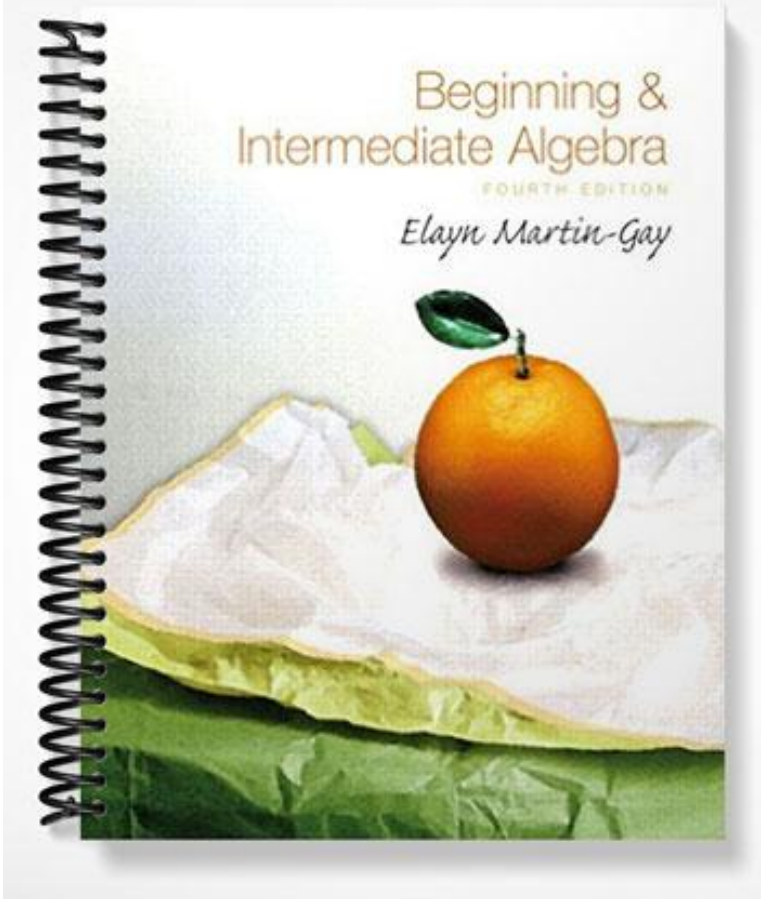
SOLUTIONS MANUAL



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. $4x^2 + 3x^2 = (4+3)x^2 = 7x^2$

b. $-3y + y = -3y + 1y = (-3 + 1)y = -2y$

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

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. $\begin{aligned} &-5(3x - 4z - 5) \\ &= -5(3x) + (-5)(-4z) + (-5)(-5) \\ &= -15x + 20z + 25 \end{aligned}$

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	+	$2x$

b.

the sum of 5 and a number	subtracted from	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 and Readiness Check

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. The numerical coefficient of $-7y$ is -7.

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

9. The numerical coefficient of x is 1.

10. The numerical coefficient of $-y$ is -1.

11. The numerical coefficient of $-\frac{5y}{3}$ is $-\frac{5}{3}$.

12. The numerical coefficient of $-\frac{2}{3}z$ is $-\frac{2}{3}$.

13. $5y$ and y are like terms.

14. $-2x^2y$ and $6xy$ are unlike terms.

15. $2z$ and $3z^2$ are unlike terms.

16. b^2a and $-\frac{7}{8}ab^2$ are like terms.

Exercise Set 2.1

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

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

6. $6g+5-3g-7 = 6g-3g+5-7$
$= (6-3)g-2$
$= 3g-2$

8. $a+3a-2-7a = a+3a-7a-2$
$= (1+3-7)a-2$
$= -3a-2$

10. $8p+4-8p-15 = (8p-8p)+(4-15)$
$= (8-8)p+(-11)$
$= 0p-11$
$= -11$

12. $7.9y-0.7-y+0.2 = 7.9y-y-0.7+0.2$
$= (7.9-1)y-0.5$
$= 6.9y-0.5$

14. $8h+13h-6+7h-h = 8h+13h+7h-h-6$
$= (8+13+7-1)h-6$
$= 27h-6$

16. $8x^3+x^3-11x^3 = (8+1-11)x^3 = -2x^3$

18. $0.4y - 6.7 + y - 0.3 - 2.6y$
$= 0.4y + y - 2.6y - 6.7 - 0.3$
$= (0.4 + 1 - 2.6)y - 7.0$
$= -1.2y - 7$

20. Answers may vary

22. $7(r - 3) = 7(r) - 7(3) = 7r - 21$

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

26. $9(z + 7) - 15 = 9z + 63 - 15 = 9z + 48$

28. $-2(4x-3z-1) = -2(4x)-(-2)(3z)-(-2)(1)$
$= -8x+6z+2$

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

32. $4(2x-3)-2(x+1) = 8x-12-2x-2$
$= 6x-14$

34. $3y-5$ added to $y+16$
$(3y-5) + (y+16) = 3y+y-5+16$
$= 4y+11$

36. $12+x$ minus $4x-7$
$(12+x) - (4x-7) = 12+x-4x+7$
$= 12+7+x-4x$
$= 19-3x$

38. $2m-6$ minus $m-3$
$(2m-6) - (m-3) = 2m-6-m+3$
$= 2m-m-6+3$
$= m-3$

40. $7c - 8 - c = 7c - c - 8 = (7 - 1)c - 8 = 6c - 8$

42. $5y-14+7y-20y = 5y+7y-20y-14$
$= (5+7-20)y-14$
$= -8y-14$

44. $-3(2x+5)-6x = -3(2x)+(-3)(5)-6x$
$= -6x-15-6x$
$= -6x-6x-15$
$= -12x-15$

46. $2(6x-1)-(x-7) = 12x-2-x+7$
$= 11x+5$

48. $8y-2-3(y+4) = 8y-2-3y-12 = 5y-14$

50. $-11c - (4 - 2c) = -11c - 4 + 2c = -9c - 4$

52. $(8-5y)-(4+3y) = 8-5y-4-3y = -8y+4$

54. $2.8w-0.9-0.5-2.8w = 2.8w-2.8w-0.9-0.5$
$= -1.4$

56. $\frac{1}{5}(9y+2)+\frac{1}{10}(2y-1)=\frac{9}{5}y+\frac{2}{5}+\frac{2}{10}y-\frac{1}{10}$
$=\frac{9}{5}y+\frac{1}{5}y+\frac{2}{5}-\frac{1}{10}$
$=\frac{10}{5}y+\frac{4}{10}-\frac{1}{10}$
$=2y+\frac{3}{10}$

58. $8+4(3x-4)=8+12x-16=-8+12x$

60. $0.2(k+8)-0.1k=0.2k+1.6-0.1k=0.1k+1.6$

62. $14-11(5m+3n)=14-55m-33n$

64. $7(2x+5)-4(x+2)-20x=14x+35-4x-8-20x$
$=14x-4x-20x+35-8$
$=-10x+27$

66. $\frac{1}{3}(9x-6)-(x-2)=3x-2-x+2$
$=2x$

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

70. 8 (↓ 8) more than (↓ +) triple a number (↓ $3x$)

72. eleven (↓ 11) increased by (↓ +) two-thirds of a number (↓ $\frac{2}{3}x$)

74. 9 times a number (↓ $9x$) subtract (↓ −) 3 times a number and 10 (↓ $(3x+10)$)
$9x-(3x+10)=9x-3x-10=6x-10$

76.

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

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

78.

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

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

80.

the product of a number and 10	less	20
↓	↓	↓
$10x$	−	20

82.

twice a number	added to	−1	added to	5 times a number	added to	−12
↓	↓	↓	↓	↓	↓	↓
$2x$	+	−1	+	$5x$	+	−12

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

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

86.
$$\begin{aligned} x^3 - x^2 + 4 &= (-3)^3 - (-3)^2 + 4 \\ &= -27 - 9 + 4 \\ &= -32 \end{aligned}$$

88.
$$\begin{aligned} x^3 - x^2 - x &= (-2)^3 - (-2)^2 - (-2) \\ &= -8 - 4 + 2 \\ &= -10 \end{aligned}$$

90.
$$\begin{aligned} 5 + (3x - 1) + (2x + 5) &= 5 + 3x - 1 + 2x + 5 \\ &= 5x + 9 \end{aligned}$$

The perimeter is $(5x + 9)$ centimeters.

92.
$$\begin{aligned} 2 \text{ cylinders} &\stackrel{?}{=} 3 \text{ cubes} \\ 2 \text{ cubes} + 2 \text{ cubes} &\stackrel{?}{=} 3 \text{ cubes} \\ 4 \text{ cubes} &= 3 \text{ cubes: Not balanced} \end{aligned}$$

94.
$$\begin{aligned} 1 \text{ cylinder} &\stackrel{?}{=} 1 \text{ cone} + 1 \text{ cube} \\ 2 \text{ cubes} &\stackrel{?}{=} 1 \text{ cube} + 1 \text{ cube} \\ 2 \text{ cubes} &= 2 \text{ cubes: Balanced} \end{aligned}$$

96. Answers may vary

98. $5x+10(3x)+25(30x-1)=5x+30x+750x-25$
$=785x-25$
The total value is $(785x-25)¢$.

100. $4m^4p^2+m^4p^2-5m^2p^4=5m^4p^2-5m^2p^4$

102. $9y^2-(6xy^2-5y^2)-8xy^2$
$=9y^2-6xy^2+5y^2-8xy^2$
$=14y^2-14xy^2$

104. $-(7c^3d-8c)-5c-4c^3d$
$=-7c^3d+8c-5c-4c^3d$
$=-11c^3d+3c$

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. $8x-5x-3+9=x+x+3-7$
$3x+6=2x-4$
$3x+6-2x=2x-4-2x$
$x+6=-4$
$x+6-6=-4-6$
$x=-10$
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.

4. $2=4(2a-3)-(7a+4)$
$2=4(2a)+4(-3)-7a-4$
$2=8a-12-7a-4$
$2=a-16$
$2+16=a-16+16$
$18=a$
Check by replacing a with 18 in the original equation.

5. $\frac{4}{5}x=16$
$\frac{5}{4}\cdot\frac{4}{5}x=\frac{5}{4}\cdot16$
$\left(\frac{5}{4}\cdot\frac{4}{5}\right)x=\frac{5}{4}\cdot16$
$1x=20$
$x=20$

Check: $\frac{4}{5}x=16$
$\frac{4}{5}\cdot20\stackrel{?}{=}16$
$16=16$
The solution is 20.

6. $8x=-96$
$\frac{8x}{8}=\frac{-96}{8}$
$x=-12$
Check: $8x=-96$
$8(-12)\stackrel{?}{=}-96$
$-96=-96$
The solution is -12.

7. $\frac{x}{5}=13$
$5\cdot\frac{x}{5}=5\cdot13$
$x=65$
Check: $\frac{x}{5}=13$
$\frac{65}{5}\stackrel{?}{=}13$
$13=13$
The solution is 65.

8. $6b-11b=18+2b-6+9$
$-5b=21+2b$
$-5b-2b=21+2b-2b$
$-7b=21$
$\frac{-7b}{-7}=\frac{21}{-7}$
$b=-3$
Check by replacing b with -3 in the original equation. The solution is -3.

9. **a.** The other number is $9-2=7$.

b. The other number is $9-x$.

c. The other piece has length $(9-x)$ feet.

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

Vocabulary and Readiness Check

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

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

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

10. By the multiplication property of equality, $9x=-63$ and $\frac{9x}{9}=\frac{-63}{9}$ are equivalent equations.

11. $3a=27$
$a=\frac{27}{3}=9$

12. $9c=54$
$c=\frac{54}{9}=6$

13. $5b=10$
$b=\frac{10}{5}=2$

14. $7t=14$
$t=\frac{14}{7}=2$

Exercise Set 2.2

2. $x+14=25$
$x+14-14=25-14$
$x=11$
Check: $x+14=25$
$11+14\stackrel{?}{=}25$
$25=25$
The solution is 11.

4. $y-9=1$
$y-9+9=1+9$
$y=10$
Check: $y-9=1$
$10-9\stackrel{?}{=}1$
$1=1$
The solution is 10.

6. $8+z=-8$
$8-8+z=-8-8$
$z=-16$
Check: $8+z=-8$
$8+(-16)\stackrel{?}{=}-8$
$-8=-8$
The solution is -16.

8. $t - 9.2 = -6.8$
$5 - 9.2 + 9.2 = -6.8 + 9.2$
$t = 2.4$
Check: $t - 9.2 = -6.8$
$2.4 - 9.2 \stackrel{?}{=} -6.8$
$-6.8 = -6.8$
The solution is 2.4.

10. $2x = x - 5$
$2x - x = x - x - 5$
$x = -5$
Check: $2x = x - 5$
$2(-5) \stackrel{?}{=} -5 - 5$
$-10 = -10$
The solution is –5.

12. $9x + 5.5 = 10x$
$9x - 9x + 5.5 = 10x - 9x$
$5.5 = x$
Check: $9x + 5.5 = 10x$
$9(5.5) + 5.5 \stackrel{?}{=} 10(5.5)$
$49.5 + 5.5 \stackrel{?}{=} 55$
$55 = 55$
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. $7y + 2 = 6y + 2$
$7y - 6y + 2 = 6y - 6y + 2$
$y + 2 = 2$
$y + 2 - 2 = 2 - 2$
$y = 0$
The solution is 0.

18. $4c + 8 - c = 8 + 2c$
$3c + 8 = 8 + 2c$
$3c - 2c + 8 = 8 + 2c - 2c$
$c + 8 = 8$
$c + 8 - 8 = 8 - 8$
$c = 0$
The solution is 0.

20. $3n + 2n = 7 + 4n$
$5n = 7 + 4n$
$5n - 4n = 7 + 4n - 4n$
$n = 7$
The solution is 7.

22. $10 = 8(3y - 4) - 23y + 20$
$10 = 24y - 32 - 23y + 20$
$10 = y - 12$
$10 + 12 = y - 12 + 12$
$22 = y$
The solution is 22.

24. $-7x = -49$
$\frac{-7x}{-7} = \frac{-49}{-7}$
$x = 7$
The solution is 7.

26. $-2x = 0$
$\frac{-2x}{-2} = \frac{0}{-2}$
$x = 0$
The solution is 0.

28. $-y = 8$
$\frac{-y}{-1} = \frac{8}{-1}$
$y = -8$
The solution is –8.

30. $-y + 4y = 33$
$3y = 33$
$\frac{3y}{3} = \frac{33}{3}$
$y = 11$
The solution is 11.

32. $\frac{3}{4}n = -15$
$\frac{4}{3}\left(\frac{3}{4}n\right) = \frac{4}{3}(-15)$
$n = -20$
The solution is –20.

34. $\frac{1}{8}v = \frac{1}{4}$
$8\left(\frac{1}{8}v\right) = 8\left(\frac{1}{4}\right)$
$v = 2$
The solution is 2.

36.
$$\frac{d}{15}=2$$
$$15\left(\frac{d}{15}\right)=15(2)$$
$$d=30$$
The solution is 30.

38.
$$\frac{f}{-5}=0$$
$$-5\left(\frac{f}{-5}\right)=-5(0)$$
$$f=0$$
The solution is 0.

40. Answers may vary

42.
$$3x-1=26$$
$$3x-1+1=26+1$$
$$3x=27$$
$$\frac{3x}{3}=\frac{27}{3}$$
$$x=9$$
Check:
$$3x-1=26$$
$$3(9)-1\stackrel{?}{=}26$$
$$27-1\stackrel{?}{=}26$$
$$26=26$$
The solution is 9.

44.
$$-x+4=-24$$
$$-x+4-4=-24-4$$
$$-x=-28$$
$$x=28$$
Check:
$$-x+4=-24$$
$$-(28)+4\stackrel{?}{=}-24$$
$$-28+4\stackrel{?}{=}-24$$
$$-24=-24$$
The solution is 28.

46.
$$8t+5=5$$
$$8t+5-5=5-5$$
$$8t=0$$
$$\frac{8t}{8}=\frac{0}{8}$$
$$t=0$$
Check:
$$8t+5=5$$
$$8(0)+5\stackrel{?}{=}5$$
$$0+5\stackrel{?}{=}5$$
$$5=5$$
The solution is 0.

48.
$$-10y+15=5$$
$$-10y+15-15=5-15$$
$$-10y=-10$$
$$\frac{-10y}{-10}=\frac{-10}{-10}$$
$$y=1$$
Check:
$$-10y+15=5$$
$$-10\cdot1+15\stackrel{?}{=}5$$
$$-10+15\stackrel{?}{=}5$$
$$5=5$$
The solution is 1.

50.
$$2+0.4p=2$$
$$2-2+0.4p=2-2$$
$$0.4p=0$$
$$\frac{0.4p}{0.4}=\frac{0}{0.4}$$
$$p=0$$
Check:
$$2+0.4p=2$$
$$2+0.4\cdot0\stackrel{?}{=}2$$
$$2+0\stackrel{?}{=}2$$
$$2=2$$
The solution is 0.

52.
$$-3n-\frac{1}{3}=\frac{8}{3}$$
$$-3n-\frac{1}{3}+\frac{1}{3}=\frac{8}{3}+\frac{1}{3}$$
$$-3n=\frac{9}{3}$$
$$-3n=3$$
$$\frac{-3n}{-3}=\frac{3}{-3}$$
$$n=-1$$
Check:
$$-3n-\frac{1}{3}=\frac{8}{3}$$
$$-3(-1)-\frac{1}{3}\stackrel{?}{=}\frac{8}{3}$$
$$3-\frac{1}{3}\stackrel{?}{=}\frac{8}{3}$$
$$\frac{9}{3}-\frac{1}{3}\stackrel{?}{=}\frac{8}{3}$$
$$\frac{8}{3}=\frac{8}{3}$$
The solution is -1.

54. $\frac{b}{4}-1=-7$

$\frac{b}{4}-1+1=-7+1$

$\frac{b}{4}=-6$

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

$b=-24$

Check: $\frac{b}{4}-1=-7$

$\frac{-24}{4}-1 \stackrel{?}{=} -7$

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

$-7=-7$

The solution is -24.

56. $12=3j-4$

$12+4=3j-4+4$

$16=3j$

$\frac{16}{3}=\frac{3j}{3}$

$\frac{16}{3}=j$

Check: $12=3j-4$

$12 \stackrel{?}{=} 3\cdot\frac{16}{3}-4$

$12 \stackrel{?}{=} 16-4$

$12=12$

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

58. $4a+1+a-11=0$

$5a-10=0$

$5a-10+10=0+10$

$5a=10$

$\frac{5a}{5}=\frac{10}{5}$

$a=2$

Check: $4a+1+a-11=0$

$4\cdot 2+1+2-11 \stackrel{?}{=} 0$

$8+1+2-11 \stackrel{?}{=} 0$

$0=0$

The solution is 2.

60. $12x+30+8x-6=10$

$20x+24=10$

$20x+24-24=10-24$

$20x=-14$

$\frac{20x}{20}=\frac{-14}{20}$

$x=-\frac{7}{10}$

Check: $12x+30+8x-6=10$

$12\left(-\frac{7}{10}\right)+30+8\left(-\frac{7}{10}\right)-6 \stackrel{?}{=} 10$

$-\frac{84}{10}+24-\frac{56}{10} \stackrel{?}{=} 10$

$-\frac{140}{10}+24 \stackrel{?}{=} 10$

$-14+24 \stackrel{?}{=} 10$

$10=10$

The solution is $-\frac{7}{10}$.

62. $-\frac{3}{4}x=9$

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

$x=-12$

Check: $-\frac{3}{4}x=9$

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

$9=9$

The solution is -12.

64. $19=0.4x-0.9x-6$

$19=-0.5x-6$

$19+6=-0.5x-6+6$

$25=-0.5x$

$\frac{25}{-0.5}=\frac{-0.5x}{-0.5}$

$-50=x$

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.

66. $t-6t=-13+t-3t$

$-5t=-2t-13$

$-5t+2t=-2t+2t-13$

$-3t=-13$

$\frac{-3t}{-3}=\frac{-13}{-3}$

$t=\frac{13}{3}$

Check: $t-6t=-13+t-3t$

$\frac{13}{3}-6\cdot\frac{13}{3}\stackrel{?}{=}-13+\frac{13}{3}-3\cdot\frac{13}{3}$

$\frac{13}{3}-\frac{78}{3}\stackrel{?}{=}-\frac{39}{3}+\frac{13}{3}-\frac{39}{3}$

$-\frac{65}{3}=-\frac{65}{3}$

The solution is $\frac{13}{3}$.

68. $0.4x-0.9x-6=19$

$-0.5x-6=19$

$-0.5x-6+6=19+6$

$-0.5x=25$

$\frac{-0.5x}{-0.5}=\frac{25}{-0.5}$

$x=-50$

Check: $0.4x-0.9x-6=19$

$0.4(-50)-0.9(-50)-6\stackrel{?}{=}19$

$-20+45-6\stackrel{?}{=}19$

$19=19$

The solution is −50.

70. $-5-6y+6=19$

$-6y+1=19$

$-6y+1-1=19-1$

$-6y=18$

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

$y=-3$

Check: $-5-6y+6=19$

$-5-6(-3)+6\stackrel{?}{=}19$

$-5+18+6\stackrel{?}{=}19$

$19=19$

The solution is −3.

72. $4b-8-b=10b-3b$

$3b-8=7b$

$3b-3b-8=7b-3b$

$-8=4b$

$\frac{-8}{4}=\frac{4b}{4}$

$-2=b$

Check: $4b-8-b=10b-3b$

$4(-2)-8-(-2)\stackrel{?}{=}10(-2)-3(-2)$

$-8-8+2\stackrel{?}{=}-20+6$

$-14=-14$

The solution is −2.

74. $-3=-5(4x+3)+21x$

$-3=-20x-15+21x$

$-3=x-15$

$-3+15=x-15+15$

$12=x$

Check: $-3=-5(4x+3)+21x$

$-3\stackrel{?}{=}-5(4\cdot12+3)+21\cdot12$

$-3\stackrel{?}{=}-5(48+3)+252$

$-3\stackrel{?}{=}-5(51)+252$

$-3\stackrel{?}{=}-255+252$

$-3=-3$

The solution is 12.

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

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

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

82. The length of the computer desk is $\left(m+1\frac{1}{2}\right)$ feet.

84. The length of I-90 is $(m+178.5)$ miles.

86. Susan received $(n+30{,}898)$ votes.

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

90. Sum = first integer + second integer + third integer + fourth integer.

$\text{Sum}=x+(x+2)+(x+4)+(x+6)$

$=x+x+2+x+4+x+6$

$=4x+12$

92. Sum = 20 + second integer.
$\text{Sum} = 20 + (x+1)$
$= 20 + x + 1$
$= x + 21$

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

96. $-7y + 2y - 3(y+1) = -7y + 2y - 3y - 3 = -8y - 3$

98. $-(3a - 3) + 2a - 6 = -3a + 3 + 2a - 6 = -a - 3$

100. $(-2)^4 = (-2)(-2)(-2)(-2) = 16$
$-2^4 = -2 \cdot 2 \cdot 2 \cdot 2 = -16$
$(-2)^4 > -2^4$

102. $(-4)^3 = (-4)(-4)(-4) = -64$
$-4^3 = -4 \cdot 4 \cdot 4 = -64$
$(-4)^3 = -4^3$

104. $360 - (x + 3x + 5x) = 360 - (9x) = 360 - 9x$
The fourth angle is $(360 - 9x)°$.

106. Answers may vary

108.
$$a + 9 = 15$$
$$a + 9 + (-9) = 15 + (-9)$$
$$a = 6$$
The answer is –9.

110. Answers may vary

112. Answers may vary

114.
$$\frac{x}{2} = 10$$
$$\frac{x}{2} \cdot \frac{1}{2} = 10$$
$$\frac{x}{2} \cdot \frac{1}{2} \cdot 2 = 10 \cdot 2$$
$$\frac{x}{2} = 20$$

116.
$$9x = 13.5$$
$$\frac{9x}{9} = \frac{13.5}{9}$$
$$x = 1.5$$
Each dose should be 1.5 milliliters.

118. Check $a = 6.3$.
$$3(a + 4.6) = 5a + 2.5$$
$$3(6.3 + 4.6) \stackrel{?}{=} 5(6.3) + 2.5$$
$$3(10.9) \stackrel{?}{=} 31.5 + 2.5$$
$$32.7 = 34$$
Not a solution

120.
$$4.95y = -31.185$$
$$\frac{4.95y}{4.95} = \frac{-31.185}{4.95}$$
$$y = -6.3$$

122.
$$0.06y + 2.63 = 2.5562$$
$$0.06y + 2.63 - 2.63 = 2.5562 - 2.63$$
$$0.06y = -0.0738$$
$$\frac{0.06y}{0.06} = \frac{-0.0738}{0.06}$$
$$y = -1.23$$

Section 2.3

Practice Exercises

1.
$$2(4a - 9) + 3 = 5a - 6$$
$$8a - 18 + 3 = 5a - 6$$
$$8a - 15 = 5a - 6$$
$$8a - 15 - 5a = 5a - 6 - 5a$$
$$3a - 15 = -6$$
$$3a - 15 + 15 = -6 + 15$$
$$3a = 9$$
$$\frac{3a}{3} = \frac{9}{3}$$
$$a = 3$$
Check: $2(4a - 9) + 3 = 5a - 6$
$$2[4(3) - 9] + 3 \stackrel{?}{=} 5(3) - 6$$
$$2(12 - 9) + 3 \stackrel{?}{=} 15 - 6$$
$$2(3) + 3 \stackrel{?}{=} 9$$
$$6 + 3 \stackrel{?}{=} 9$$
$$9 = 1$$
The solution is 3 or the solution set is {3}.

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

Check: $7(x-3) = -6x$

$$7\left(\frac{21}{13}-3\right) \stackrel{?}{=} -6\left(\frac{21}{13}\right)$$

$$7\left(\frac{21}{13}-\frac{39}{13}\right) \stackrel{?}{=} -\frac{126}{13}$$

$$7\left(-\frac{18}{13}\right) \stackrel{?}{=} -\frac{126}{13}$$

$$-\frac{126}{13} = -\frac{126}{13}$$

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

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

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

$$\frac{3}{5}\cdot -15-2 \stackrel{?}{=} \frac{2}{3}\cdot -15-1$$
$$-9-2 \stackrel{?}{=} -10-1$$
$$-11 = -11$$

The solution is −15.

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

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

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

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

6.
$$4(x+4)-x = 2(x+11)+x$$
$$4x+16-x = 2x+22+x$$
$$3x+16 = 3x+22$$
$$3x+16-3x = 3x+22-3x$$
$$16 = 22$$

There is no solution.

7.
$$12x-18 = 9(x-2)+3x$$
$$12x-18 = 9x-18+3x$$
$$12x-18 = 12x-18$$
$$12x-18+18 = 12x-18+18$$
$$12x = 12x$$
$$12x-12x = 12x-12x$$
$$0 = 0$$

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 ≠ −60.1)

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

6. Solution (−316 = −316)

Vocabulary and Readiness Check

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.

Exercise Set 2.3

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

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

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

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

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

30.
$$14x+7=7(2x+1)$$
$$14x+7=14x+7$$
$$14x+7-14x=14x+7-14x$$
$$7=7$$
All real numbers are solutions.

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

34.
$$2(x-5)=2x+10$$
$$2x-10=2x+10$$
$$2x-2x-10=2x-2x+10$$
$$-10=10$$
There is no solution.

36.
$$-5(4y-3)+2=-20y+17$$
$$-20y+15+2=-20y+17$$
$$-20y+17=-20y+17$$
$$-20y+17+20y=-20y+17+20y$$
$$17=17$$
All real numbers are solutions.

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

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

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

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

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

48. $3(2x-1)+5=6x+2$
$6x-3+5=6x+2$
$6x+2=6x+2$
$6x-6x+2=6x-6x+2$
$2=2$
All real numbers are solutions.

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

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

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

56. $4(2+x)+1=7x-3(x-2)$
$8+4x+1=7x-3x+6$
$9+4x=4x+6$
$9+4x-4x=4x-4x+6$
$9=6$
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.

3	times	a number	
↓	↓	↓	
3	·	x	$= 3x$

70.

8	minus	twice a number	
↓	↓	↓	
8	−	$2x$	

72.

the quotient of -12	and	the difference of a number and 3	
↓	↓	↓	
-12	÷	$(x-3)$	$= \frac{-12}{x-3}$

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

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

The Bigger Picture

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

2.
$$\begin{aligned} 5+2x &= 5(x+1) \\ 5+2x &= 5x+5 \\ 5+2x-5x &= 5x+5-5x \\ 5-3x &= 5 \\ 5-3x-5 &= 5-5 \\ -3x &= 0 \\ \frac{-3x}{-3} &= \frac{0}{-3} \\ x &= 0 \end{aligned}$$

3. $\dfrac{x+3}{2}=1$

$2\left(\dfrac{x+3}{2}\right)=2(1)$

$x+3=2$

$x+3-3=2-3$

$x=-1$

4. $\dfrac{x-2}{2}-\dfrac{x-4}{3}=\dfrac{5}{6}$

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

$3(x-2)-2(x-4)=5$

$3x-6-2x+8=5$

$x+2=5$

$x+2-2=5-2$

$x=3$

5. $\dfrac{7}{5}+\dfrac{y}{10}=2$

$10\left(\dfrac{7}{5}+\dfrac{y}{10}\right)=10(2)$

$2(7)+y=20$

$14+y=20$

$14+y-14=20-14$

$y=6$

6. $5+2x=2(x+1)$

$5+2x=2x+2$

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

$5=2$ False

This false statement indicates that there is no solution.

7. $4(x-2)+3x=9(x-1)-2$

$4x-8+3x=9x-9-2$

$7x-8=9x-11$

$7x-8-9x=9x-11-9x$

$-2x-8=-11$

$-2x-8+8=-11+8$

$-2x=-3$

$\dfrac{-2x}{-2}=\dfrac{-3}{-2}$

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

8. $6(x+1)-2=6x+4$

$6x+6-2=6x+4$

$6x+4=6x+4$

$6x+4-6x=6x+4-6x$

$4=4$ True

This true statement indicates that all real numbers are solutions of the equation.

Integrated Review

1. $x-10=-4$

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

$x=6$

2. $y+14=-3$

$y+14-14=-3-14$

$y=-17$

3. $9y=108$

$\dfrac{9y}{9}=\dfrac{108}{9}$

$y=12$

4. $-3x=78$

$\dfrac{-3x}{-3}=\dfrac{78}{-3}$

$x=-26$

5. $-6x+7=25$

$-6x+7-7=25-7$

$-6x=18$

$\dfrac{-6x}{-6}=\dfrac{18}{-6}$

$x=-3$

6. $5y-42=-47$

$5y-42+42=-47+42$

$5y=-5$

$\dfrac{5y}{5}=\dfrac{-5}{5}$

$y=-1$

7. $\dfrac{2}{3}x=9$

$\dfrac{3}{2}\left(\dfrac{2}{3}x\right)=\dfrac{3}{2}(9)$

$x=\dfrac{27}{2}$

8. $\frac{4}{5}z = 10$

$\frac{5}{4}\left(\frac{4}{5}z\right) = \frac{5}{4}(10)$

$z = \frac{25}{2}$

9. $\frac{r}{-4} = -2$

$-4\left(\frac{r}{-4}\right) = -4(-2)$

$r = 8$

10. $\frac{y}{-8} = 8$

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

$y = -64$

11. $6 - 2x + 8 = 10$

$-2x + 14 = 10$

$-2x + 14 - 14 = 10 - 14$

$-2x = -4$

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

$x = 2$

12. $-5 - 6y + 6 = 19$

$-6y + 1 = 19$

$-6y + 1 - 1 = 19 - 1$

$-6y = 18$

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

$y = -3$

13. $2x - 7 = 2x - 27$

$2x - 2x - 7 = 2x - 2x - 27$

$-7 = -27$

There is no solution.

14. $3 + 8y = 8y - 2$

$3 + 8y - 8y = 8y - 8y - 2$

$3 = -2$

There is no solution.

15. $-3a + 6 + 5a = 7a - 8a$

$2a + 6 = -a$

$2a - 2a + 6 = -a - 2a$

$6 = -3a$

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

$-2 = a$

16. $4b - 8 - b = 10b - 3b$

$3b - 8 = 7b$

$3b - 3b - 8 = 7b - 3b$

$-8 = 4b$

$\frac{-8}{4} = \frac{4b}{4}$

$-2 = b$

17. $-\frac{2}{3}x = \frac{5}{9}$

$-\frac{3}{2}\left(-\frac{2}{3}x\right) = -\frac{3}{2}\left(\frac{5}{9}\right)$

$x = -\frac{5}{6}$

18. $-\frac{3}{8}y = -\frac{1}{16}$

$-\frac{8}{3}\left(-\frac{3}{8}y\right) = -\frac{8}{3}\left(-\frac{1}{16}\right)$

$y = \frac{1}{6}$

19. $10 = -6n + 16$

$10 - 16 = -6n + 16 - 16$

$-6 = -6n$

$\frac{-6}{-6} = \frac{-6n}{-6}$

$1 = n$

20. $-5 = -2m + 7$

$-5 - 7 = -2m + 7 - 7$

$-12 = -2m$

$\frac{-12}{-2} = \frac{-2m}{-2}$

$6 = m$

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

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

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

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

25. $-2(2x-5)=-3x+7-x+3$
$-4x+10=-4x+10$
$-4x+4x+10=-4x+4x+10$
$10=10$
All real numbers are solutions.

26. $-4(5x-2)=-12x+4-8x+4$
$-20x+8=-20x+8$
$-20x+20x+8=-20x+20x+8$
$8=8$
All real numbers are solutions.

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

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

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

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

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

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

33.
$$\frac{1}{10}(3x - 7) = \frac{3}{10}x + 5$$
$$10\left[\frac{1}{10}(3x - 7)\right] = 10\left(\frac{3}{10}x + 5\right)$$
$$3x - 7 = 3x + 50$$
$$3x - 7 - 3x = 3x + 50 - 3x$$
$$-7 = 50$$
There is no solution.

34.
$$\frac{1}{7}(2x - 5) = \frac{2}{7}x + 1$$
$$7\left[\frac{1}{7}(2x - 5)\right] = 7\left(\frac{2}{7}x + 1\right)$$
$$2x - 5 = 2x + 7$$
$$2x - 5 - 2x = 2x + 7 - 2x$$
$$-5 = 7$$
There is no solution.

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

36.
$$3 + 5(2x - 4) = -7(5x + 2)$$
$$3 + 10x - 20 = -35x - 14$$
$$10x - 17 = -35x - 14$$
$$10x - 17 + 35x = -35x - 14 + 35x$$
$$45x - 17 = -14$$
$$45x - 17 + 17 = -14 + 17$$
$$45x = 3$$
$$\frac{45x}{45} = \frac{3}{45}$$
$$x = \frac{1}{15}$$

Section 2.4

Practice Exercises

1. Let x = the number.
$$3x - 6 = 2x + 3$$
$$3x - 6 - 2x = 2x + 3 - 2x$$
$$x - 6 = 3$$
$$x - 6 + 6 = 3 + 6$$
$$x = 9$$
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 Republicans, then
$x + 6$ = number of Democrats.

$$\begin{aligned} x+x+6 &= 50 \\ 2x+6 &= 50 \\ 2x+6-6 &= 50-6 \\ 2x &= 44 \\ \frac{2x}{2} &= \frac{44}{2} \\ x &= 22 \end{aligned}$$

$x + 6 = 22 + 6 = 28$

There were 22 Republican and 28 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 and Readiness Check

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 $(-10 + y) \div 9$

Exercise Set 2.4

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.

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

The number is −5.

8. Let x = the number.

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

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

10. Let x = length of shorter piece,
then $5x + 1$ = length of longer piece.

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

$5x + 1 = 5(4) + 1 = 21$
The shorter piece is 4 feet and the longer piece is 21 feet.

12. Let x = area of Gobi Desert,
then $7x$ = area of Sahara Desert.

$$x + 7x = 4,000,000$$
$$8x = 4,000,000$$
$$\frac{8x}{8} = \frac{4,000,000}{8}$$
$$x = 500,000$$

$7x = 7(500{,}000) = 3{,}500{,}000$
The area of the Gobi Desert is 500,000 square miles, and the area of the Sahara Desert is 3,500,000 miles.

14. Let x = number of television stations in China,
then $x + 4066$ = number of television stations in Russia.

$$x + x + 4066 = 10,546$$
$$2x + 4066 = 10,546$$
$$2x + 4066 - 4066 = 10,546 - 4066$$
$$2x = 6480$$
$$\frac{2x}{2} = \frac{6480}{2}$$
$$x = 3240$$

$x + 4066 = 3240 + 4066 = 7306$
China has 3240 television stations and Russia has 7306.

16. Let x = the measure of angles B and C, and $x - 42$ = the measure of A.

$$x + x + x - 42 = 180$$
$$3x - 42 = 180$$
$$3x - 42 + 42 = 180 + 42$$
$$3x = 222$$
$$\frac{3x}{3} = \frac{222}{3}$$
$$x = 74$$

$x - 42 = 74 - 42 = 32$
The angles are $B = 74°$, $C = 74°$, and $A = 32°$.

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.

$$x + 3x + (2 + 7x) = 46$$
$$11x + 2 = 46$$
$$11x + 2 - 2 = 46 - 2$$
$$11x = 44$$
$$\frac{11x}{11} = \frac{44}{11}$$
$$x = 4$$

$3x = 3(4) = 12$
$2 + 7x = 2 + 7(4) = 30$
The lengths of the pieces are 4 feet, 12 feet, and 30 feet.

32. 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 $\frac{19}{2}$.

34. 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.

36. 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°.

38. 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.

40. Let x = the number.

$$2(x + 6) = 3(x + 4)$$
$$2x + 12 = 3x + 12$$
$$2x + 12 - 12 = 3x + 12 - 12$$
$$2x = 3x$$
$$2x - 2x = 3x - 2x$$
$$0 = x$$

The number is 0.

42. Let x = votes for Zanzi,
then $x + 35{,}650$ = votes for Bishop.

$$\begin{aligned} x + x + 35{,}650 &= 158{,}192 \\ 2x + 35{,}650 &= 158{,}192 \\ 2x + 35{,}650 - 35{,}650 &= 158{,}192 - 35{,}650 \\ 2x &= 122{,}542 \\ \frac{2x}{2} &= \frac{122{,}542}{2} \\ x &= 61{,}271 \end{aligned}$$

$x + 35{,}650 = 61{,}271 + 35{,}650 = 96{,}921$
Zanzi received 61,271 votes and Bishop received 96,921 votes.

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. 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 $-\frac{5}{4}$.

48. Let x = the measure of each of the two equal angles A and D,
and $2x$ = the measure of each of the other two equal angles C and B.

$$\begin{aligned} x + x + 2x + 2x &= 360 \\ 6x &= 360 \\ \frac{6x}{6} &= \frac{360}{6} \\ x &= 60 \end{aligned}$$

$2x = 2(60) = 120$
The angles are $A = 60°$, $D = 60°$, $C = 120°$, $B = 120°$.

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 = points for Michigan,
and $x + 14$ = points for USC.

$$\begin{aligned} x + (x + 14) &= 50 \\ 2x + 14 &= 50 \\ 2x + 14 - 14 &= 50 - 14 \\ 2x &= 36 \\ \frac{2x}{2} &= \frac{36}{2} \\ x &= 18 \end{aligned}$$

$x + 14 = 18 + 14 = 32$
Michigan scored 18 points and USC scored 32 points.

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

$$x + 4x + 4x = 180$$
$$9x = 180$$
$$\frac{9x}{9} = \frac{180}{9}$$
$$x = 20$$

$4x = 4(20) = 80$

The angles measure 20°, 80°, and 80°.

60. Let x = length of first piece,
then $4x$ = length of second piece,
and $5x$ = length of third piece.

$$x + 4x + 5x = 30$$
$$10x = 30$$
$$\frac{10x}{10} = \frac{30}{10}$$
$$x = 3$$

$4x = 4(3) = 12$

$5x = 5(3) = 15$

The first piece is 3 feet, the second piece is 12 feet, and the third piece is 15 feet.

62. The heights of the bars representing Texas and Pennsylvania are between 30 and 40. Therefore, Texas and Pennsylvania spend between \$30 million and \$40 million on tourism.

64. Let x = amount spent by Pennsylvania,
then $2x - 14.2$ = amount spent by Hawaii.

$$x + (2x - 14.2) = 91.1$$
$$3x - 14.2 = 91.1$$
$$3x - 14.2 + 14.2 = 91.1 + 14.2$$
$$3x = 105.3$$
$$\frac{3x}{3} = \frac{105.3}{3}$$
$$x = 35.1$$

$2x - 14.2 = 2(35.1) - 14.2 = 56$

Pennsylvania spends \$35.1 million and Hawaii spends \$56 million.

66. Answers may vary.

68. $\frac{1}{2}Bh = \frac{1}{2}(14)(22) = 7 \cdot 22 = 154$

70. $r \cdot t = 15 \cdot 2 = 30$

72. Answers may vary

Section 2.5

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. $A = \frac{1}{2}a(b + B)$

$$2 \cdot A = 2 \cdot \frac{1}{2}a(b + B)$$

$$2A = a(b + B)$$

$$2A = ab + aB$$

$$2A - ab = ab + aB - ab$$

$$2A - ab = aB$$

$$\frac{2A - ab}{a} = \frac{aB}{a}$$

$$\frac{2A - ab}{a} = B \text{ or } B = \frac{2A - ab}{a}$$

Exercise Set 2.5

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 $h = 5$.

$$V = \frac{1}{3}Ah$$

$$45 = \frac{1}{3}A(5)$$

$$3(45) = 3\left[\frac{1}{3}(5A)\right]$$

$$135 = 5A$$

$$\frac{135}{5} = \frac{5A}{5}$$

$$27 = A$$

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. a. $A = \frac{1}{2}bh$ $\qquad P = l_1 + l_2 + l_3$

$A = \frac{1}{2} \cdot 36 \cdot 27$ $\qquad P = 27 + 36 + 45$

$A = 486$ $\qquad P = 108$

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.

32. 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.

34. Let $A = 52{,}400$ and $l = 400$.

$$A = lw$$

$$52{,}400 = 400w$$

$$\frac{52{,}400}{400} = \frac{400w}{400}$$

$$131 = w$$

The width is 131 feet.

36. Let $C = -5$.

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

The equivalent temperature is 23°F.

38. Let $d = 303$ and $t = 8\frac{1}{2}$.

$$d = rt$$

$$303 = r\left(8\frac{1}{2}\right)$$

$$303 = \frac{17}{2}r$$

$$2(303) = 2\left(\frac{17}{2}r\right)$$

$$606 = 17r$$

$$\frac{606}{17} = \frac{17r}{17}$$

$$\frac{606}{17} = r$$

$$r = \frac{606}{17} = 35\frac{11}{17}$$

The average rate was $35\frac{11}{17}$ mph.

40. 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.

42. 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.

44. 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.

46. 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.

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

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

The height is 8 feet.

50. 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.

52.

$$\begin{aligned} x + (2x-8) + (3x-12) &= 82 \\ 6x - 20 &= 82 \\ 6x - 20 + 20 &= 82 + 20 \\ 6x &= 102 \\ \frac{6x}{6} &= \frac{102}{6} \\ x &= 17 \end{aligned}$$

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

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

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

54. Let $d = 6$ and $r = 0.5$.

$$\begin{aligned} d &= rt \\ 6 &= 0.5t \\ \frac{6}{0.5} &= \frac{0.5t}{0.5} \\ \frac{6}{0.5} &= t \\ 12 &= t \end{aligned}$$

It took about 12 hours.

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

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

$2x - 15 = 2(22.5) - 15 = 45 - 15 = 30$
The side of the triangle is 30 units and the side of the square is 22.5 units.

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

$$\begin{aligned} d &= rt \\ 150 &= 45t \\ \frac{150}{45} &= \frac{45t}{45} \\ \frac{150}{45} &= t \\ t &= \frac{150}{45} = \frac{10}{3} \end{aligned}$$

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.

60. Let $F = 78$.

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

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

62. 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

64. Let $d = 2810$ and $r = 105$.

$$\begin{aligned} d &= rt \\ 2810 &= 105t \\ \frac{2810}{105} &= \frac{105t}{105} \\ \frac{2810}{105} &= t \\ t &= \frac{2810}{105} \approx 26.8 \end{aligned}$$

The trip will take 26.8 hours.

66. Let $\pi \approx 3.14$ and $d = 30$ so $r = 15$.

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

The volume is 14,130 cubic inches.

68. Let $F = -227$.

$$\begin{aligned} C &= \frac{5}{9}(F-32) \\ C &= \frac{5}{9}(-227-32) \approx -144 \end{aligned}$$

The equivalent temperature is −144°C.

70. Half the product of a number and five is $\frac{1}{2}(5x)$.

72. Double the sum of ten and four times a number is $2(10 + 4x)$.

74. A number minus the sum of the number and six is $x - (x + 6)$.

76. $\diamondsuit \cdot \square + \triangle = \bigcirc$

$$\begin{aligned} \diamondsuit \cdot \square &= \bigcirc - \triangle \\ \square &= \frac{\bigcirc - \triangle}{\diamondsuit} \end{aligned}$$

78. Let $F = 50{,}000$.

$$\begin{aligned} C &= \frac{5}{9}(F-32) \\ C &= \frac{5}{9}(50{,}000-32) = 27{,}760 \end{aligned}$$

The equivalent temperature is 27,760°C.

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

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

It will take 1.3 seconds.

82. $20\ \dfrac{\text{miles}}{\text{hour}}$

$$= 20\ \frac{\text{miles}}{\text{hour}}\left(\frac{5280\text{ feet}}{1\text{ mile}}\right)\left(\frac{1\text{ hour}}{3600\text{ seconds}}\right)$$
$$= \frac{88}{3}\text{ feet/second}$$

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.

84. Let $C = F$.

$$F = \frac{9}{5}C + 32$$
$$F = \frac{9}{5}F + 32$$
$$F - \frac{9}{5}F = \frac{9}{5}F - \frac{9}{5}F + 32$$
$$-\frac{4}{5}F = 32$$
$$-\frac{5}{4}\left(-\frac{4}{5}F\right) = -\frac{5}{4}(32)$$
$$F = -40$$

The measurements are the same number at –40°.

86. The original box has a volume $V = LWH$.
The altered box, has a length $2L$, a width $2W$, a height $2H$ and a new volume
$V = 2L(2W)(2H) = 8LWH$.
The volume is multiplied by 8.

Section 2.6

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, 4% of trips made by American travelers are for combined business/pleasure.

b. From the circle graph,
17% + 66% + 4% = 87% of trips are for business, pleasure, or combined business/pleasure.

c. Since 4% are trips for business/pleasure, find 4% of 325.
$0.04 \cdot 325 = 13$
We can expect 13 of the Americans to be traveling for business/pleasure.

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 = 299,800 – 198,900 = 100,900
Let x = percent increase.

$$100{,}900 = x \cdot 198{,}900$$
$$\frac{100{,}900}{198{,}900} = \frac{198{,}900x}{198{,}900}$$
$$0.507 \approx x$$

The percent increase is 50.7%.

6. Let x = number of new films in 2004.

$$x + 0.028x = 535$$
$$1.028x = 535$$
$$\frac{1.028x}{1.028} = \frac{535}{1.028}$$
$$x \approx 520$$

There were 520 new feature films released in 2004.

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%	$0.03(6)$

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

$6 - x = 6 - 4 = 2$

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

Vocabulary and Readiness Check

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%.

Exercise Set 2.6

2. Let x = the number.

$x = 88\% \cdot 1000$
$x = 0.88 \cdot 1000$
$x = 880$

880 is 88% of 1000.

4. Let x = the percent.

$$87.2 = x \cdot 436$$
$$\frac{87.2}{436} = \frac{436x}{436}$$
$$0.2 = x$$

87.2 is 20% of 436.

6. Let x = the number.

$$126 = 35\% \cdot x$$
$$126 = 0.35x$$
$$\frac{126}{0.35} = \frac{0.35x}{0.35}$$
$$360 = x$$

126 is 35% of 360.

8. Exports = 19%
Not Exports = 100% − 19% = 81%
81% of corn production is not used for exports.

10. 12% of 10,535 = 0.12 · 10,535 = 1264.2
1264.2 million bushels or 1,264,200,000 bushels were used for food, seed, or other.

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. Increase = 22,200 − 19,000 = 3200
Let x = percent.

$$3200 = x \cdot 19{,}000$$
$$\frac{3200}{19{,}000} = \frac{19{,}000x}{19{,}000}$$
$$17 \approx x$$

The percent increase is 17%.

18. Decrease = 100 − 81 = 11
Let x = percent.

$$11 = x \cdot 100$$
$$\frac{11}{100} = \frac{100x}{100}$$
$$0.11 = x$$

The percent 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.

$$\text{No. of cu cm} \cdot \text{Strength} = \text{Amt. of Antibiotic}$$

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 65. Therefore, 65% of the population in Charlottesville, Virginia, shop by catalog.

36. 81% of 30,987 = $0.81 \cdot 30{,}987 \approx 25{,}099$
We predict 25,099 catalog shoppers live in Juneau.

38.

Kraft Foods North America Volume Food Produced in a Year		
Food Group	*Volume (in pounds)*	*Percent (Round to Nearest Percent)*
Cheese, Meals, and Enhancers	6183	$\frac{6183}{13{,}741} \approx 45\%$
Biscuits, Snacks, and Confectionaries	2083	Example: $\frac{2083}{13{,}741} \approx 15\%$
Beverages, Desserts, and Cereals	3905	$\frac{3905}{13{,}741} \approx 28\%$
Oscar Mayer and Pizza	1570	$\frac{1570}{13{,}741} \approx 11\%$
Total	13,741	99% due to rounding
Source: Kraft Foods, North America		

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. Decrease $= 25.6 - 22.4 = 3.2$
Let x = the percent.
$$3.2 = x \cdot 25.6$$
$$\frac{3.2}{25.6} = \frac{25.6x}{25.6}$$
$$0.125 = x$$
The percent decrease is 12.5%.

44. Let x = amount produced in 2007, and $0.44x$ = amount of increase.
$$x + 0.44x = 10{,}800$$
$$1.44x = 10{,}800$$
$$\frac{1.44x}{1.44} = \frac{10{,}800}{1.44}$$
$$x = 7500$$
There were 7500 million gallons produced in 2007.

46. Let x = the gallons of water.
No. of Gal. · Strength = Amt. of Antifreeze

Water	x	0	0
70%	30	0.7	0.7(30)
60%	$x + 30$	0.6	$0.6(x + 30)$

$$0.7(30) = 0.6(x + 30)$$
$$21 = 0.6x + 18$$
$$21 - 18 = 0.6x + 18 - 18$$
$$3 = 0.6x$$
$$\frac{3}{0.6} = \frac{0.6x}{0.6}$$
$$5 = x$$
Add 5 gallons of water.

48. Let x = mark-up.
$x = 10\% \cdot 99.90$
$x = 0.1 \cdot 99.9$
$x = 9.99$
New price = 99.90 + 9.99 = 109.89
The mark-up is \$9.99 and the new price is \$109.89.

50. Increase $= 24 - 6 = 18$
Let x = percent.
$$18 = x \cdot 6$$
$$\frac{18}{6} = \frac{6x}{6}$$
$$3 = x$$
The percent increase is 300%.

52. Let x = average in 1920,
then $0.44x$ = decrease.
$$x - 0.44x = 1.9$$
$$0.56x = 1.9$$
$$\frac{0.56x}{0.56} = \frac{1.9}{0.56}$$
$$x \approx 3.4$$
In 1920, there were 3.4 children per woman.

54. Let x = ounces of self-tanning lotion.

	ounces	$ per ounce	$
self-tanning lotion	x	3.00	$3x$
everyday lotion	800	0.30	0.3(800)
experimental lotion	$x + 800$	1.20	$1.2(x + 800)$

$$\begin{aligned} 3x + 0.3(800) &= 1.2(x + 800) \\ 3x + 240 &= 1.2x + 960 \\ 3x + 240 - 1.2x &= 1.2x + 960 - 1.2x \\ 1.8x + 240 &= 960 \\ 1.8x + 240 - 240 &= 960 - 240 \\ 1.8x &= 720 \\ \frac{1.8x}{1.8} &= \frac{720}{1.8} \\ x &= 400 \end{aligned}$$

Therefore, 400 ounces of self-tanning lotion should be mixed.

56. Increase = 444 − 436 = 8
Let x = percent.

$$\begin{aligned} 8 &= x \cdot 436 \\ \frac{8}{436} &= \frac{436x}{436} \\ 0.018 &\approx x \end{aligned}$$

The percent increase is 1.8%.

58. Let x = movie screens in 2000,
then $0.043x$ = increase.

$$\begin{aligned} x + 0.043x &= 37{,}092 \\ \frac{1.043x}{1.043} &= \frac{37{,}092}{1.043} \\ x &\approx 35{,}563 \end{aligned}$$

There were 35,563 movie screens operating in 2000.

60. Let x = increase.

$$\begin{aligned} x &= 80.4\% \cdot 138.56 \\ x &= 0.804 \cdot 138.56 \\ x &\approx 111.40 \end{aligned}$$

His throw = 138.56 + 111.40 ≈ 250
Christian Sandstrom's throw was 250 meters.

62. 64% of 9800 = 0.64 · 9800 = 6272
We would expect 6272 U.S. colleges to have Internet access in their classrooms.

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

66. $-3^3 = (-3)^3$

68. $|-2| = 2$; $-|-2| = -2$
$|-2| > -|-2|$

70. Answers may vary

72. a. Yes; answers may vary

b. No; answers may vary

74. 23 is y percent of 300.
$y(300) = 23$
$$y = \frac{23}{300} \approx 0.077 = 7.7\%$$
This is about 7.7% of the daily value.

76. Let x = percent of calories from fat.
$x(280) = 9(6)$
$$x = \frac{54}{280} \approx 0.193 = 19.3\%$$
19.3% of the calories in one serving are from fat.

78. Answers may vary

Section 2.7

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%.

Exercise Set 2.7

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	$7.2 - x$	$40(7.2 - x)$

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

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

$$20(6x) + 50x = 3910$$
$$120x + 50x = 3910$$
$$170x = 3910$$
$$x = 23$$

$6x = 6(23) = 138$
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

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

$x + 250 = 400 + 250 = 650$
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

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

$2x = 2(8500) = 17{,}000$
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

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

$732 - x = 732 - 276 = 456$
Sales included 276 adult tickets and 456 child tickets.

22. 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	$-0.04(20{,}000 - x)$

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

$20{,}000 - x = 20{,}000 - 5000 = 15{,}000$
She invested \$15,000 at 4% and \$5000 at 12%.

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

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

$$5x + 4x = 20$$
$$9x = 20$$
$$\frac{9x}{9} = \frac{20}{9}$$
$$x = 2\frac{2}{9}$$

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

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

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

$$0.25x + 0.10(5x) = 27.75$$
$$0.25x + 0.5x = 27.75$$
$$0.75x = 27.75$$
$$x = 37$$

$5x = 5(37) = 185$
The collection has 37 quarters and 185 dimes.

28. 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

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

$2x = 2(4500) = 9000$
$3x = 3(4500) = 13{,}500$
She invested \$4500 at 9%, \$9000 at 10% and \$13,500 at 11%.

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

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

$$3x + 4x = 12$$
$$7x = 12$$
$$\frac{7x}{7} = \frac{12}{7}$$
$$x = 1\frac{5}{7}$$

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

32. 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.

34. $(-2) + (-8) = -10$

36. $-11 + 2.9 = -8.1$

38. $-12 - 3 = -12 + (-3) = -15$

40. 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.

42.
$$\begin{aligned} R &= C \\ 60x &= 50x + 5000 \\ 10x &= 5000 \\ \frac{10x}{10} &= \frac{5000}{10} \\ x &= 500 \end{aligned}$$

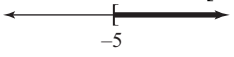
Should sell 500 boards to break even.
$C = R = 60x = 60(500) = 30{,}000$
It costs \$30,000 to produce the break-even number of boards.

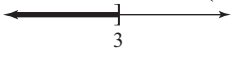
44. $R = C$
$105x = 870 + 70x$
$105x - 70x = 870 + 70x - 70x$
$35x = 870$
$\frac{35x}{35} = \frac{870}{35}$
$x \approx 24.857$
Should sell 25 monitors to break even.

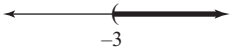
Section 2.8

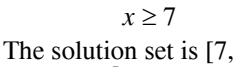
Practice Exercises

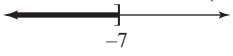
1. $x < 5$
Place a parenthesis at 5 since the inequality symbol is <. Shade to the left of 5. The solution set is $(-\infty, 5)$.

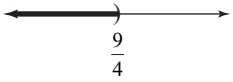

2. $x + 11 \geq 6$
$x + 11 - 11 \geq 6 - 11$
$x \geq -5$
The solution set is $[-5, \infty)$.


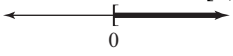
3. $-5x \geq -15$
$\frac{-5x}{-5} \leq \frac{-15}{-5}$
$x \leq 3$
The solution set is $(-\infty, 3]$.


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


5. $45 - 7x \leq -4$
$45 - 7x - 45 \leq -4 - 45$
$-7x \leq -49$
$\frac{-7x}{-7} \geq \frac{-49}{-7}$
$x \geq 7$
The solution set is $[7, \infty)$.


6. $3x + 20 \leq 2x + 13$
$3x + 20 - 2x \leq 2x + 13 - 2x$
$x + 20 \leq 13$
$x + 20 - 20 \leq 13 - 20$
$x \leq -7$
The solution set is $(-\infty, -7]$.


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


8. $3(x - 4) - 5 \leq 5(x - 1) - 12$
$3x - 12 - 5 \leq 5x - 5 - 12$
$3x - 17 \leq 5x - 17$
$3x - 17 - 5x \leq 5x - 17 - 5x$
$-2x - 17 \leq -17$
$-2x - 17 + 17 \leq -17 + 17$
$-2x \leq 0$
$\frac{-2x}{-2} \geq \frac{0}{-2}$
$x \geq 0$
The solution set is $[0, \infty)$.


9. $-3 \leq x < 1$
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. $-4 < 3x + 2 \le 8$

$-4 - 2 < 3x + 2 - 2 \le 8 - 2$

$-6 < 3x \le 6$

$\frac{-6}{3} < \frac{3x}{3} \le \frac{6}{3}$

$-2 < x \le 2$

The solution set is $(-2, 2]$.

11. $1 < \frac{3}{4}x + 5 < 6$

$4(1) < 4\left(\frac{3}{4}x + 5\right) < 4(6)$

$4 < 3x + 20 < 24$

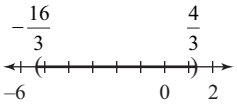
$4 - 20 < 3x + 20 - 20 < 24 - 20$

$-16 < 3x < 4$

$\frac{-16}{3} < \frac{3x}{3} < \frac{4}{3}$

$-\frac{16}{3} < x < \frac{4}{3}$

The solution set is $\left(-\frac{16}{3}, \frac{4}{3}\right)$.



12. Let x = number of classes.

$300 + 375x \le 1500$

$300 + 375x - 300 \le 1500 - 300$

$375x \le 1200$

$\frac{375x}{375} \le \frac{1200}{375}$

$x \le 3.2$

Kasonga can afford at most 3 community college classes this semester.

Vocabulary and Readiness Check

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. $\frac{9}{7} = \frac{x+2}{14}$ is an equation.

6. $\frac{9}{7} - \frac{x+2}{14}$ is an expression.

7. -5 is not a solution to $x \ge -3$.

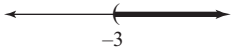
8. $|-6| = 6$ is not a solution to $x < 6$.

9. 4.1 is not a solution to $x < 4.01$.

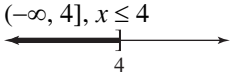
10. -4 is not a solution to $x \ge -3$.

Exercise Set 2.8

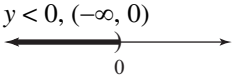
2. $(-3, \infty)$, $x > -3$



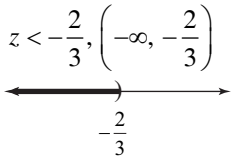
4. $(-\infty, 4]$, $x \le 4$



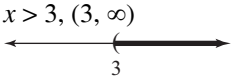
6. $y < 0$, $(-\infty, 0)$



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

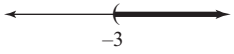


10. $x > 3$, $(3, \infty)$



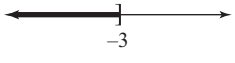
12. $3x > -9$

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



14. $x + 4 \le 1$

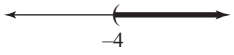
$x \le -3$, $(-\infty, -3]$



16. $-5x < 20$

$\frac{-5x}{-5} > \frac{20}{-5}$

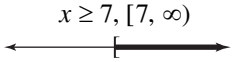
$x > -4$, $(-4, \infty)$



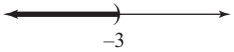
18. $3 - 7x \ge 10 - 8x$

$3 + x \ge 10$

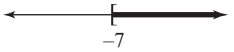
$x \ge 7$, $[7, \infty)$



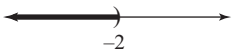
20. $7x+3<9x-3x$
$7x+3<6x$
$x+3<0$
$x<-3,\ (-\infty,-3)$



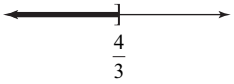
22. $3x+9\le 5(x-1)$
$3x+9\le 5x-5$
$-2x+9\le -5$
$-2x\le -14$
$\frac{-2x}{-2}\ge\frac{-14}{-2}$
$x\ge 7,\ [7,\infty)$



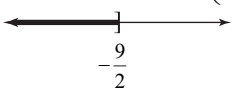
24. $-7x+4>3(4-x)$
$-7x+4>12-3x$
$-4x+4>12$
$-4x>8$
$\frac{-4x}{-4}<\frac{8}{-4}$
$x<-2,\ (-\infty,-2)$



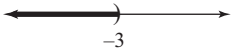
26. $3(5x-4)\le 4(3x-2)$
$15x-12\le 12x-8$
$3x-12\le -8$
$3x\le 4$
$x\le\frac{4}{3},\ \left(-\infty,\frac{4}{3}\right]$



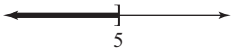
28. $7(x-2)+x\le -4(5-x)-12$
$7x-14+x\le -20+4x-12$
$8x-14\le -32+4x$
$4x-14\le -32$
$4x\le -18$
$x\le -\frac{9}{2},\ \left(-\infty,-\frac{9}{2}\right]$



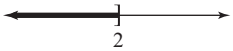
30. $-7x>21$
$\frac{-7x}{-7}<\frac{21}{-7}$
$x<-3,\ (-\infty,-3)$



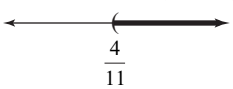
32. $y-4\le 1$
$y\le 5,\ (-\infty,5]$



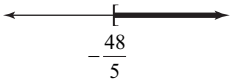
34. $2x-1\ge 4x-5$
$-2x-1\ge -5$
$-2x\ge -4$
$\frac{-2x}{-2}\le\frac{-4}{-2}$
$x\le 2,\ (-\infty,2]$



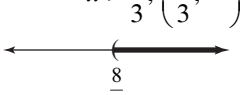
36. $4-x<8x+2x$
$4-x<10x$
$4-11x<0$
$-11x<-4$
$\frac{-11x}{-11}>\frac{-4}{-11}$
$x>\frac{4}{11},\ \left(\frac{4}{11},\infty\right)$



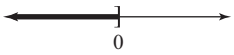
38. $\frac{5}{6}x\ge -8$
$x\ge -\frac{48}{5},\ \left[-\frac{48}{5},\infty\right)$



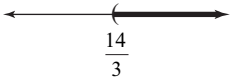
40. $5(x+4)<4(2x+3)$
$5x+20<8x+12$
$-3x+20<12$
$-3x<-8$
$\frac{-3x}{-3}>\frac{-8}{-3}$
$x>\frac{8}{3},\ \left(\frac{8}{3},\infty\right)$



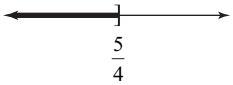
42. $6(2-x) \geq 12$
$12-6x \geq 12$
$-6x \geq 0$
$\frac{-6x}{-6} \leq \frac{0}{-6}$
$x \leq 0, (\infty, 0]$



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



46. $-5(1-x)+x \leq -(6-2x)+6$
$-5+5x+x \leq -6+2x+6$
$-5+6x \leq 2x$
$-5+4x \leq 0$
$4x \leq 5$
$x \leq \frac{5}{4}, \left(-\infty, \frac{5}{4}\right]$



48. $-(x-4) < 4$
$-x+4 < 4$
$-x < 0$
$\frac{-x}{-1} > \frac{0}{-1}$
$x > 0, (0, \infty)$

50. Answers may vary

52. $2 \leq y \leq 3, [2, 3]$

54. $-1 \leq x \leq 4, [-1, 4]$

56. $-5 < 2x < -2$
$-\frac{5}{2} < x < -1, \left(-\frac{5}{2}, -1\right)$

58. $4 \leq 5x-6 \leq 19$
$10 \leq 5x \leq 25$
$2 \leq x \leq 5, [2, 5]$

60. $0 < 4(x+5) \leq 8$
$0 < 4x+20 \leq 8$
$-20 < 4x \leq -12$
$-5 < x \leq -3, (-5, -3]$

62. $1 < 4+2x \leq 7$
$-3 < 2x \leq 3$
$-\frac{3}{2} < x \leq \frac{3}{2}, \left(-\frac{3}{2}, \frac{3}{2}\right]$

64. $-5 \leq 2(x+4) < 8$
$-5 \leq 2x+8 < 8$
$-13 \leq 2x < 0$
$-\frac{13}{2} \leq x < 0, \left[-\frac{13}{2}, 0\right)$

66. Answers may vary

68. $5x+1 \leq 10$
$5x \leq 9$
$x \leq \frac{9}{5}$

70. Let x = the number of people invited.
$15x+40 \leq 860$
$15x \leq 820$
$x \leq 54.67$
They may invite 54 people.

72. $4x + x + 12 \le 87$
$5x + 12 \le 87$
$5x \le 75$
$x \le 15$
x can be no greater than 15.

74. Let x = the sales per month and
$x - 1000$ = sales over 1000.
$600 + 0.04(x - 1000) \ge 3000$
$600 + 0.04x - 40 \ge 3000$
$0.04x + 560 \ge 3000$
$0.04x \ge 2440$
$x \ge 61{,}000$
He must sell \$61,000 or more per month.

76. Let x = the height of the center in inches.
$$\frac{80 + 78 + 72 + 69 + x}{5} \ge 77$$
$$5\left(\frac{80 + 78 + 72 + 69 + x}{5}\right) \ge 5(77)$$
$299 + x \ge 385$
$x \ge 86$
He must be at least $86 \text{ in.} = 7'2''$ tall.

78. EF-0 $65 \le y \le 85$
EF-1 $86 \le y \le 110$
EF-2 $111 \le y \le 135$
EF-3 $136 \le y \le 165$
EF-4 $166 \le y \le 200$
EF-5 $y \ge 201$

80. 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

82. Let x = score needed on the final exam.
$$90 \le \frac{85 + 95 + 92 + 3x}{6} \le 100$$
$$6(90) \le 6\left(\frac{85 + 95 + 92 + 3x}{6}\right) \le 6(100)$$
$540 \le 272 + 3x \le 600$
$268 \le 3 \le 328$
$89.3 \le x \le 109.3$
He must make between 89.3 and 100.

84. $(3)^3 = (3)(3)(3) = 27$

86. $0^5 = (0)(0)(0)(0)(0) = 0$

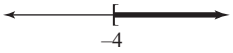
88. $\left(\frac{2}{3}\right)^3 = \left(\frac{2}{3}\right)\left(\frac{2}{3}\right)\left(\frac{2}{3}\right) = \frac{8}{27}$

90. Read the value on the vertical axis corresponding to 2005; \$50.20

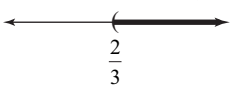
92. Find the points on the graph greater than \$52. The years are 2001, 2002, 2003.

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. $x^2 - 4x + 8 < x(x + 8)$
$x^2 - 4x + 8 < x^2 + 8x$
$-4x + 8 < 8x$
$-12x + 8 < 0$
$-12x < -8$
$$\frac{-12x}{-12} > \frac{-8}{-12}$$
$$x > \frac{2}{3}, \left(\frac{2}{3}, \infty\right)$$



The Bigger Picture

1. $-5x = 15$
$$\frac{-5x}{-5} = \frac{15}{-5}$$
$x = -3$
The solution is -3.

2. $-5x > 15$
$$\frac{-5x}{-5} < \frac{15}{-5}$$
$x < -3$
The solution set is $(-\infty, -3)$.

3. $9y - 14 = -12$
$9y - 14 + 14 = -12 + 14$
$9y = 2$
$\frac{9y}{9} = \frac{2}{9}$
$y = \frac{2}{9}$
The solution is $\frac{2}{9}$.

4. $9x - 3 = 5x - 4$
$9x - 3 - 5x = 5x - 4 - 5x$
$4x - 3 = -4$
$4x - 3 + 3 = -4 + 3$
$4x = -1$
$\frac{4x}{4} = \frac{-1}{4}$
$x = -\frac{1}{4}$
The solution is $-\frac{1}{4}$.

5. $4(x - 2) \le 5x + 7$
$4x - 8 \le 5x + 7$
$4x - 8 - 5x \le 5x + 7 - 5x$
$-x - 8 \le 7$
$-x - 8 + 8 \le 7 + 8$
$-x \le 15$
$\frac{-x}{-1} \ge \frac{15}{-1}$
$x \ge -15$
The solution set is $[-15, \infty)$.

6. $5(4x - 1) = 2(10x - 1)$
$20x - 5 = 20x - 2$
$20x - 5 - 20x = 20x - 2 - 20x$
$-5 = -2$
Since this is a false statement, there is no solution.

7. $-5.4 = 0.6x - 9.6$
$-5.4 + 9.6 = 0.6x - 9.6 + 9.6$
$4.2 = 0.6x$
$\frac{4.2}{0.6} = \frac{0.6x}{0.6}$
$7 = x$
The solution is 7.

8. $\frac{1}{3}(x - 4) < \frac{1}{4}(x + 7)$
$12\left[\frac{1}{3}(x - 4)\right] < 12\left[\frac{1}{4}(x + 7)\right]$
$4(x - 4) < 3(x + 7)$
$4x - 16 < 3x + 21$
$4x - 16 - 3x < 3x + 21 - 3x$
$x - 16 < 21$
$x - 16 + 16 < 21 + 16$
$x < 37$
The solution set is $(-\infty, 37)$.

9. $3y - 5(y - 4) = -2(y - 10)$
$3y - 5y + 20 = -2y + 20$
$-2y + 20 = -2y + 20$
$-2y + 20 + 2y = -2y + 20 + 2y$
$20 = 20$
All real numbers are solutions.

10. $\frac{7(x - 1)}{3} = \frac{2(x + 1)}{5}$
$15\left[\frac{7(x - 1)}{3}\right] = 15\left[\frac{2(x + 1)}{5}\right]$
$35(x - 1) = 6(x + 1)$
$35x - 35 = 6x + 6$
$35x - 35 - 6x = 6x + 6 - 6x$
$29x - 35 = 6$
$29x - 35 + 35 = 6 + 35$
$29x = 41$
$\frac{29x}{29} = \frac{41}{29}$
$x = \frac{41}{29}$
The solution is $\frac{41}{29}$.

Chapter 2 Vocabulary Check

1. Terms with the same variables raised to exactly the same powers are called <u>like terms</u>.

2. A <u>linear equation in one variable</u> can be written in the form $ax + b = c$.

3. Equations that have the same solution are called <u>equivalent equations</u>.

4. Inequalities containing two inequality symbols are called <u>compound inequalities</u>.

5. An equation that describes a known relationship among quantities is called a <u>formula</u>.

6. A linear inequality in one variable can be written in the form $ax + b < c$, (or $>, \le, \ge$).

7. The numerical coefficient of a term is its numerical factor.

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. $(y - 0.7) - (1.4y - 3) = y - 0.7 - 1.4y + 3$
$= -0.4y + 2.3$

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 a number is $2(x + 2.8) + 3x$.

11.
$$8x + 4 = 9x$$
$$8x + 4 - 8x = 9x - 8x$$
$$4 = x$$

12.
$$5y - 3 = 6y$$
$$5y - 3 - 5y = 6y - 5y$$
$$-3 = y$$

13.
$$\frac{2}{7}x + \frac{5}{7}x = 6$$
$$\frac{7}{7}x = 6$$
$$x = 6$$

14.
$$3x - 5 = 4x + 1$$
$$-5 = x + 1$$
$$-6 = x$$

15.
$$2x - 6 = x - 6$$
$$x - 6 = -6$$
$$x = 0$$

16.
$$4(x + 3) = 3(1 + x)$$
$$4x + 12 = 3 + 3x$$
$$x + 12 = 3$$
$$x = -9$$

17.
$$6(3 + n) = 5(n - 1)$$
$$18 + 6n = 5n - 5$$
$$18 + n = -5$$
$$n = -23$$

18.
$$5(2 + x) - 3(3x + 2) = -5(x - 6) + 2$$
$$10 + 5x - 9x - 6 = -5x + 30 + 2$$
$$-4x + 4 = -5x + 32$$
$$x + 4 = 32$$
$$x = 28$$

19.
$$x - 5 = 3$$
$$x - 5 + \underline{5} = 3 + \underline{5}$$
$$x = 8$$

20.
$$x + 9 = -2$$
$$x + 9 - \underline{9} = -2 - \underline{9}$$
$$x = -11$$

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.
$$\frac{3}{4}x = -9$$
$$\frac{4}{3}\left(\frac{3}{4}x\right) = \frac{4}{3}(-9)$$
$$x = -12$$

26.
$$\frac{x}{6} = \frac{2}{3}$$
$$6 \cdot \frac{x}{6} = 6 \cdot \frac{2}{3}$$
$$x = 4$$

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. $-4(2x+1) = -5x+5$
$-8x-4 = -5x+5$
$-3x-4 = 5$
$-3x = 9$
$x = -3$

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 = number of Keebler plants, then
$2x - 1$ = number of Kellogg plants.

$$x + (2x - 1) = 53$$
$$3x - 1 = 53$$
$$3x = 54$$
$$x = 18$$

$2x - 1 = 2(18) - 1 = 35$
There were 18 Keebler plants and 35 Kellogg plants.

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 $r = 125$.

$$d = rt$$
$$10{,}000 = 125t$$
$$80 = t$$

It will take 80 minutes or 1 hour and 20 minutes.

70. Let $F = 104$.

$$C = \frac{5}{9}(F - 32)$$
$$= \frac{5}{9}(104 - 32)$$
$$= \frac{5}{9}(72)$$
$$= 40$$

The temperature was 40°C.

71. Let x = the percent.

$$9 = x \cdot 45$$
$$\frac{9}{45} = \frac{45x}{45}$$
$$0.2 = x$$

9 is 20% of 45.

72. Let x = the percent.

$$59.5 = x \cdot 85$$
$$\frac{59.5}{85} = \frac{85x}{85}$$
$$0.7 = x$$

59.5 is 70% of 85.

73. Let x = the number.

$$137.5 = 125\% \cdot x$$
$$137.5 = 1.25x$$
$$\frac{137.5}{1.25} = \frac{1.25x}{1.25}$$
$$110 = x$$

137.5 is 125% of 110.

74. Let x = the number.

$$768 = 60\% \cdot x$$
$$768 = 0.6x$$
$$\frac{768}{0.6} = \frac{0.6x}{0.6}$$
$$1280 = x$$

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 66.9% of 76,000.
$0.669 \cdot 76{,}000 = 50{,}844$
We would expect 50,844 people 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)

$$0.4x + 0.1(30 - x) = 0.2(30)$$
$$0.4x + 3 - 0.1x = 6$$
$$0.3x + 3 = 6$$
$$0.3x = 3$$
$$x = 10$$
$30 - x = 30 - 10 = 20$
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.
$$0.3 = x \cdot 20.7$$
$$\frac{0.3}{20.7} = \frac{20.7x}{20.7}$$
$$0.0145 \approx x$$
The percent increase is 1.45%.

79. From the graph, the height of 'Almost hit a car' is 18%.

80. Choose the tallest graph. 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. 46% + 41% + 21% + 18% = 126%
No; answers may vary

83. 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.

84. 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%.

85. 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.

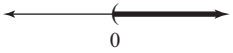
86. Let x = the time traveled by the Amtrak train.

	Rate ·	Time =	Distance
Amtrak	60	x	$60x$
Freight	45	$x + 1.5$	$45(x + 1.5)$

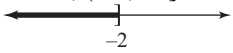
$$d = d$$
$$60x = 45(x + 1.5)$$
$$60x = 45x + 67.5$$
$$15x = 67.5$$
$$x = 4.5$$

It will take 4.5 hours.

87. $x > 0$, $(0, \infty)$



88. $x \le -2$, $(-\infty, -2]$

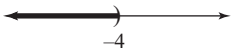


89. $0.5 \le y < 1.5$, $[0.5, 1.5)$

90. $-1 < x < 1$, $(-1, 1)$

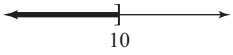
91. $-3x > 12$

$$\frac{-3x}{-3} < \frac{12}{-3}$$
$$x < -4, (-\infty, -4)$$



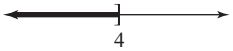
92. $-2x \ge -20$

$$\frac{-2x}{-2} \le \frac{-20}{-2}$$
$$x \le 10, (-\infty, 10]$$



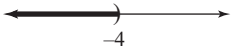
93. $x + 4 \ge 6x - 16$

$$-5x + 4 \ge -16$$
$$-5x \ge -20$$
$$\frac{-5x}{-5} \le \frac{-20}{-5}$$
$$x \le 4, (-\infty, 4]$$



94. $5x - 7 > 8x + 5$

$$-3x - 7 > 5$$
$$-3x > 12$$
$$\frac{-3x}{-3} < \frac{12}{-3}$$
$$x < -4, (-\infty, -4)$$



95. $-3 < 4x - 1 < 2$

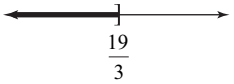
$$-2 < 4x < 3$$
$$-\frac{1}{2} < x < \frac{3}{4}, \left(-\frac{1}{2}, \frac{3}{4}\right)$$

96. $2 \le 3x - 4 < 6$

$$6 \le 3x < 10$$
$$2 \le x < \frac{10}{3}, \left[2, \frac{10}{3}\right)$$

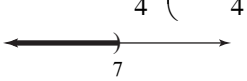
97. $4(2x - 5) \le 5x - 1$

$$8x - 20 \le 5x - 1$$
$$3x - 20 \le -1$$
$$3x \le 19$$
$$x \le \frac{19}{3}, \left(-\infty, \frac{19}{3}\right]$$



98. $-2(x - 5) > 2(3x - 2)$

$$-2x + 10 > 6x - 4$$
$$-8x + 10 > -4$$
$$-8x > -14$$
$$\frac{-8x}{-8} < \frac{-14}{-8}$$
$$x < \frac{7}{4}, \left(-\infty, \frac{7}{4}\right)$$



99. 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.

100. 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.

101.
$$6x + 2x - 1 = 5x + 11$$
$$8x - 1 = 5x + 11$$
$$3x - 1 = 11$$
$$3x = 12$$
$$x = 4$$

102.
$$2(3y - 4) = 6 + 7y$$
$$6y - 8 = 6 + 7y$$
$$-8 = 6 + y$$
$$-14 = y$$

103.
$$4(3 - a) - (6a + 9) = -12a$$
$$12 - 4a - 6a - 9 = -12a$$
$$3 - 10a = -12a$$
$$3 = -2a$$
$$-\frac{3}{2} = a$$

104.
$$\frac{x}{3} - 2 = 5$$
$$\frac{x}{3} = 7$$
$$3 \cdot \frac{x}{3} = 3 \cdot 7$$
$$x = 21$$

105.
$$2(y + 5) = 2y + 10$$
$$2y + 10 = 2y + 10$$
$$10 = 10$$
All real numbers are solutions.

106.
$$7x - 3x + 2 = 2(2x - 1)$$
$$4x + 2 = 4x - 2$$
$$2 = -2$$
There is no solution.

107. Let x = the number.
$$6 + 2x = x - 7$$
$$6 + x = -7$$
$$x = -13$$
The number is -13.

108. 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.

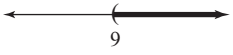
109.
$$V = \frac{1}{3}Ah$$
$$3 \cdot V = 3 \cdot \frac{1}{3}Ah$$
$$3V = Ah$$
$$\frac{3V}{A} = \frac{Ah}{A}$$
$$\frac{3V}{A} = h$$

110. Let x = the number.
$$x = 26\% \cdot 85$$
$$x = 0.26 \cdot 85$$
$$x = 22.1$$
22.1 is 26% of 85.

111. 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.

112. Increase = 282 − 235 = 47
Let x = percent.
$$47 = x \cdot 235$$
$$\frac{47}{235} = \frac{235x}{235}$$
$$0.2 = x$$
The percent increase is 20%.

113.
$$4x - 7 > 3x + 2$$
$$x - 7 > 2$$
$x > 9$, $(9, \infty)$



114. $-5x < 20$

$$\frac{-5x}{-5} > \frac{20}{-5}$$

$$x > -4,\ (-4, \infty)$$

115. $-3(1+2x)+x \ge -(3-x)$

$$-3-6x+x \ge -3+x$$

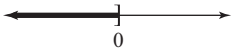
$$-3-5x \ge -3+x$$

$$-5x \ge x$$

$$-6x \ge 0$$

$$\frac{-6x}{-6} \le \frac{0}{-6}$$

$$x \le 0,\ (-\infty, 0]$$



Chapter 2 Test

1. $2y - 6 - y - 4 = y - 10$

2. $2.7x + 6.1 + 3.2x - 4.9 = 5.9x + 1.2$

3. $4(x-2)-3(2x-6) = 4x-8-6x+18$

$$= -2x+10$$

4. $7 + 2(5y - 3) = 7 + 10y - 6 = 10y + 1$

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

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

$$x = -5$$

6. $4(n-5) = -(4-2n)$

$$4n-20 = -4+2n$$

$$2n-20 = -4$$

$$2n = 16$$

$$n = 8$$

7. $5y-7+y = -(y+3y)$

$$6y-7 = -4y$$

$$-7 = -10y$$

$$\frac{7}{10} = y$$

8. $4z+1-z = 1+z$

$$3z+1 = 1+z$$

$$2z+1 = 1$$

$$2z = 0$$

$$z = 0$$

9. $$\frac{2(x+6)}{3} = x-5$$

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

$$2x+12 = 3x-15$$

$$12 = x-15$$

$$27 = x$$

10. $$\frac{1}{2} - x + \frac{3}{2} = x-4$$

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

$$1-2x+3 = 2x-8$$

$$-2x+4 = 2x-8$$

$$-4x+4 = -8$$

$$-4x = -12$$

$$x = 3$$

11. $-0.3(x-4)+x = 0.5(3-x)$

$$10[-0.3(x-4)+x] = 10[0.5(3-x)]$$

$$-3(x-4)+10x = 5(3-x)$$

$$-3x+12+10x = 15-5x$$

$$7x+12 = 15-5x$$

$$12x+12 = 15$$

$$12x = 3$$

$$x = \frac{3}{12} = \frac{1}{4} = 0.25$$

12. $-4(a+1)-3a = -7(2a-3)$

$$-4a-4-3a = -14a+21$$

$$-7a-4 = -14a+21$$

$$7a-4 = 21$$

$$7a = 25$$

$$a = \frac{25}{7}$$

13. $-2(x-3) = x+5-3x$

$$-2x+6 = -2x+5$$

$$6 = 5$$

There is no solution.

14. 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.

15. Let $l = 35$, and $w = 20$.
$2A = 2lw = 2(35)(20) = 1400$
Let x = the number of gallons needed at 200 square feet per gallon.
$1400 = 200x$
$7 = x$
7 gallons are needed.

16. 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.

17. 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%.

18. Let x = the time they travel.

Rate · Time = Distance

Train 1	50	x	$50x$
Train 2	64	x	$64x$
Total			285

$50x + 64x = 285$
$114x = 285$
$x = 2\frac{1}{2}$

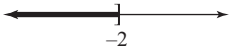
They must travel for $2\frac{1}{2}$ hours.

19. Let $y = -14$, $m = -2$, and $b = -2$.
$y = mx + b$
$-14 = -2x - 2$
$-12 = -2x$
$6 = x$

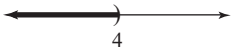
20. $V = \pi r^2 h$
$\frac{V}{\pi r^2} = \frac{\pi r^2 h}{\pi r^2}$
$\frac{V}{\pi r^2} = h$

21. $3x - 4y = 10$
$-4y = -3x + 10$
$y = \frac{-3x + 10}{-4}$
$y = \frac{3x - 10}{4}$

22. $3x - 5 \geq 7x + 3$
$-4x - 5 \geq 3$
$-4x \geq 8$
$\frac{-4x}{-4} \leq \frac{8}{-4}$
$x \leq -2$, $(-\infty, -2]$



23. $x + 6 > 4x - 6$
$-3x + 6 > -6$
$-3x > -12$
$\frac{-3x}{-3} < \frac{-12}{-3}$
$x < 4$, $(-\infty, 4)$



24. $-2 < 3x + 1 < 8$
$-3 < 3x < 7$
$-1 < x < \frac{7}{3}$, $\left(-1, \frac{7}{3}\right)$

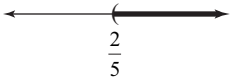
25. $\dfrac{2(5x+1)}{3} > 2$

$2(5x+1) > 6$

$10x+2 > 6$

$10x > 4$

$x > \dfrac{4}{10} = \dfrac{2}{5}, \left(\dfrac{2}{5}, \infty\right)$



$\frac{2}{5}$

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. $\dfrac{2}{5} = \dfrac{2}{5} \cdot \dfrac{4}{4} = \dfrac{8}{20}$

8. $\dfrac{2}{3} = \dfrac{2}{3} \cdot \dfrac{8}{8} = \dfrac{16}{24}$

9. $3[4+2(10-1)] = 3[4+2(9)]$
$= 3[4+18]$
$= 3[22]$
$= 66$

10. $5[16-4(2+1)] = 5[16-4(3)]$
$= 5[16-12]$
$= 5[4]$
$= 20$

11. Let $x = 2$.
$3x+10 = 8x$
$3(2)+10 \stackrel{?}{=} 8(2)$
$6+10 \stackrel{?}{=} 16$
$16 = 16$
2 is a solution of the equation.

12. Let $x = 3$.
$5x-2 = 4x$
$5(3)-2 \stackrel{?}{=} 4(3)$
$15-2 \stackrel{?}{=} 12$
$13 \neq 12$
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. $-\frac{3}{4}\cdot-\frac{8}{17} = \frac{3\cdot 8}{4\cdot 17} = \frac{24}{68} = \frac{6}{17}$

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. $y + 0.6 = -1.0$
$y + 0.6 - 0.6 = -1.0 - 0.6$
$y = -1.6$

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. $7 = -5(2a-1)-(-11a+6)$
$7 = -10a+5+11a-6$
$7 = a-1$
$7+1 = a-1+1$
$8 = a$

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. $6x+5 = 4(x+4)-1$
$6x+5 = 4x+16-1$
$6x+5 = 4x+15$
$2x+5 = 15$
$2x = 10$
$x = 5$

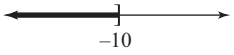
41. Let x = a number.
$2(x+4) = 4x-12$
$2x+8 = 4x-12$
$8 = 2x-12$
$20 = 2x$
$10 = x$
The number is 10.

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. $x - 3 > 2$
$x > 5$, $(5, \infty)$