. $1\frac{5}{7}$
11. $1\frac{3}{5}$ hours
12. 12 minutes
    24 minutes
13. 16 mph
14. 4 and 6 mph
15. 3 and 4 mph
16. 35 mph in mountains
    63 mph level road
17. 2.5
18. 1.4 inches
19. $13\frac{1}{5}$ minutes
20. 20 mph

Additional Exercises, 7.7

1. direct
2. inverse
3. direct
4. inverse
5. direct
6. $y = \frac{1}{4}x$
7. $y = 8x$
8. y = 2x
9. y = $\frac{12}{x}$
10. y = $\frac{0.3}{x}$
11. $s = kt$
12. $t = k\sqrt{x}$
13. $t = \frac{k}{x^3}$
14. 27
15. 2.25
16. 2
17. $\frac{5}{9}$
18. $166.75
19. 1.25 amps
20. 50 gallons

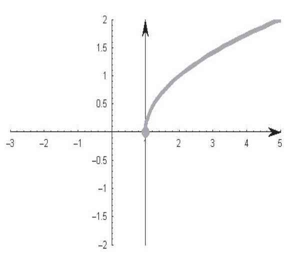
Additional Exercises, 7.8

1. $-\frac{5}{12}$
2. $\frac{7}{12}$
3. $-\frac{3}{5}$
4. $\frac{4}{45}$
5. 1
6. $\frac{x^2 - 6x}{4x^2 + 6}$
7. $\frac{2}{y-1}$
8. $\frac{2}{x+y}$
9. $\frac{5+14x}{5-14x}$
10. $\frac{1}{2}$
11. $2a(a-3)$
12. $\frac{5x^2+1}{5x^2-x}$
13. $\frac{11+6x}{-6x+4}$
14. $\frac{a}{a-b}$
15. $\frac{1+a}{1-a}$
16. $\frac{17}{40}$
17. $\frac{7n+4}{2n^2}$
18. $\frac{31}{48}$
19. $\frac{4(2+3n)}{n^2}$
20. $\frac{f_1 f_2}{f_1 + f_2}$

Chapter 8 Answers

Additional Exercises, 8.1

1. 9
2. $\frac{1}{7}$
3. -6
4. Not a real number
5. $\frac{11}{2}$
6. 20
7. 6
8. -4
9. -4
10. 3
11. Not a real number
12. -2
13. 6.782
14. 13.342
15. 862 sq. ft.
16. n^2
17. $4y^3$
18. $9z^{10}$
19. $-5xy^5$
20. 0, 1, 2. $\sqrt{6} \approx 2.45$, 3



Additional Exercises, 8.2

1. $5\sqrt{3}$
2. $3\sqrt{11}$
3. $6\sqrt{2}$
4. $\frac{3\sqrt{5}}{8}$
5. $-\frac{2\sqrt{21}}{5}$
6. $\frac{5\sqrt{3}}{9}$
7. $\frac{4\sqrt{3}}{15}$
8. $x^3\sqrt{x}$
9. $2y^6\sqrt{13}$
10. $3x^3y^4\sqrt{5}$
11. $\frac{2\sqrt{14}}{y^2}$
12. $\frac{7y\sqrt{2}}{x^5}$
13. $\frac{x^4\sqrt{x}}{y^{10}}$
14. 30
15. $2\sqrt{7}$
16. $\frac{\sqrt[3]{14}}{5}$
17. $\frac{3\sqrt[4]{10}}{x^6}$
18. $3x^3y\sqrt[3]{13x}$
19. $3\sqrt[3]{10}$ in.
20. $10\sqrt{13}$ ft.

Additional Exercises, 8.3

1. $-3\sqrt{7}$
2. $2\sqrt{10}$
3. $-7\sqrt{19}$
4. $9\sqrt{2}$
5. $-2\sqrt{5}$
6. $2\sqrt{6}-\sqrt{2}$
7. $3\sqrt{y}-6y$
8. 0
9. $2x\sqrt{x}$
10. $\frac{3\sqrt{13}}{10}$
11. $-\sqrt{x}$
12. $15z\sqrt{10y}$
13. $3x\sqrt{5x}-6x\sqrt{3}$
14. $10x\sqrt{2x}+7\sqrt{x}$
15. $6\sqrt[3]{25}-\sqrt[3]{4}$
16. $6\sqrt[3]{2y}$
17. $12\sqrt[3]{x}$
18. $\left(16+4\sqrt{5}\right)$ ft.
19. $12\sqrt{7}$ m
20. $71\sqrt{3}$ ft.

Additional Exercises, 8.4

1. 10
2. 14
3. $3\sqrt{11}$
4. $17x$
5. $49x$
6. $5\sqrt{2xy}$
7. $2xy\sqrt{3y}$
8. $\sqrt{35}+\sqrt{5}$
9. -9
10. $\sqrt{35}+\sqrt{30}-\sqrt{42}-6$
11. $x-8\sqrt{x}+16$
12. $3y+4\sqrt{3y}+4$
13. 2
14. $3\sqrt{2}$
15. $2xy\sqrt{3x}$
16. $\dfrac{\sqrt{70}}{7}$
17. $\dfrac{\sqrt{6y}}{6y}$
18. $\dfrac{9\sqrt{x}+54}{x-36}$
19. $2\sqrt{2}-\sqrt{3}$
20. $45\sqrt{91}$ sq. in.

Additional Exercises, 8.5

1. 49
2. 79
3. 9
4. 16
5. 25
6. no real solution
7. 7
8. 9
9. 3
10. 2
11. 4
12. 5
13. 7
14. 0, -4
15. 16
16. 4
17. 3
18. 9
19. no solution
20. $\dfrac{2}{5}$

Additional Exercises, 8.6

1. $3\sqrt{13}\approx 10.82$
2. $\sqrt{30}\approx 5.48$
3. $2\sqrt{10}\approx 6.32$
4. $5\sqrt{2}\approx 7.07$
5. $\sqrt{109}\approx 10.44$
6. $3\sqrt{5}\approx 6.71$
7. $4\sqrt{5}\approx 8.94$
8. $3\sqrt{6}\approx 7.35$
9. $\sqrt{31}\approx 5.57$
10. 8.54 ft.
11. 7.81 ft.
12. 8 ft.
13. 19 ft.
14. 13.4 in.
15. 45 mph
16. $\sqrt{185}\approx 13.6$
17. $5\sqrt{2}\approx 7.07$
18. $2\sqrt{26}\approx 10.2$
19. $3\sqrt{5}\approx 6.71$
20. $2\sqrt{5}\approx 4.47$

Additional Exercises, 8.7

1. 12
2. 4
3. -2
4. -3
5. $\frac{2}{3}$
6. $-\frac{2}{3}$
7. 256
8. 243
9. $\frac{1}{4}$
10. $\frac{1}{512}$
11. 25
12. $\frac{1}{3}$
13. 2
14. $4^{3/4}$
15. $\frac{1}{5^{7/4}}$
16. $\frac{1}{\sqrt{y}}$
17. $\frac{9m^{1/3}n^2}{16}$
18. $5xy^2z^3$
19. $y^{4/3}$
20. $\frac{2z^3}{w}$

Chapter 9 Answers

Additional Exercises, 9.1

1. 11, –11
2. 4, –4
3. 5, –5
4. $\pm 7\sqrt{2}$
5. $\pm\frac{1}{8}$
6. No real solution
7. $\pm\frac{\sqrt{30}}{10}$
8. $\pm\frac{5\sqrt{6}}{6}$
9. $\pm\sqrt{11}$
10. $\pm 2\sqrt{7}$
11. 10, –2
12. –5, –11
13. $12\pm\sqrt{3}$
14. $0, \frac{1}{2}$
15. 3,8
16. $\frac{6\pm 3\sqrt{6}}{5}$
17. $\frac{-2+3\sqrt{5}}{5}, \frac{-2-3\sqrt{5}}{5}$
18. $\frac{7\pm 4\sqrt{5}}{4}$
19. 4.47 m
20. 24.75 ft.

Additional Exercises, 9.2

1. –3, –9
2. 8, –2
3. $-2\pm\sqrt{11}$
4. $-4\pm 2\sqrt{7}$
5. 0, 10
6. $\frac{-3\pm\sqrt{33}}{2}$
7. $\frac{9\pm\sqrt{97}}{2}$
8. $\frac{7\pm\sqrt{37}}{2}$
9. –2, –9
10. No real solution
11. 1, –6
12. 10, –3
13. 6, –2
14. $-1\pm\frac{2\sqrt{7}}{7}$
15. $\frac{5\pm\sqrt{39}}{2}$
16. $\frac{3\pm\sqrt{14}}{2}$
17. No real solution
18. $\frac{7}{2}, -1$
19. $-\frac{7}{6}, \frac{1}{6}$
20. $h=-14$

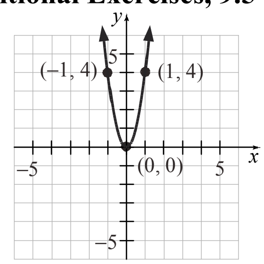
Additional Exercises, 9.3

1. –1, 7
2. 3, –2
3. $-1, -\frac{2}{5}$
4. $\frac{-5\pm\sqrt{19}}{2}$
5. $\pm\frac{1}{6}$
6. 8, –7
7. $\frac{9\pm\sqrt{77}}{2}$
8. $4\pm\sqrt{5}$
9. Not a real number
10. $\frac{-1\pm\sqrt{65}}{4}$
11. $\pm\sqrt{2}$
12. Not a real number
13. $\frac{-1\pm\sqrt{17}}{8}$
14. $\frac{2}{3}, -\frac{1}{5}$
15. $\frac{3\pm\sqrt{13}}{8}$
16. $\pm 2\sqrt{2}$
17. $\frac{6}{5}, -\frac{1}{3}$
18. $1\pm\sqrt{6}$
19. $1\pm\sqrt{19}$
20. $-\frac{1}{4}, -\frac{1}{2}$

Additional Exercises, 9.4

1. $9i$
2. $12i$
3. $4i\sqrt{7}$
4. $6+i$
5. $-9+i$
6. $-7+7i$
7. -9
8. $-3i$
9. $-28-28i$
10. $69+45i$
11. 89
12. $-17+144i$
13. $-15+112i$
14. $3-3i$
15. $\dfrac{3}{10}+\dfrac{1}{10}i$
16. $-6\pm 4i$
17. $\dfrac{1\pm 3i\sqrt{3}}{3}$
18. $-2\pm 3i$
19. $2i, -2i$
20. $\dfrac{1}{4}\pm\dfrac{i\sqrt{23}}{4}$

Additional Exercises, 9.5

1.


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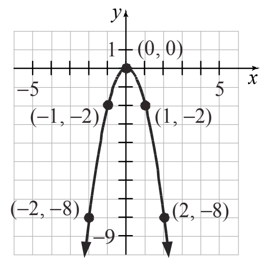

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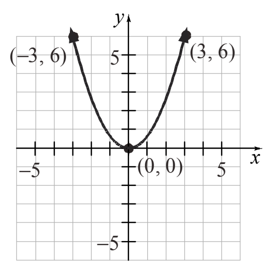

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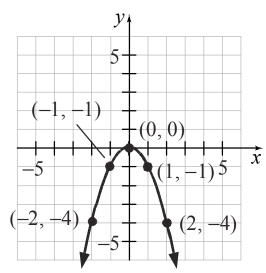

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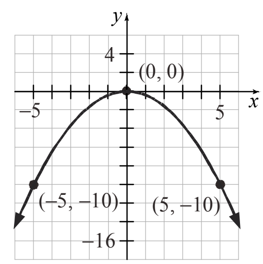

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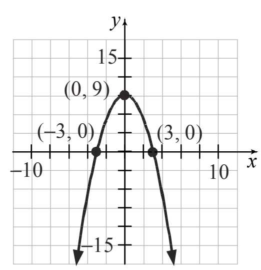

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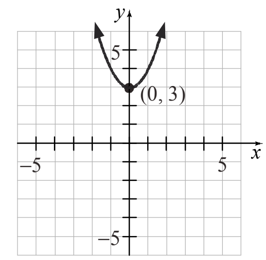

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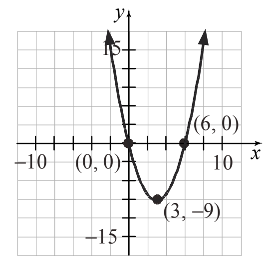

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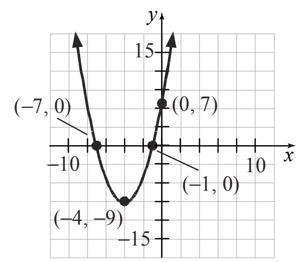

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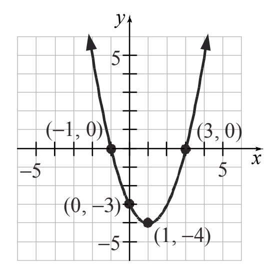

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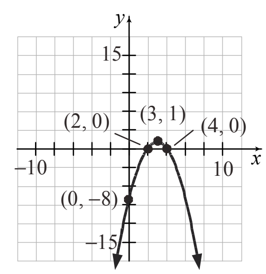

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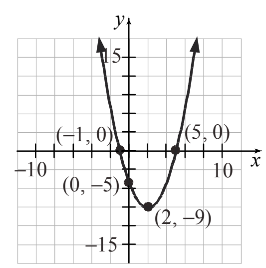
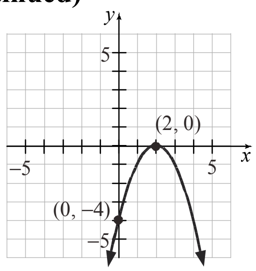


Additional Exercises, 9.5 (continued)

13.



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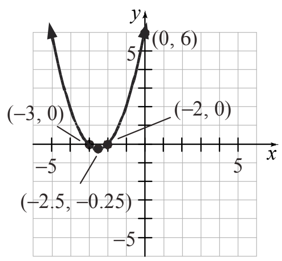

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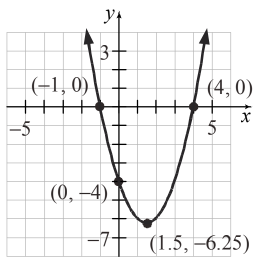

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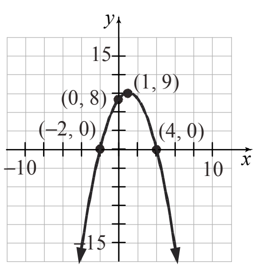

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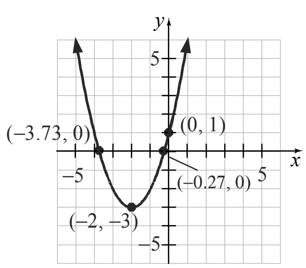

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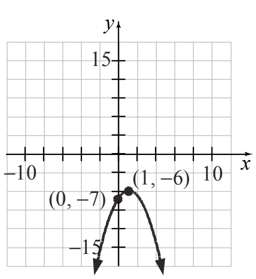

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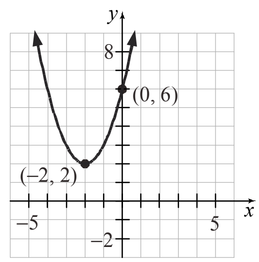

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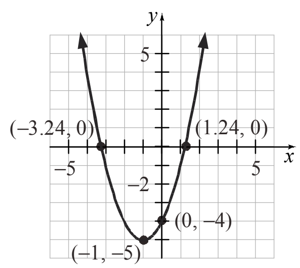


Name: **Date:**
Instructor: **Section:**

Section 1.3 Fractions and Mixed Numbers

Objective: Understand the concepts of fractions.
Suggested Format: Group A Structure A
Time: 15 minutes

Find the indicated fractional portion of each word and record it in the corresponding blank. Compose a hidden message by reading down the columns when you have finished.

First $\frac{1}{2}$ of will ________

Last $\frac{1}{3}$ of length ________

First $\frac{1}{2}$ of Friday ________

Last $\frac{2}{3}$ of trends ________

First $\frac{1}{3}$ of linear ________

Last $\frac{1}{2}$ of bike ________

Last $\frac{4}{9}$ of determine ________

First $\frac{2}{5}$ of which ________

Last $\frac{1}{7}$ of multiplication ________

Last $\frac{3}{4}$ of need ________

First $\frac{3}{8}$ of sentence ________

Last $\frac{1}{3}$ of redeem ________

Last $\frac{3}{7}$ of parties ________

First $\frac{1}{2}$ of jump ________

First $\frac{1}{3}$ of liable ________

First $\frac{1}{3}$ of usable ________

First $\frac{2}{7}$ of capable ________

First $\frac{1}{4}$ of estimate ________

Last $\frac{2}{7}$ of popular ________

The message is ____

Name: **Date:**
Instructor: **Section:**

Sections 1.5 Adding Real Numbers & 1.6 Subtracting Real Numbers

Objective: Application of Real Numbers.
Suggested Format: Group A Structure A
Time: 15 minutes

Find the balance of the checking account after each activity.

Action	Amount	Balance
Beginning Balance		$865.34
Deposit Paycheck	$462.83	
Pay Rent	$450.00	
Pay Electronic Bill	$75.29	
Pay Telephone Bill	$57.81	
Write a check for cash	$150.00	

Name: **Date:**
Instructor: **Section:**

Chapter 1 Group Activity - Magic Squares

A magic square is a set of numbers arranged in a square table so that the sum of the numbers in each column, row, and diagonal is the same. For instance, in the magic square below, the sum of each column, row, and diagonal is 15. Notice that no number is used more than once in the magic square.

2	9	4
7	5	3
6	1	8

The properties of magic squares have been known for a very long time and once were thought to be good luck charms. The ancient Egyptians and Greeks understood their patterns. A magic square even made it into a famous work of art. The engraving titled Melencolia I, created by German artist Albrecht Dürer in 1514, features the following four-by-four magic square on the building behind the central figure.

16	3	2	13
5	10	11	8
9	6	7	12
4	15	14	1

1. Verify that what is shown in the Dürer engraving is, in fact, a magic square. What is the common sum of the columns, rows, and diagonals?

2. Negative numbers can also be used in magic squares. Complete the following magic square:

		-2
	-1	
0		-4

(cont'd)

Name: **Date:**
Instructor: **Section:**

Group Activity 1 (cont'd)

3. Use the numbers -12, -9, -6, -3, 0, 3, 6, 9, and 12 to form a magic square.

Name: **Date:**
Instructor: **Section:**

Section 2.1 Simplifying Algebraic Expressions

Objective: Combining like terms.
Suggested Format: Relay Race
Time: 15 minutes

(Instructors: Make enough copies for each group. Cut the problems apart and hand a copy of problem one to the first student in each group, problem 2 to the second student, etc.)

Problem 1: $3x-7x-6+8$

Write your answer on a sheet of paper and hand it to the next student.

Problem 2: Add the expression you were given to $3x-12$.

Write your answer on a sheet of paper and hand it to the next student.

Problem 3: Subtract the expression you were given from $3x-6$.

Write your answer on a sheet of paper and hand it to the next student.

Problem 4: Add the expression you were given to $-5x+8$.

Write your answer on a sheet of paper and hand it to the next student.

Problem 5: Subtract $5x-8$ from the expression you were given.

When you have your answer, raise your hand and the instructor will see if it is correct.

Name: **Date:**
Instructor: **Section:**

Section 2.4 Solving Linear Equations

Objective: Practice in using techniques for solving equations.
Suggested Format: Group Structure B
Time: 20 minutes

I. Solve each equation. Write the answer in the box that corresponds to the letter in the equation.

$3a+5=4a+1$

$2b-b=9$

$3c+4=2c+3c$

$4(d-1)=d+5$

$5(e-6)+8=e-2$

$2(f-3)+7=3f-6$

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

$3h-6=2h-5$

$\frac{1}{2}i=3$

$a=$	$b=$	$c=$
$d=$	$e=$	$f=$
$g=$	$h=$	$i=$

II. Look at just the numbers in the box. (Ignore the letters). Do you notice any pattern?

Name: **Date:**
Instructor: **Section:**

Chapter 2 Group Activity - Investigating Averages

Sections 2.1–2.9

Materials:
• small rubber ball or crumpled paper ball
• bucket or waste can

This activity may be completed by working in groups or individually.

1. Try shooting the ball into the bucket or waste can 5 times. Record your results below.

   Shots Made **Shots Missed**

2. Find your shooting percent for the 5 shots (that is, the percent of the shots you actually made out of the number you tried).

3. Suppose you are going to try an additional 5 shots. How many of the next 5 shots will you have to make to have a 50% shooting percent for all 10 shots? An 80% shooting percent?

4. Did you solve an equation in Question 3? If so, explain what you did. If not, explain how you could use an equation to find the answers.

5. Now suppose you are going to try an additional 22 shots. How many of the next 22 shots will you have to make to have at least a 50% shooting percent for all 27 shots? At least a 70% shooting percent?

6. Choose one of the sports played at your college that is currently in season. How many regular-season games are scheduled? What is the team's current percent of games won?

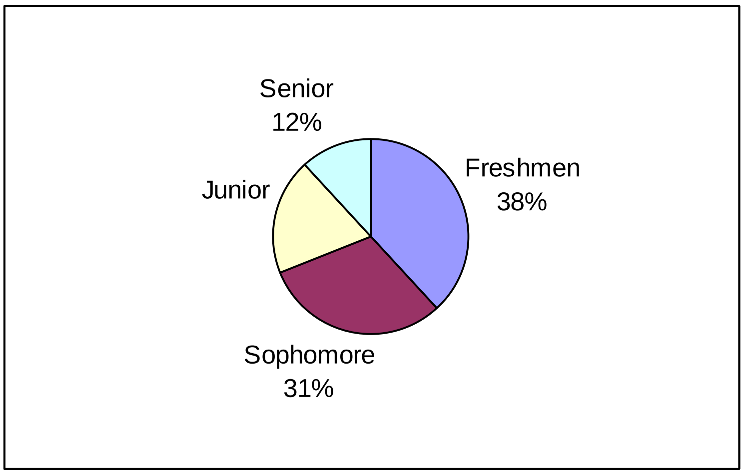
7. Suppose the team has a goal of finishing the season with a winning percent better than 110% of their current wins. At least how many of the remaining games must they win to achieve their goal?

Name: **Date:**
Instructor: **Section:**

Section 3.1 Reading Graphs and the Rectangular Coordinate System

Objective: Interpret Real Data.
Suggested Format: Group Structure A or B
Time: 15 minutes

Enrollment at William's College, 2008



Use the graph to answer the following questions.

1. What percent of the total student body were Freshmen? ________________

2. What percent of the total student body were Sophomores? ________________

3. What percent of the total student body were Juniors? ________________

4. What percent of the total student body were Seniors? ________________

The total enrollment was 8,480.

5. How many students were Freshmen? ________________

6. How many students were Sophomores? ________________

7. How many students were Juniors? ________________

8. How many students were Seniors? ________________

Name: **Date:**
Instructor: **Section:**

Section 3.4 Slope and Rate of Change

Objective: Find the slope of a line for a practical application.
Suggested Format: Group Structure A
Time: 10 minutes

Use the information in each stated problem to write two points, then use the two points to find the slope of a line going through those two points.

1. A business had 580 employees in 2010 and 780 employees in 2015. Find the rate of change (the slope of the line). HINT: Let y = the number of employees. If you let $x = 0$ represent the year 2010, what x-value represents 2015? Explain what the slope means.

2. A piece of office equipment cost $20,000 new. In ten years it will be worth $5000. Find the rate of depreciation (slope). HINT: Let y = the value of the machine. Let $x = 0$ be the year the machine was purchased. Explain what the slope means.

Name: **Date:**
Instructor: **Section:**

Section 3.5 Equations of Lines

Objective: Provide a practical application of equations of lines.
Suggested Format: Group Structure B
Time: 20 minutes

1. A business had 580 employees in 2010 and 780 employees in 2015. Find the rate of change (the slope of the line). HINT: Let y = the number of employees. If you let $x = 0$ represent the year 2010, 2015 will be x = ?
   (a) Find the slope of the line and the equation that represents the data.

   (b) How many employees will the business have in 2017?

   (c) In what year will the number of employees be 980?

2. A piece of office equipment cost $20,000 new. In ten years it will be worth $5000. Find the rate of depreciation (slope). HINT: Let y = the value of the machine. Let $x = 0$ be the year the machine was purchased.
   (a) Find the slope of the line and the equation that represents the data.

   (b) What will be the value of the equipment in 5 years?

   (c) After how many years will the value of the equipment be $15,500?

Name: **Date:**
Instructor: **Section:**

Chapter 3 Group Activity - Financial Analysis

Investment analysts investigate a company's sales, net profit, debt, and assets to decide whether investing in it is a wise choice. One way to analyze this data is to graph it and look for trends over time. Another way is to find algebraically the rate at which the data changes over time.

The following table gives the net incomes in millions of dollars for some of the leading U.S. businesses in the pharmaceutical industry for the years 2004 and 2005. In this project, you will analyze the performances of these companies and, based on this information alone, make an investment recommendation. This project may be completed by working in groups or individually.

Pharmaceutical Industry Net Income (In Millions of Dollars)

Company	***2004***	***2005***
Merck	\$5813.4	\$4631.3
Pfizer	\$11,361	\$8085
Johnson & Johnson	\$8509	\$10411
Bristol-Myers Squibb	\$2378	\$2992
Abbot Laboratories	\$3175.8	\$3372.1
Eli Lilly	\$1819.1	\$1979.6
Schering-Plough	\$269	−\$947
Wyeth	\$1234	\$3656.3

Source: The 2006 annual report for each of the companies listed.

1. Scan the table. Did any of the companies have a loss during the years shown? If so, which company and when? What does this mean?

2. Write the data for each company as two ordered pairs of the form (year, net income). Assuming that the trends in net income are linear, use graph paper to graph the line represented by the ordered pairs for each company. Describe the trends shown by each graph.

3. Find the slope of the line for each company.

4. Which of the lines, if any, have positive slopes? What does that mean in this context? Which of the lines have negative slopes? What does that mean in this context?

5. Of these pharmaceutical companies, which one(s) would you recommend as an investment choice? Why?

(cont'd)

Name: **Date:**
Instructor: **Section:**

Group Activity 3 (cont'd)

6. Do you think it is wise to make a decision after looking at only two years of net profits? What other factors do you think should be taken into consideration when making an investment choice?

(Optional) Use financial magazines, company annual reports, or online investing information to find net income information for two different years for two to four companies in the same industry. Analyze the net income and make an investment recommendation.

Name: **Date:**
Instructor: **Section:**

Section 4.4 Systems of Linear Equations and Problem Solving

Objective: Provide a practical application of systems of equations of lines.
Suggested Format: Group Structure B
Time: 15 minutes

To encourage car pooling, a toll road decided to charge less for vehicles with 3 or more passengers. The toll is normally $3 per vehicle, but the toll for a car with 3 or more passengers is reduced to $2 per vehicle.

The first day the new prices went in to effect, the supervisor told Anne to count how many vehicles of each type went through her toll booth. Anne knew that an automatic counter kept track of the total number of vehicles that went by her booth. At the end of her shift, she had collected $2150 and the automatic counter told her that a total of 800 vehicles had passed by. Write a system of equations and solve so Anne can tell her supervisor how many vehicles she charged $3 and how many she charged $2.

Name: **Date:**
Instructor: **Section:**

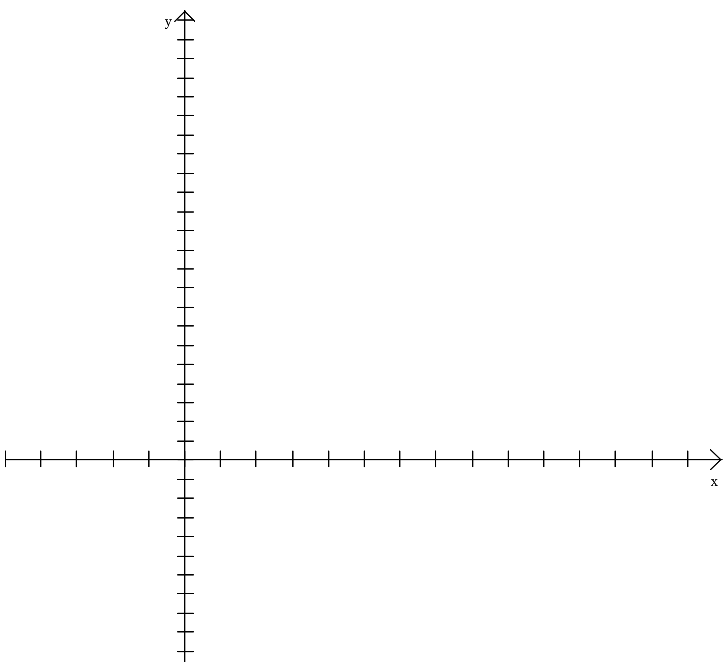
Section 4.6 Systems of Linear Inequalities

Objective: Provide a practical application of systems of inequalities.
Suggested Format: Group Structure B
Time: 20 minutes

Jan makes bracelets and necklaces to sell at an arts and crafts fair. She has 20 hours at most to work on making more jewelry. It takes her 4 hours to make 1 bracelet and 1 hour to make 1 necklace. She only needs 11 more pieces to fill her display, so she wants to make 11 or less pieces.

Write a system of inequalities to model what she needs (remember x and y need to be positive). Then graph the system.

	Bracelets x	Necklaces y	
Hours			$\leq$ 20
Number of items			$\leq$ 11
	x		$\leq$ 0
		y	$\leq$ 0



Find a point that satisfies the condition. Explain what that point represents.

Name: **Date:**
Instructor: **Section:**

Chapter 4 Group Activity - Break-Even Point

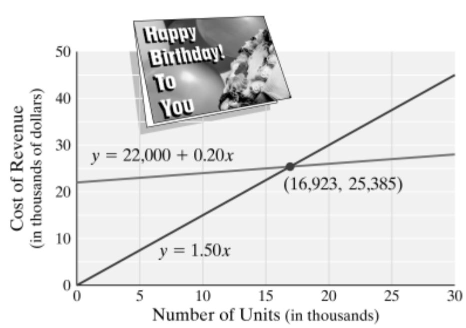
When a business sells a new product, it generally does not start making a profit right away. There are usually many expenses associated with creating a new product. These expenses might include an advertising blitz to introduce the product to the public. These start-up expenses might also include the cost of market research and product development or any brand-new equipment needed to manufacture the product. Start-up costs like these are generally called fixed costs because they don't depend on the number of items manufactured. Expenses that depend on the number of items manufactured, such as the cost of materials and shipping, are called variable costs. The total cost of manufacturing the new product is given by the cost equation:
Total cost = Fixed costs + Variable costs.

For instance, suppose a greeting card company is launching a new line of greeting cards. The company spent $7000 doing product research and development for the new line and spent $15,000 on advertising the new line. The company does not need to buy any new equipment to manufacture the cards, but the paper and ink needed to make each card will cost $0.20 per card. The total cost y in dollars for manufacturing x cards is $y = 22{,}000 + 0.20x$.

Once a business sets a price for the new product, the company can find the product's expected revenue. Revenue is the amount of money the company takes in from the sales of its product. The revenue from selling a product is given by the revenue equation:
Revenue = Price per item × Number of items sold.

For instance, suppose that the card company plans to sell its new cards for $1.50 each. The revenue y, in dollars, that the company can expect to receive from the sales of x cards is $y = 150x$.

If the total cost and revenue equations are graphed on the same coordinate system, the graphs should intersect. The point of intersection is where total cost equals revenue and is called the break-even point. The break-even point gives the number of items x that must be manufactured and sold for the company to recover its expenses. If fewer than this number of items are produced and sold, the company loses money. If more than this number of items are produced and sold, the company makes a profit. In the case of the greeting card company, approximately 16,923 cards must be manufactured and sold for the company to break even on this new card line. The total cost and revenue of producing and selling 16,923 cards is the same. It is approximately $25,385.



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Name: **Date:**
Instructor: **Section:**

Group Activity 4 (cont'd)

Suppose your group is starting a small business near your campus.

a. Choose a business and decide what campus-related product or service you will provide.

b. Research the fixed costs of starting up such a business.

c. Research the variable costs of producing such a product or providing such a service.

d. Decide how much you would charge per unit of your product or service.

e. Find a system of equations for the total cost and revenue of your product or service.

f. How many units of your product or service must be sold before your business will break even?

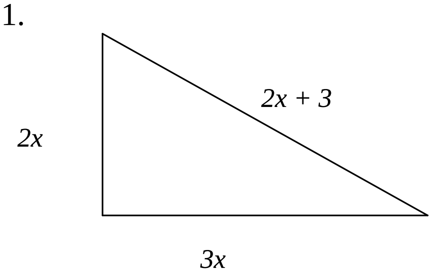
Name:	**Date:**
Instructor:	**Section:**

Section 5.2 Adding and Subtracting Polynomials

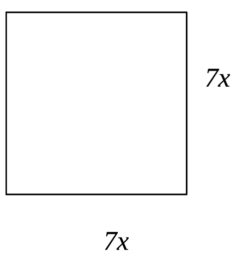
Objective: Provide practice with adding and subtracting polynomial expressions.
Suggested Format: The Math is Right Game
Time: 15 minutes

Express the perimeter of each figure as a polynomial expression.

1.



2.



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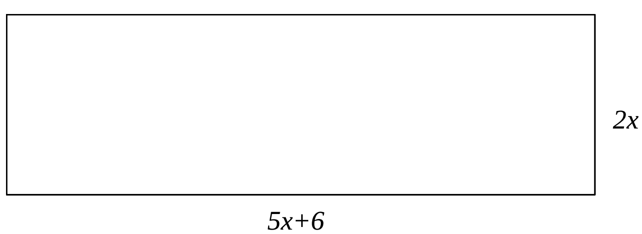

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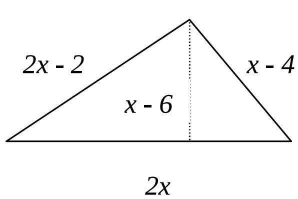


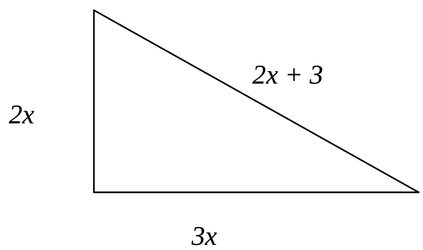
Name: **Date:**
Instructor: **Section:**

Section 5.3 Multiplying Polynomials

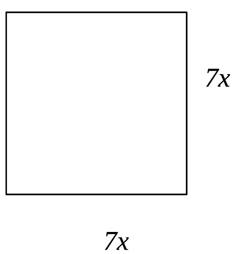
Objective: Provide practice with multiplying polynomial expressions.
Suggested Format: The Math is Right Game
Time: 15 minutes

Express the area of each figure as a polynomial expression.

1.



2.



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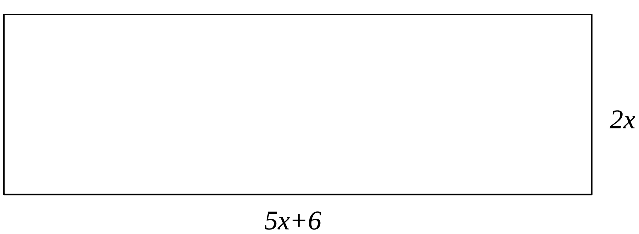

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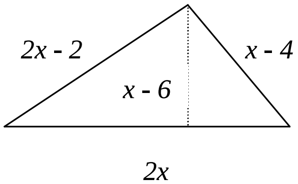


Name: **Date:**
Instructor: **Section:**

Chapter 5 Group Activity - Modeling with Polynomials

The polynomial $-2.02x^2 + 51.60x + 674.60$ dollars represents consumer spending per person per year on all U.S. media from 2000 to 2006. This includes spending on subscription TV services, recorded music, newspapers, magazines, books, home video, theater movies, video games, and educational software. The polynomial model $-1.39x^2 + 22.61x + 206.53$ dollars represents consumer spending per person per year on subscription TV services alone during this same period. In both models, x is the number of years after 2000 (*Source:* Based on data from *Statistical Abstract of the United States, 2007*).

In this project, you will have the opportunity to investigate these polynomial models numerically, algebraically, and graphically. This project may be completed by working in groups or individually.

1. Use the polynomials to complete the following table showing the annual consumer spending per person over the period 2000 – 2006 by evaluating each polynomial at the given values of x. Then subtract each value in the fourth column from the corresponding value in the third column. Record the result in the last column, "Difference." What do you think these values represent? What trends do you notice in the data?

Year	x	*Consumer Spending per Person per Year on All U.S. Media*	*Consumer Spending per Person per Year on Subscription TV*	*Difference*
2000	0			
2002	2			
2004	4			
2006	6			

2. Use the polynomial models to find a new polynomial model representing the amount of consumer spending per person on U.S. media other than subscription TV services (such as recorded music, newspapers, magazines, books, home video, theater movies, video games, and educational software). Then use this new polynomial to complete the following table.

Year	x	*Consumer Spending per Person per Year on Media Other Than Subscription TV*
2000	0	
2002	2	
2004	4	
2006	6	

(cont'd)

Name: **Date:**
Instructor: **Section:**

Group Activity 5 (cont'd)

3. Compare the values in the last column of the table in Question 1 to the values in the last column of the table in Question 2. What do you notice? What can you conclude?

4. Use the polynomial models to estimate consumer spending on
   a. all U.S. media,
   b. subscription TV,
   c. media other than subscription TV for the year 2008.

5. Use the polynomial models to estimate consumer spending on
   a. all U.S. media,
   b. subscription TV,
   c. media other than subscription TV for the year 2010.

6. Create a bar graph that represents the data for consumer spending on all U.S. media in the years 2000, 2002, 2004, and 2006 along with your estimates for 2008 and 2010. Study your bar graph. Discuss what the graph implies about the future.

Name: **Date:**
Instructor: **Section:**

Chapter 6 Integrated Review – Choosing a Factoring Strategy

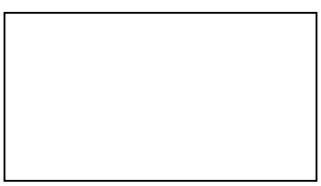
Objective: Provide practice with deciding on a factoring strategy.
Suggested Format: Group A or B
Time: 20 minutes

I. Factor the polynomials then find an expression for the width and an expression for the length. Then use the length and the width to find an expression for the perimeter of each figure.

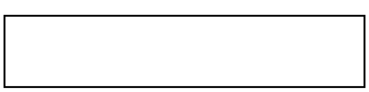
1. $A = x^2 + 2x - 15$ $\quad l =$ ________ $\quad w =$ ________ $\quad P =$ ________

2. $A = x^2 - 49$ $\quad l =$ ________ $\quad w =$ ________ $\quad P =$ ________

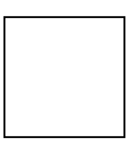
3. $A = 6x^2 + 7x - 20$ $\quad l =$ ________ $\quad w =$ ________ $\quad P =$ ________



4. $A = 6x^2 - x - 15$ $\quad l =$ ________ $\quad w =$ ________ $\quad P =$ ________



5. $A = 9x^2 + 12x + 4$ $\quad s =$ ________ $\quad P =$ ________



Name: **Date:**
Instructor: **Section:**

Section 6.6 Solving Quadratic Equations by Factoring

Objective: Discover rules about the solutions to quadratic equations.
Suggested Format: Group A or B
Time: 20 minutes

I. Solve each of the following quadratic equations by factoring. Write both answers in column **A**.

	A	B	C	D	E
$x^2+3x-10=0$					
$x^2+x-6=0$					
$2x^2+5x-3=0$					
$3x^2-10x-8=0$					
$x^2-3x-18=0$					
$6x^2+23x-4=0$					
$x^2-7x-12=0$					
$6x^2-11x-10=0$					
$5x^2-13x-6=0$					
$7x^2-11x-6=0$					

II. Add the two solutions to each equation. Write the sum in column **B**.

III. Each equation is written in the form $ax^2+bx+c=0$. Find the quotient $\frac{b}{a}$ for each equation and write that value in column **C**.

IV. Write the product of the two solutions in column **D**.

V. Each equation is written in the form $ax^2+bx+c=0$. Find the quotient $\frac{a}{c}$ for each equation and write that value in column **E**.

Study columns **B** and **C**. Can you define the relationship between the sum of the answers and the quotient $\frac{b}{a}$?

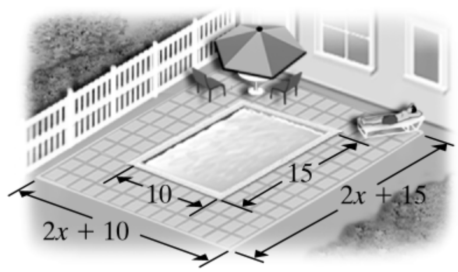
Study columns **D** and **E**. Can you define the relationship between the product of the answer and the quotient $\frac{a}{c}$?

Name: **Date:**
Instructor: **Section:**

Chapter 6 Group Activity - Choosing Among Building Options

Whether putting in a new floor, hanging new wallpaper, or retiling a bathroom, it may be necessary to choose among several different materials with different pricing schemes. If a fixed amount of money is available for projects like these, it can be helpful to compare the choices by calculating how much area can be covered by a fixed dollar-value of material.

In this project, you will have the opportunity to choose among three different choices of materials for building a patio around a swimming pool. This project may be completed by working in groups or individually.



Situation: Suppose you have just had a 10-foot-by-15-foot in-ground swimming pool installed in your backyard. You have $3000 left from the building project that you would like to spend on surrounding the pool with a patio, equally wide on all sides (see figure). You have talked to several local suppliers about options for building this patio and must choose among the following.

Option	*Material*	*Price*
A	Poured cement	$5 per square foot
B	Brick	$7.50 per square foot plus a $30 flat fee for delivering the bricks
C	Outdoor carpeting	$4.50 per square foot plus $10.86 per foot of the pool's perimeter to install edging

1. Find the area of the swimming pool.

2. Write an algebraic expression for the total area of the region containing both the pool and the patio.

3. Use subtraction to find an algebraic expression for the area of just the patio (not including the area of the pool).

(cont'd)

Group Activity 6 (cont'd)

4. Find the perimeter of the swimming pool alone.

5. For each patio material option, write an algebraic expression for the total cost of installing the patio based on its area and the given price information.

6. If you plan to spend the entire $3000 on the patio, how wide would the patio in option A be?

7. If you plan to spend the entire $3000 on the patio, how wide would the patio in option B be?

8. If you plan to spend the entire $3000 on the patio, how wide would the patio in option C be?

9. Which option would you choose? Why? Discuss the pros and cons of each option.

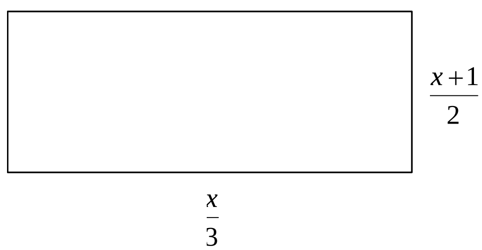
Name: **Date:**
Instructor: **Section:**

Chapter 7 Integrated Review – Summary on Rational Expressions

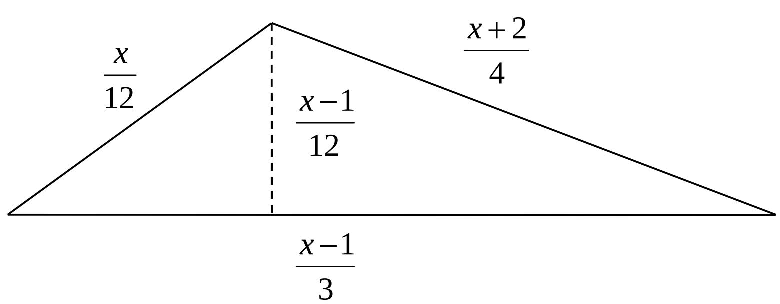
Objective: Provide practice adding and multiplying radical expressions.
Suggested Format: Group A or B
Time: 20 minutes

Find an expression for the perimeter and area of each figure.

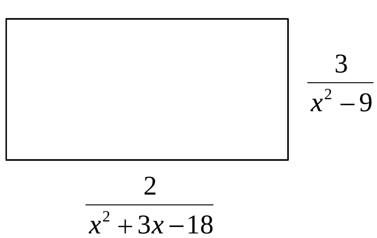
1. $P =$ ________________ $A =$ ________________



2. $P =$ ________________ $A =$ ________________



3. $P =$ ________________ $A =$ ________________



Name: **Date:**
Instructor: **Section:**

Section 7.6 Proportion and Problem Solving with Rational Equations

Objective: Provide a better understanding of problem solving.
Suggested Format: Group A or B
Time: 15 minutes

Divide each group into two smaller groups.

First Group:

A. Solve the following problem.
An airplane can fly 500 miles with the wind in 2 hours. In the same amount of time, it flies 300 miles against the wind. Find the air speed of the plane in still air and the wind speed.

B. Write a problem about an airplane flying with the wind and against the wind. Use problem A as an example. (Hint: Start by deciding on what the answers will be and then write the problem.)

C. Give the problem you wrote to the second group and ask them to solve it.

Second Group:

A. Solve the following problem.
A boat goes upstream 9 miles in one hour. In the same amount of time it goes 11 miles downstream. Find the speed of the boat in still water and the speed of the current in the river.

B. Write a problem about a boat going upstream and downstream. Use problem A as an example. (Hint: Start by deciding on what the answers will be and then write the problem.)

C. Give the problem you wrote to the first group and ask them to solve it.

Name: **Date:**
Instructor: **Section:**

Chapter 7 Group Activity - Comparing Dosage Formulas

In this project, you will have the opportunity to investigate two well-known formulas for predicting the correct doses of medication for children. This project may be completed by working in groups or individually.

Young's Rule and Cowling's Rule are dose formulas for prescribing medicines to children. Unlike formulas for area or distance, these dose formulas describe only an approximate relationship. The formulas relate a child's age A in years and an adult dose D of medication to the proper child's dose C. The formulas are most accurate when applied to children between the ages of 2 and 13.

Young's Rule: $C = \dfrac{DA}{A+12}$

Cowling's Rule: $C = \dfrac{D(A+1)}{24}$

1. Let the adult dose D = 1000 mg. Complete the Young's Rule and Cowling's Rule columns of the following table comparing the doses predicted by both formulas for ages 2 through 13.

Age A	*Young's Rule*	*Cowling's Rule*	*Difference*	*Age A*	*Young's Rule*	*Cowling's Rule*	*Difference*
2				8			
3				9			
4				10			
5				11			
6				12			
7				13			

2. Use the data from the table in Question 1 to form sets of ordered pairs of the form (age, child's dose) for each formula. Graph the ordered pairs for each formula on the same graph. Describe the shapes of the graphed data.

3. Use your table, graph, or both, to decide whether either formula will consistently predict a larger dose than the other. If so, which one? If not, is there an age at which the doses predicted by one becomes greater than the doses predicted by the other? If so, estimate that age.

4. Use your graph to estimate for what age the difference in the two predicted doses is greatest.

5. Return to the table in Question 1 and complete the last column, titled "Difference," by finding the absolute value of the difference between the Young's dose and the Cowling's dose for each age. Use this column in the table to verify your graphical estimate found in Question 4.

(cont'd)

Name: **Date:**
Instructor: **Section:**

Group Activity 7 (cont'd)

6. Does Cowling's Rule ever predict exactly the adult dose? If so, at what age? Explain. Does Young's Rule ever predict exactly the adult dose? If so, at what age? Explain.

7. Many doctors prefer to use formulas that relate doses to factors other than a child's age. Why is age not necessarily the most important factor when predicting a child's dose? What other factors might be used?

Name: **Date:**
Instructor: **Section:**

Section 8.2 Simplifying Radicals

Objective: Use radicals to find the distance between two points.
Suggested Format: Group A or B
Time: 10 minutes

The distance formula can be used to find the distance between any two points (x_1, y_1) and (x_2, y_2).

Distance formula: $D = \sqrt{(x_2 - x_1) + (y_2 - y_1)}$

Calculate the distances between the following points. Give an exact answer and then give an approximate answer to the nearest hundredth of a unit.

1. (−2, 5) and (−6, 3)

2. (0, 3) and (−2, 4)

Name: **Date:**
Instructor: **Section:**

Section 8.6 Radical Equations and Problem Solving

Objective: use the Pythagorean Theorem.
Suggested Format: Group B
Time: 20 minutes

Find the hypotenuse of each right triangle using the Pythagorean Theorem.

1. $a = 4$, $b = 3$, $c =$ ________________

2. $a = 8$, $b = 6$, $c =$ ________________

3. $a = 12$, $b = 9$, $c =$ ________________

4. $a = 16$, $b = 12$, $c =$ ________________

Study the previous problems and see if you can solve the next problem without using the Pythagorean Theorem.

5. $a = 20$, $b = 15$, $c =$ ________________

Name: **Date:**
Instructor: **Section:**

Chapter 8 Group Activity - Investigating the Dimensions of Cylinders

The volume V (in cubic units) of a cylinder is given by the formula $V = \pi r^2 h,$ where r is the radius of the cylinder and h is its height. In this project, you will investigate the radii of several cylinders by completing the table below.

For this project, you will need several empty cans of different sizes, a 2-cup (16-fluid-ounce) transparent measuring cup with metric markings (in milliliters), a metric ruler, and water. This project may be completed by working in groups or individually.

Can	*Volume (ml)*	*Height (cm)*	*Calculated Radius (cm)*	*Measured Radius (cm)*
A				
B				
C				
D				

1. For each can, measure its volume by filling it with water and pouring the water into the measuring cup. Find the volume of the water in milliliters (ml). Record the volumes of the cans in the table. (Remember that 1 ml = 1 cm^3.)

2. Use a ruler to measure the height of each can in centimeters (cm). Record the heights in the table.

3. Solve the formula $V = \pi r^2 h$ for the radius r.

4. Use your formula from Question 3 to calculate an estimate of each can's radius based on the volume and height measurements recorded in the table. Record these calculated radii in the table.

5. Try to measure the radius of each can and record these measured radii in the table. (Remember that radius = $\frac{1}{2}$ diameter.)

6. How close are the values of the calculated radius and the measured radius of each can? What factors could account for the differences?

Name: **Date:**
Instructor: **Section:**

Section 9.3 Solving Quadratic Equations by the Quadratic Formula

Objective: Derive the Quadratic Formula.
Suggested Format: Group A
Time: 15 minutes

Study the example where your textbook derived the quadratic formula. Shut your book and notes. Complete the square to derive the quadratic formula.

$ax^2 + bx + c = 0$

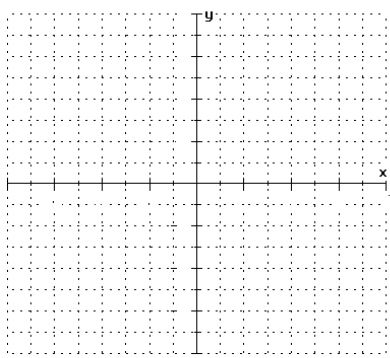
Name: **Date:**
Instructor: **Section:**

Section 9.5 Graphing Quadratic Equations

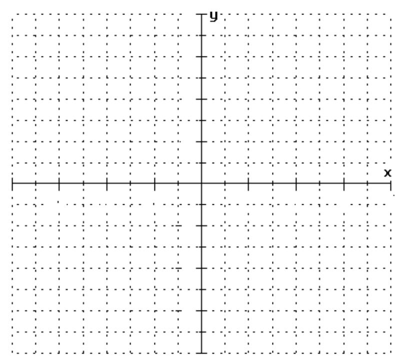
Objective: Seeing patterns in the graphs of quadratic equations.
Suggested Format: Group B
Time: 20 minutes

Have each member of the group graph one of the following quadratic equations.

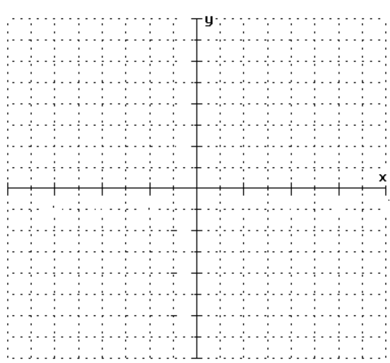
1. $y = x^2$



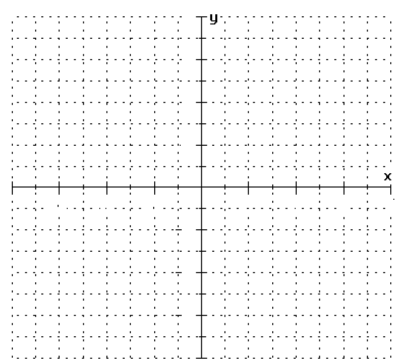
2. $y = x^2 + 2$



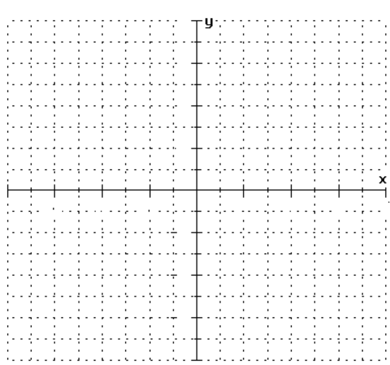
3. $y = x^2 - 2$



4. $y = x^2 + 3$



Compare the four graphs. Can you sketch the graph of $y = x^2 - 3$ without finding any points?



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Chapter 9 Group Activity - Modeling a Physical Situation

When water comes out of a water fountain, it initially heads upward, but then gravity causes the water to fall. The curve formed by the stream of water can be modeled using a quadratic equation (parabola).

In this project, you will have the opportunity to model the parabolic path of water as it leaves a drinking fountain. This project may be completed by working in groups or individually.

1. Using the figure above, collect data for the *x*-intercepts of the parabolic path. Let points *A* and *B* in the figure be on the *x*-axis and let the coordinates of point *A* be (0, 0). Use a ruler to measure the distance between points *A* and *B* on the figure to the nearest even one-tenth centimeter, and use this information to determine the coordinates of point *B*. Record this data in the data table. (Hint: If the distance from *A* to *B* measures 8 one-tenth centimeters, then the coordinates of point *B* are (8, 0).)

Data Table

	x	*y*
Point A		
Point B		
Point V		

2. Next, collect data for the vertex *V* of the parabolic path. What is the relationship between the *x*-coordinate of the vertex and the *x*-intercepts found in Question 1? What is the line of symmetry? To locate point *V* in the figure, find the midpoint of the line segment joining points *A* and *B* and mark point *V* on the path of water directly above the midpoint. To approximate the *y*-coordinate of the vertex, use a ruler to measure its distance from the *x*-axis to the nearest one-tenth centimeter. Record this data in the data table.

3. Plot the points from the data table on a rectangular coordinate system. Sketch the parabola through your points *A*, *B*, and *V*.

(cont'd)

Name: **Date:**
Instructor: **Section:**

Group Activity 9 (cont'd)

4. Which of the following models best fits the data you collected? Explain your reasoning.
   a. $y = 16x + 18$
   b. $y = -13x^2 + 20x$
   c. $y = 0.13x^2 - 2.6x$
   d. $y = -0.13x^2 + 2.6x$

5. ***(Optional)*** Enter your data into a graphing calculator and use the quadratic curve-fitting feature to find a model for your data. How does the model compare with your selection from Question 4?

Mini-Lecture 2.1
Simplifying Algebraic Expressions

Learning Objectives:

1. Identify terms, like terms, and unlike terms.
2. Combine like terms.
3. Use the distributive property to remove parentheses.
4. Write word phrases as algebraic expressions.

Examples

1. Identify the numerical coefficient of each term.

   a) $9x$ b) $-3y$ c) $-x$ d) $2.7x^2y$

   Indicate whether the terms in each list are like or unlike.

   e) $6x, -3x$ f) $-xy^2, -x^2y$ g) $5ab, -\frac{1}{2}ba$ h) $2x^3yz^2, -x^3yz^3$

2. Simplify each expression by combining any like terms.

   a) $7x - 2x + 4$ b) $-9y + 2 - 1 + 6 + y - 7$ c) $1.6x^5 + 0.9x^2 - 0.3x^5$

3. Simplify each expression. Use the distributive property to remove any parentheses.

   a) $3(x + 6)$ b) $-(-5m + 6n - 2p)$ c) $\frac{1}{3}(6x - 9)$

   Remove parentheses and simplify each expression.

   d) $14(2x + 6) - 4$ e) $10a - 5 - 2(a - 3)$ f) $3(2x - 5) - (x + 7)$

4. Write each phrase as an algebraic expression. Simplify if possible.

   a) Add $-4y + 3$ to $6y - 9$ b) Subtract $2x - 1$ from $3x + 7$

   c) Triple a number, decreased by six d) Six times the sum of a number and two

Teaching Notes:

- Students will need repeated practice with identifying terms and like terms.
- Some students do not know that a variable without a numerical coefficient actually has a coefficient of 1.
- Some students will forget to distribute the minus sign in 3b), 3e), and 3f). Some students might need to write a 1 in front of the parentheses in 3b) and 3f).

Answers: *1a) 9; 1b) -3; 1c) -1; 1d) 2.7; 1e) like; 1f) unlike; 1g) like; 1h) unlike; 2a) 5x+4; 2b) -8y; 2c)* $1.3x^5+0.9x^2$*; 3a) 3x+18; 3b) 5m-6n+2p; 3c) 2x-3; 3d) 28x+80; 3e) 8a+1; 3f) 5x-22; 4a) (-4y+3) + (6y-9) = 2y-6; 4b) (3x+7) – (2x-1) = x + 8; 4c) 3x-6; 4d) 6(x + 2)*

Mini-Lecture 2.2

The Addition Property of Equality

Learning Objectives:

1. Define linear equations and use the addition property of equality to solve linear equations.
2. Write word phrases as algebraic expressions.

Examples:

1. Solve each equation. Check each solution.

   a) $y - 6 = 18$ b) $-18 = t - 5$ c) $8.1 + y = 13.9$ d) $a + \frac{2}{3} = -\frac{3}{4}$

Solve each equation. If possible, be sure to first simplify each side of the equation. Check each solution.

   e) $5(y + 2) = 6(y - 3)$ f) $10x = 4x + 9 + 5x$

   g) $-8z + 5 + 6z = -3z + 10$ h) $-5x + 4 + 6x = 15 - 28$

   i) $-\frac{1}{6}x - \frac{1}{3} = \frac{5}{6}x + \frac{1}{2}$ j) $-14.9 + 4a - 2.7 + 2a = 5.1 + 7a + 1.5$

2. Write each algebraic expression described.

   a) Two numbers have a sum of 72. If one number is z, express the other number in terms of z.

   b) During a recent marathon, Tom ran 8 more miles than Judy ran. If Judy ran x miles, how many miles did Tom run?

   c) On a recent car trip, Raymond drove x miles on day one. On day two, he drove 170 miles more than he did on day one. How many miles, in terms of x, did Raymond drive for both days combined?

Teaching Notes:

- Some students need a quick review of "like terms."
- Advise students to write out each step until they have mastered this concept. Avoid shortcuts!
- Some students need to be taught how to work a problem in sequential order showing each step.
- Encourage students to take their time and organize their work. This will help when the problems become more complex.

Answers: *1a) 24; 1b) -13; 1c) 5.8; 1d) -17/12; 1e) 28; 1f) 9; 1g) 5; 1h) -17; 1i) -5/6; 1j) 11; 2a) 72 – z; 2b) x+8; 2c) 2x+ 170*

Mini-Lecture 2.3
The Multiplication Property of Equality

Learning Objectives:

1. Use the multiplication property of equality to solve linear equations.
2. Use both the addition and multiplication properties of equality to solve linear equations.
3. Write word phrases as algebraic expressions.

Examples:

1. Use the multiplication property of equality to solve the following linear equations. Check each solution.

   a) $-8x = -24$ b) $7x = 0$ c) $-z = 19$ d) $3x = -22$

   e) $\frac{2}{5}a = 12$ f) $\frac{y}{-11} = 2.5$ g) $\frac{-3}{8}b = 0$ h) $-10.2 = -3.4c$

2. Use the addition property of equality and the multiplication property of equality to solve the following linear equations. Check each solution.

   a) $5x + 6 = 46$ b) $\frac{a}{9} - 7 = 11$ c) $-24 = -3x - 9$ d) $\frac{1}{3}y - \frac{1}{3} = -6$

   e) $-5.8z + 1.9 = -32.5 - 1.5z$ f) $8y + 7 = 6 - 2y - 10y$ g) $4(4x - 1) = (-8) - (-24)$

3. Write each algebraic expression described. Simplify if possible.

   a) If z represents the first of two consecutive even integers, express the sum of the two integers in terms of z.

   b) If x represents the first of three consecutive even integers, express the sum of the first and third integer in terms of x.

   c) Houses on one side of a street are all numbered using consecutive odd integers. If the first house on the street is numbered x, write an expression in x for the sum of five house numbers in a row.

Teaching Notes:

- Review "like terms" with students.
- Many students do not combine like terms before using one of the properties.
- Encourage students to always take the time to check their solution.

Answers: *1a) 3; 1b) 0; 1c) -19; 1d) -22/3; 1e) 30; 1f) -27.5; 1g) 0; 1h) 3; 2a) 8; 2b) 162; 2c) 5; 2d) -17; 2e) 8; 2f) -1/20; 2g) 5/4; 3a) 2z+2; 3b) 2x+4; 3c) 5x+20*

Mini-Lecture 2.4

Solving Linear Equations

Learning Objectives:

1. Apply a general strategy for solving a linear equation.
2. Solve equations containing fractions.
3. Solve equations containing decimals.
4. Recognize identities and equations with no solution.

Examples:

1. Solve the following linear equations.

   a) $6a - (5a - 1) = 4$ b) $4(3b - 1) = 16$ c) $4z = 8(2z + 9)$

   d) $2(x + 8) = 3(x - 5)$ e) $3(2a - 3) = 5(a + 4)$ f) $12(4c - 2) = 3c - 4$

2. Solve each equation containing fractions.

   a) $\frac{y}{6} - 4 = 1$ b) $\frac{1}{4}x - \frac{3}{8}x = 5$ c) $\frac{-6x+5}{4} + 1 = -\frac{5x}{4}$

   Solve each equation containing decimals.

   d) $0.05x + 0.06(x - 1{,}500) = 570$ e) $0.4(x + 7) - 0.1(3x + 6) = -0.8$

3. Solve each equation. Indicate if it is an identity or an equation with no solution.

   a) $6(z + 7) = 6z + 42$ b) $3 + 12x - 1 = 8x + 4x - 1$ c) $\frac{x}{3} - 3 = \frac{2x}{6} + 1$

Teaching Notes:

- Refer students to the beginning of this section in the textbook for steps: Solving Linear Equations in One Variable.
- Most students find solving equations with fractions or decimals difficult.
- Common error: When multiplying equations with fractions by the LCD, some students multiply only the terms with fractions instead of all terms.
- Common error: When solving equations with decimals and parentheses (examples 2d and 2e), some students multiply terms both inside parentheses and outside parentheses by a power of 10.

<u>Answers:</u> 1a) 3; 1b) 5/3; 1c) -6; 1d) 31; 1e) 29; 1f) 4/9; 2a) 30; 2b) -40; 2c) 9; 2d) 6,000 2e) -30; 3a) identity; 3b) no solution; 3c) no solution

Mini-Lecture 2.5

An Introduction to Problem Solving

Learning Objectives:

Apply the steps for problem solving as we

1. Solve problems involving direct translations.
2. Solve problems involving relationships among unknown quantities.
3. Solve problems involving consecutive integers.

Examples:

1. Solve.
   a) Eight is added to a number and the sum is doubled, the result is 11 less than the number. Find the number.

   b) Three times the difference of a number and 2 is equal to 8 subtracted from twice a number. Find the integers.

2. Solve.

   a) A college graduating class is made up of 450 students. There are 206 more girls than boys. How many boys are in the class?

   b) A 22-ft pipe is cut into two pieces. The shorter piece is 7 feet shorter than the longer piece. What is the length of the longer piece?

   c) A triangle has three angles, A, B, and C. Angle C is 18° greater than angle B. Angle A is 4 times angle B. What is the measure of each angle?
   (Hint: The sum of the angles of a triangle is 180°).

3. Solve.
   a) The room numbers of two adjacent hotel rooms are two consecutive odd numbers. If their sum is 1380, find the hotel room numbers.

   b) When you open a book, the left and right page numbers are two consecutive natural numbers. The sum of their page numbers is 349. What is the number of the page that comes first?

Teaching Notes:

- Many students find application problems challenging.
- Encourage students, whenever possible, to draw diagrams, charts, etc.
- Encourage students to use algebra to solve a problem even though they may be able to solve without it.
- Refer students to ***General Strategy for Problem Solving*** section 2.5, page 111.

Answers: *1a) -27; 1b) 21, 63; 2a) 122 boys; 2b) 14.5 feet; 2c) A=108°, B=27°, C=45°; 3a) 689, 691; 3b) 174*

Mini-Lecture 2.6

Formulas and Problem Solving

Learning Objectives:

1. Use formulas to solve problems.
2. Solve a formula or equation for one of its variables.

Examples:

1. Substitute the given values into each given formula and solve for the unknown variable. If necessary, round to one decimal place.

   a) Distance Formula
   $d = rt$; $t = 9$, $d = 63$

   b) Perimeter of a rectangle
   $P = 2l + 2w$; $P = 32$, $w = 7$

   c) Volume of a pyramid
   $V = \frac{1}{3}Bh$; $V = 40$, $h = 8$

   d) Simple interest
   $I = prt$; $I = 23$, $p = 230$, $r = 0.02$

   e) Convert the record high temperature of 102°F to Celsius. ($F = \frac{9}{5}C + 32$)

   f) You have decided to fence an area of your backyard for your dog. The length of the area is 1 meter less than twice the width. If the perimeter of the area is 70 meters, find the length and width of the rectangular area.

   g) For the holidays, Chris and Alicia drove 476 miles. They left their house at 7 a.m. and arrived at their destination at 4 p.m. They stopped for 1 hour to rest and re-fuel. What was their average rate of speed?

2. Solve each formula for the specified variable.

   a) Area of a triangle
   $A = \frac{1}{2}bh$ for b

   b) Perimeter of a triangle
   $P = s_1 + s_2 + s_3$ for s_3

   c) Surface area of a special rectangular box
   $S = 4lw + 2wh$ for l

   d) Circumference of a circle
   $C = 2\pi r$ for r

Teaching Notes:

- Most students will only need algebra reminders when working with a formula given values.
- Refer students to ***Solving Equations for a Specified Variable*** chart in the textbook, page 127.
- Most students have problems with applications. Refer them back to section 2.5 and the ***General Strategy for Problem Solving*** in the textbook, page 111.

Answers: *1a) 7; 1b) 9; 1c) 15; 1d) 5; 1e) 38.9°C; 1f) l=23, w=12; 1g) 59.5 mph; 2a)* $b = \frac{2A}{h}$;

2b) $s_3 = P - s_1 - s_2$; *2c)* $\frac{S - 2wh}{4w}$; *2d)* $r = \frac{C}{2\pi}$

Mini-Lecture 2.7
Percent and Mixture Problem Solving

Learning Objectives:

1. Solve percent equations.
2. Solve discount and mark-up problems.
3. Solve percent of increase and percent of decrease problems.
4. Solve mixture problems.

Examples:

1. Find each number described.

   a) 5% of 300 is what number?
   b) 207 is 90% of what number?
   c) 15 is 1% of what number?
   d) What percent of 350 is 420?

2. Solve the following discount and mark-up problems. If needed, round answers to the nearest cent.

   a) A "Going-Out-Of-Business" sale advertised a 75% discount on all merchandise. Find the discount and the sale price of an item originally priced at $130.

   b) Recently, an anniversary dinner cost $145.23 excluding tax. Find the total cost if a 15% tip is added to the cost.

3. Solve the following percent increase and decrease problems.

   a) The number of minutes on a cell phone bill went from 1200 minutes in March to1600 minutes in April. Find the percent increase. Round to the nearest whole percent.

   b) In 2004, a college campus had 8,900 students enrolled. In 2005, the same college campus had 7,600 students enrolled. Find the percent decrease. Round to the nearest whole percent.

   c) Find the original price of a pair of boots if the sale price is $120 after a 20% discount.

4. How much pure acid should be mixed with 4 gallons of a 30% acid solution in order to get a 80% acid solution? Use the following table to model the situation.

	Number of Gallons · Acid Strength = Amount of Acid		
Pure Acid			
30% Acid Solution			
80% Acid Solution Needed			

Teaching Notes:

- Most students find problem solving challenging. Encourage students to make a list of all appropriate formulas.

Answers: *1a) 15; 1b) 230; 1c) 1500; 1d) 120%; 2a) discount - $97.50, sale price - $32.50; 2b) $167.01; 3a) 33%; 3b) 15%; 3c) $150; 4) 10 gallons*

Mini-Lecture 2.8

Further Problem Solving

Learning Objectives:

1. Solve problems involving distance.
2. Solve problems involving money.
3. Solve problems involving interest.

Examples:

1. How long will it take a car traveling 60 miles per hour to overtake an activity bus traveling 45-miles per hour if the activity bus left 2 hours before the car?

	r	***D***	***t***
Car	60 mph	$60x$	x
Activity Bus	45 mph	$45(x + 2)$	$x + 2$

2. A collection of dimes and quarters and nickels are emptied from a drink machine. There were four times as many dimes as quarters, and there were ten less nickels than there were quarters. If the value of the coins was $19.50, find the number of quarters, the number of dimes, and the number of nickels.

	Number	**Value of each**	**Total value**	
Quarters	$\boldsymbol{x}$	0.25	$0.25x$	40 @ 0.25=$10.00
Dimes	$\boldsymbol{2x}$	0.10	$0.10(2x)$	80 @ 0.10=$$8.00
Nickels	$\boldsymbol{x - 10}$	0.05	$0.05(x – 10)$	30 @ 0.05=$1.50
Entire Collection			$19.50	$19.50

3. Jeff received a year end bonus of $80,000. He invested some of this money at 8% and the rest at 10%. If his yearly earned income was $7,300, how much did Jeff invest at 10%? Use the following table to model the situation.

	Principal ·	Rate ·	Time =	Interest
8% Fund	x	0.08	1	$0.08x$
10% Fund	$80{,}000 - x$	0.1	1	$0.01(50{,}000 – x)$
Total	80,000			7,300

Teaching Notes:

- Most students find problem solving challenging. Encourage students to make a list of all appropriate formulas.

Answers: *1) 6 hours; 2) Number of Quarters = 40, Number of dimes = 80, number of nickels = 303; 3) $45,000*

Mini-Lecture 2.9

Solving Linear Inequalities

Learning Objectives:

1. Define linear inequality in one variable, graph solution sets on a number line, and use interval notation.
2. Solve linear inequalities.
3. Solve compound inequalities.
4. Solve inequality applications.

Examples:

1. Graph each inequality on a number line and write it in interval notation.

   a) $x \geq -5$ b) $y < 7$ c) $-\frac{3}{2} \geq m$ d) $x > -\frac{2}{5}$

2. Using the addition property of inequality, solve each inequality. Graph the solution set and write it in interval notation.

   a) $x + 7 \leq 12$ b) $x - 10 > -3$ c) $-4z - 2 > -5z + 1$ d) $18 - 2x \leq -3x + 24$

   Using the multiplication property of inequality, solve each inequality. Graph the solution set and write it in interval notation.

   e) $-8 \geq \frac{x}{3}$ f) $3x < 73$ g) $0 < \frac{y}{8}$ h) $-\frac{3}{5}z \leq 9$

   Using both properties, solve each inequality.

   i) $3(3x - 16) < 12(x - 2)$ j) $-18(z - 2) \geq -21z + 24$ k) $\frac{8}{21}(x+2) > \frac{1}{7}(x+3)$

3. Solve each inequality. Graph the solution set and write it in interval notation.

   a) $-5 < t \leq 0$ b) $-12 \leq 2x < -8$ c) $3 \leq 4x - 9 \leq 7$

4. Solve the following.

   a) Eight more than twice a number is less than negative twelve. Find all numbers that make this statement true.

   b) One side of a triangle is six times as long as another side and the third side is 8 inches long. If the perimeter can be no more than 106 inches, find the maximum lengths of the other two sides.

Teaching Notes:

- Remind students to reverse the direction of the inequality symbol when multiplying or dividing by a negative number.
- Suggest students keep the coefficient of the variable positive whenever possible.

Answers: *(For all graphs, see Mini-Lecture Graphing Answers starting on page M-63): 1a) [-5,∞); 1b) (∞,7); 1c) [- 3/2, ∞); 1d) (-2/5, ∞); 2a)* $(-\infty,5]$; *2b)* $(7,\infty)$; *2c)* $(3,\infty)$; *2d)* $(-\infty,6]$; *2e)* $(-\infty,-24]$; *2f)* $(-\infty,24\tfrac{1}{3})$; *2g)* $(0,\infty)$; *2h)* $[-15,\infty)$; *2i)* $(-8,\infty)$; *2j)* $[-4,\infty)$; *2k) (7/5, ∞); 3a)* $(-5,0]$; *3b) [-6,4); 3c) [3,4]; 4a) x<-10; 4b) 14, 84*

Chapter 2 Test Answers

Test 2 – A

1. $3x-4$
2. $0.8x-5.3$
3. $5x+6$
4. $9x-7$
5. 5
6. 27
7. −3
8. −5
9. 3
10. $-\frac{4}{21}$
11. 0
12. No solution
13. 1
14. 67, 68
15. 6 hours
16. 400 liters of 20%, 200 liters of 50%
17. 3 hours
18. 533.3604
19. $b=\frac{P-2a}{2}$
20. $h=\frac{A}{lw}$
21. $x\geq\frac{10}{3}$
22. $x\geq-17$
23. $x\geq5$
24. $13<x<26$
25. $-6<x\leq3$

Test 2 – B

1. $-x-8$
2. $9.5x-6.3$
3. $6x-8$
4. $-5x+9$
5. 6
6. 75
7. −5
8. 11
9. $\frac{3}{7}$
10. $\frac{9}{4}$
11. −31
12. 0
13. No solution
14. 30º, 60º
15. \$20,000 at 5%, \$4000 at 3%
16. 84, 85, 86
17. 32
18. 11
19. $\pi=\frac{3V}{r^2h}$
20. $y=\frac{-Ax-C}{B}$
21. $x\geq-1$
22. $x\geq-\frac{13}{4}$
23. $x\leq 9$
24. $-6<x<6$
25. $2<x<6$

Test 2 – C

1. $10x-13$
2. $2.6x-2.1$
3. $-2x-18$
4. $5x+12$
5. 3
6. −98
7. 6
8. −1
9. 8
10. $\frac{13}{12}$
11. −10
12. 4
13. No solution
14. 40º, 40º, 100º
15. \$25.92
16. \$15,000 at 3%, \$30,000 at 8%
17. 80 miles
18. 8
19. $x=\frac{y-b}{m}$
20. $x=\frac{3y+7}{2y}$
21. $x<-4$
22. $x>10$
23. $x\geq-4$
24. $-1<x<11$
25. $-4<x<8$

Chapter 2 Test Answers

Test 2 – D	Test 2 – E	Test 2 – F
1. c	1. d	1. d
2. a	2. a	2. a
3. a	3. c	3. c
4. b	4. b	4. b
5. a	5. c	5. c
6. b	6. a	6. b
7. a	7. b	7. a
8. d	8. a	8. c
9. a	9. b	9. b
10. c	10. c	10. a
11. d	11. d	11. d
12. b	12. a	12. d
13. d	13. d	13. b
14. a	14. b	14. c
15. b	15. d	15. b
16. b	16. b	16. b
17. b	17. c	17. d
18. a	18. b	18. b
19. c	19. c	19. a
20. a	20. a	20. a
21. d	21. a	21. b
22. d	22. d	22. d
23. a	23. c	23. a
24. b	24. b	24. c
25. c	25. c	25. c