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Chapter 2

Section 2.1 Practice Exercises

1. $x-5=8$

$x-5+5=8+5$

$x=13$

Check: $x-5=8$

$13-5 \stackrel{?}{=} 8$

$8=8$ True

The solution is 13.

2. $y+1.7=0.3$

$y+1.7-1.7=0.3-1.7$

$y=-1.4$

Check: $y+1.7=0.3$

$-1.4+1.7 \stackrel{?}{=} 0.3$

$0.3=0.3$ True

The solution is -1.4.

3. $\frac{7}{8}=y-\frac{1}{3}$

$\frac{7}{8}+\frac{1}{3}=y-\frac{1}{3}+\frac{1}{3}$

$\frac{7}{8}\cdot\frac{3}{3}+\frac{1}{3}\cdot\frac{8}{8}=y$

$\frac{21}{24}+\frac{8}{24}=y$

$\frac{29}{24}=y$

Check: $\frac{7}{8}=y-\frac{1}{3}$

$\frac{7}{8} \stackrel{?}{=} \frac{29}{24}-\frac{1}{3}$

$\frac{7}{8} \stackrel{?}{=} \frac{29}{24}-\frac{8}{24}$

$\frac{7}{8} \stackrel{?}{=} \frac{21}{24}$

$\frac{7}{8}=\frac{7}{8}$ True

The solution is $\frac{29}{24}$.

4. $3x+10=4x$

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

$10=x$

Check: $3x+10=4x$

$3(10)+10 \stackrel{?}{=} 4(10)$

$30+10 \stackrel{?}{=} 40$

$40=40$ True

The solution is 10.

5. $10w+3-4w+4=-2w+3+7w$

$6w+7=5w+3$

$-5w+6w+7=-5w+5w+3$

$w+7=3$

$w+7-7=3-7$

$w=-4$

Check:

$10w+3-4w+4=-2w+3+7w$

$10(-4)+3-4(-4)+4 \stackrel{?}{=} -2(-4)+3+7(-4)$

$-40+3+16+4 \stackrel{?}{=} 8+3-28$

$-17=-17$ True

The solution is -4.

6. $3(2w-5)-(5w+1)=-3$

$3(2w)-3(5)-1(5w)-1(1)=-3$

$6w-15-5w-1=-3$

$w-16=-3$

$w-16+16=-3+16$

$w=13$

Check: $3(2w-5)-(5w+1)=-3$

$3(2\cdot 13-5)-(5\cdot 13+1) \stackrel{?}{=} -3$

$3(26-5)-(65+1) \stackrel{?}{=} -3$

$3(21)-66 \stackrel{?}{=} -3$

$63-66 \stackrel{?}{=} -3$

$-3=-3$ True

The solution is 13.

7. $12-y=9$

$12-y-12=9-12$

$-y=-3$

$y=3$

Check: $12-y=9$

$12-3 \stackrel{?}{=} 9$

$9=9$ True

The solution is 3.

8. a. If the sum of two numbers is 11 and one number is 4, find the other number by subtracting 4 from 11. The other number is $11-4$, or 7.

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b. If the sum of two numbers is 11 and one number is x, find the other number by subtracting x from 11. The other number is $11 - x$.

c. If the sum of two numbers is 56 and one number is a, find the other number by subtracting a from 56. The other number is $56 - a$.

9. Mike received 100,445 more votes than Zane, who received n votes. So, Mike received $(n + 100{,}445)$ votes.

Vocabulary, Readiness & Video Check 2.1

1. A combination of operations on variables and numbers is called an expression.

2. A statement of the form "expression = expression" is called an equation.

3. An equation contains an equal sign (=).

4. An expression does not contain an equal sign (=).

5. An expression may be simplified and evaluated while an equation may be solved.

6. A solution of an equation is a number that when substituted for a variable makes the equation a true statement.

7. Equivalent equations have the same solution.

8. By the addition property of equality, the same number may be added to or subtracted from both sides of an equation without changing the solution of the equation.

9. $x + 4 = 6$
$x = 2$

10. $x + 7 = 17$
$x = 10$

11. $n + 18 = 30$
$n = 12$

12. $z + 22 = 40$
$z = 18$

13. $b - 11 = 6$
$b = 17$

14. $d - 16 = 5$
$d = 21$

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

16. $15x - 14 = 14x - 1$

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

Exercise Set 2.1

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

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

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

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

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10. $y-\frac{4}{7}=-\frac{3}{14}$

$y-\frac{4}{7}+\frac{4}{7}=-\frac{3}{14}+\frac{4}{7}$

$y=-\frac{3}{14}+\frac{8}{14}$

$y=\frac{5}{14}$

Check: $y-\frac{4}{7}=-\frac{3}{14}$

$\frac{5}{14}-\frac{4}{7}\stackrel{?}{=}-\frac{3}{14}$

$\frac{5}{14}-\frac{8}{14}\stackrel{?}{=}-\frac{3}{14}$

$-\frac{3}{14}=-\frac{3}{14}$ True

The solution is $\frac{5}{14}$.

12. $c+\frac{1}{6}=\frac{3}{8}$

$c+\frac{1}{6}-\frac{1}{6}=\frac{3}{8}-\frac{1}{6}$

$c=\frac{9}{24}-\frac{4}{24}$

$c=\frac{5}{24}$

Check: $c+\frac{1}{6}=\frac{3}{8}$

$\frac{5}{24}+\frac{1}{6}\stackrel{?}{=}\frac{3}{8}$

$\frac{5}{24}+\frac{4}{24}\stackrel{?}{=}\frac{3}{8}$

$\frac{9}{24}\stackrel{?}{=}\frac{3}{8}$

$\frac{3}{8}=\frac{3}{8}$ True

The solution is $\frac{5}{24}$.

14. $3n+2n=7+4n$

$5n=7+4n$

$5n-4n=7+4n-4n$

$n=7$

Check: $3n+2n=7+4n$

$3(7)+2(7)\stackrel{?}{=}7+4(7)$

$21+14\stackrel{?}{=}7+28$

$35=35$ True

The solution is 7.

16. $\frac{13}{11}y-\frac{2}{11}y=-3$

$\frac{11}{11}y=-3$

$y=-3$

Check: $\frac{13}{11}y-\frac{2}{11}y=-3$

$\frac{13}{11}(-3)-\frac{2}{11}(-3)\stackrel{?}{=}-3$

$-\frac{39}{11}+\frac{6}{11}\stackrel{?}{=}-3$

$-\frac{33}{11}\stackrel{?}{=}-3$

$-3=-3$ True

The solution is -3.

18. $4x-4=10x-7x$

$4x-4=3x$

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

$-4=-x$

$4=x$

Check: $4x-4=10x-7x$

$4(4)-4\stackrel{?}{=}10(4)-7(4)$

$16-4\stackrel{?}{=}40-28$

$12=12$ True

The solution is 4.

20. $-4(z-3)=2-3z$

$-4z+12=2-3z$

$-4z+12+3z=2-3z+3z$

$-z+12=2$

$-z+12-12=2-12$

$-z=-10$

$z=10$

Check: $-4(z-3)=2-3z$

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

$-4(7)\stackrel{?}{=}2-30$

$-28=-28$ True

The solution is 10.

22. $\frac{1}{5}x-1=-\frac{4}{5}x-13$

$\frac{4}{5}x+\frac{1}{5}x-1=\frac{4}{5}x-\frac{4}{5}x-13$

$\frac{5}{5}x-1=-13$

$x-1=-13$

$x-1+1=-13+1$

$x=-12$

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Check: $\frac{1}{5}x-1=-\frac{4}{5}x-13$

$\frac{1}{5}(-12)-1 \stackrel{?}{=} -\frac{4}{5}(-12)-13$

$-\frac{12}{5}-\frac{5}{5} \stackrel{?}{=} \frac{48}{5}-\frac{65}{5}$

$-\frac{17}{5}=-\frac{17}{5}$ True

The solution is -12.

24. $2x+7=x-10$

$-x+2x+7=-x+x-10$

$x+7=-10$

$x+7-7=-10-7$

$x=-17$

Check: $2x+7=x-10$

$2(-17)+7 \stackrel{?}{=} -17-10$

$-34+7 \stackrel{?}{=} -27$

$-27=-27$ True

The solution is -17.

26. $4p-11-p=2+2p-20$

$3p-11=2p-18$

$-2p+3p-11=-2p+2p-18$

$p-11=-18$

$p-11+11=-18+11$

$p=-7$

Check: $4p-11-p=2+2p-20$

$4(-7)-11-(-7) \stackrel{?}{=} 2+2(-7)-20$

$-28-11+7 \stackrel{?}{=} 2-14-20$

$-32=-32$ True

The solution is -7.

28. $-2(x-1)=-3x$

$-2x+2=-3x$

$2x-2x+2=2x-3x$

$2=-x$

$-2=x$

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

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

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

$6=6$ True

The solution is -2.

30. $\frac{2}{5}x-\frac{1}{12}=-\frac{3}{5}x-\frac{3}{4}$

$\frac{2}{5}x-\frac{1}{12}+\frac{3}{5}x=-\frac{3}{5}x-\frac{3}{4}+\frac{3}{5}x$

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

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

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

$x=-\frac{9}{12}+\frac{1}{12}$

$x=-\frac{8}{12}$

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

Check: $\frac{2}{5}x-\frac{1}{12}=-\frac{3}{5}x-\frac{3}{4}$

$\frac{2}{5}\left(-\frac{2}{3}\right)-\frac{1}{12} \stackrel{?}{=} -\frac{3}{5}\left(-\frac{2}{3}\right)-\frac{3}{4}$

$-\frac{4}{15}-\frac{1}{12} \stackrel{?}{=} \frac{6}{15}-\frac{3}{4}$

$-\frac{16}{60}-\frac{5}{60} \stackrel{?}{=} \frac{24}{60}-\frac{45}{60}$

$-\frac{21}{60}=-\frac{21}{60}$ True

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

32. $3(y+7)=2y-5$

$3y+21=2y-5$

$-2y+3y+21=-2y+2y-5$

$y+21=-5$

$y+21-21=-5-21$

$y=-26$

Check: $3(y+7)=2y-5$

$3(-26+7) \stackrel{?}{=} 2(-26)-5$

$3(-19) \stackrel{?}{=} -52-5$

$-57=-57$ True

The solution is -26.

34. $5(3+z)-(8z+9)=-4z$

$15+5z-8z-9=-4z$

$-3z+6=-4z$

$3z-3z+6=3z-4z$

$6=-z$

$-6=z$

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Check: $5(3+z)-(8z+9)=-4z$

$5(3+(-6))-(8(-6)+9) \stackrel{?}{=} -4(-6)$

$5(-3)-(-48+9) \stackrel{?}{=} 24$

$-15-(-39) \stackrel{?}{=} 24$

$-15+39 \stackrel{?}{=} 24$

$24 = 24$ True

The solution is −6.

36. $-5(x+1)+4(2x-3)=2(x+2)-8$

$-5x-5+8x-12=2x+4-8$

$3x-17=2x-4$

$3x-17-2x=2x-4-2x$

$x-17=-4$

$x-17+17=-4+17$

$x=13$

Check: $-5(x+1)+4(2x-3)=2(x+2)-8$

$-5(13+1)+4(2\cdot 13-3) \stackrel{?}{=} 2(13+2)-8$

$-5(14)+4(26-3) \stackrel{?}{=} 2(15)-8$

$-70+4(23) \stackrel{?}{=} 30-8$

$-70+92 \stackrel{?}{=} 22$

$22 = 22$ True

The solution is 13.

38. $18x-9=19x$

$18x-9-18x=19x-18x$

$-9=x$

40. $9x+5.5=10x$

$9x+5.5-9x=10x-9x$

$5.5=x$

42. $7y+2=6y+2$

$7y+2-6y=6y+2-6y$

$y+2=2$

$y+2-2=2-2$

$y=0$

44. $15x+20-10x-9=25x+8-21x-7$

$5x+11=4x+1$

$-4x+5x+11=-4x+4x+1$

$x+11=1$

$x+11-11=1-11$

$x=-10$

46. $6(5+c)=5(c-4)$

$30+6c=5c-20$

$30+6c-5c=5c-20-5c$

$30+c=-20$

$-30+30+c=-30-20$

$c=-50$

48. $m+2=7.1$

$m+2-2=7.1-2$

$m=5.1$

50. $15-(6-7k)=2+6k$

$15-6+7k=2+6k$

$9+7k=2+6k$

$9+7k-6k=2+6k-6k$

$9+k=2$

$-9+9+k=-9+2$

$k=-7$

52. $\frac{1}{11}=y+\frac{10}{11}$

$\frac{1}{11}-\frac{10}{11}=y+\frac{10}{11}-\frac{10}{11}$

$-\frac{9}{11}=y$

54. $-1.4-7x-3.6-2x=-8x+4.4$

$-9x-5=-8x+4.4$

$8x-9x-5=8x-8x+4.4$

$-x-5=4.4$

$-x-5+5=4.4+5$

$-x=9.4$

$x=-9.4$

56. If the sum of the two numbers is 13 and one number is y, then the other number is $13 - y$.

58. If the sum of the lengths of the two pieces is 5 feet and one piece is x feet, then the other piece has a length of $(5 - x)$ feet.

60. If the sum of the measures of two angles is 90° and one angle measures x°, then the other angle measures $(90 - x)$°.

62. If the length of I-80 is m miles and the length of I-90 is 121 miles longer than I-80, the length of I-90 is $(m + 121)$ miles.

64. If the weight of the Armanty meteorite is y kilograms and the weight of the Hoba West meteorite is 3 times the weight of the Armanty meteorite, then the weight of the Hoba West meteorite is $3y$ kilograms.

66. The multiplicative inverse of $\frac{7}{6}$ is $\frac{6}{7}$, since $\frac{7}{6}\cdot\frac{6}{7}=1$.

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68. The multiplicative inverse of 5 is $\frac{1}{5}$, since

$5 \cdot \frac{1}{5} = 1.$

70. The multiplicative inverse of $-\frac{3}{5}$ is $-\frac{5}{3}$ since

$-\frac{3}{5} \cdot \left(-\frac{5}{3}\right) = 1.$

72. $\frac{-2y}{-2} = \frac{-2 \cdot y}{-2 \cdot 1} = \frac{y}{1} = y$

74. $7\left(\frac{1}{7}r\right) = \left(7 \cdot \frac{1}{7}\right)r = 1r = r$

76. $\frac{9}{2}\left(\frac{2}{9}x\right) = \left(\frac{9}{2} \cdot \frac{2}{9}\right)x = 1x = x$

78. answers may vary

80.
$$a + 9 = 15$$
$$a + 9 + (-9) = 15 + (-9)$$
$$a = 6$$

82. answers may vary

84. $360 - x - 3x - 5x = 360 - 9x$
The measure of the fourth angle is $(360 - 9x)°$.

86. answers may vary

88.
$$-85.325 = x - 97.985$$
$$-85.325 + 97.985 = x - 97.985 + 97.985$$
$$12.66 = x$$

Section 2.2 Practice Exercises

1.
$$\frac{3}{7}x = 9$$
$$\frac{7}{3} \cdot \left(\frac{3}{7}x\right) = \frac{7}{3} \cdot 9$$
$$\left(\frac{7}{3} \cdot \frac{3}{7}\right)x = \frac{7}{3} \cdot 9$$
$$1x = 21$$
$$x = 21$$

Check: $\frac{3}{7}x = 9$

$\frac{3}{7}(21) \stackrel{?}{=} 9$

$9 = 9$ True

The solution is 21.

2.
$$7x = 42$$
$$\frac{7x}{7} = \frac{42}{7}$$
$$1 \cdot x = 6$$
$$x = 6$$

Check: $7x = 42$

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

$42 = 42$ True

The solution is 6.

3.
$$-4x = 52$$
$$\frac{-4x}{-4} = \frac{52}{-4}$$
$$1x = -13$$
$$x = -13$$

Check: $-4x = 52$

$-4(-13) \stackrel{?}{=} 52$

$52 = 52$ True

The solution is -13.

4.
$$\frac{y}{5} = 13$$
$$\frac{1}{5}y = 13$$
$$5 \cdot \frac{1}{5}y = 5 \cdot 13$$
$$1y = 65$$
$$y = 65$$

Check: $\frac{y}{5} = 13$

$\frac{65}{5} \stackrel{?}{=} 13$

$13 = 13$ True

The solution is 65.

5.
$$2.6x = 13.52$$
$$\frac{2.6x}{2.6} = \frac{13.52}{2.6}$$
$$x = 5.2$$

Check: $2.6x = 13.52$

$2.6(5.2) \stackrel{?}{=} 13.52$

$13.52 = 13.52$ True

The solution is 5.2.

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6. $-\frac{5}{6}y=-\frac{3}{5}$

$-\frac{6}{5}\cdot-\frac{5}{6}y=-\frac{6}{5}\cdot-\frac{3}{5}$

$y=\frac{18}{25}$

Check: $-\frac{5}{6}y=-\frac{3}{5}$

$-\frac{5}{6}\left(\frac{18}{25}\right)\stackrel{?}{=}-\frac{3}{5}$

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

The solution is $\frac{18}{25}$.

7. $-x+7=-12$

$-x+7-7=-12-7$

$-x=-19$

$\frac{-x}{-1}=\frac{-19}{-1}$

$1x=19$

$x=19$

Check: $-x+7=-12$

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

$-12=-12$ True

The solution is 19.

8. $-7x+2x+3-20=-2$

$-5x-17=-2$

$-5x-17+17=-2+17$

$-5x=15$

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

$x=-3$

Check: $-7x+2x+3-20=-2$

$-7(-3)+2(-3)+3-20\stackrel{?}{=}-2$

$21-6+3-20\stackrel{?}{=}-2$

$-2=-2$ True

The solution is –3.

9. $10x-4=7x+14$

$10x-4-7x=7x+14-7x$

$3x-4=14$

$3x-4+4=14+4$

$3x=18$

$\frac{3x}{3}=\frac{18}{3}$

$x=6$

Check: $10x-4=7x+14$

$10(6)-4\stackrel{?}{=}7(6)+14$

$60-4\stackrel{?}{=}42+14$

$56=56$ True

The solution is 6.

10. $4(3x-2)=-1+4$

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

$12x-8=3$

$12x-8+8=3+8$

$12x=11$

$\frac{12x}{12}=\frac{11}{12}$

$x=\frac{11}{12}$

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

$4\left(3\cdot\frac{11}{12}-2\right)\stackrel{?}{=}-1+4$

$4\left(\frac{11}{4}-2\right)\stackrel{?}{=}-1+4$

$11-8\stackrel{?}{=}3$

$3=3$ True

The solution is $\frac{11}{12}$.

11. a. If x is the first integer, then $x + 1$ is the second integer.
Their sum is $x + (x + 1) = x + x + 1 = 2x + 1$.

b. If x is the first odd integer, then $x + 2$ is the second consecutive odd integer.
Their sum is $x + (x + 2) = x + x + 2 = 2x + 2$.

Vocabulary, Readiness & Video Check 2.2

1. By the multiplication property of equality, both sides of an equation may be multiplied or divided by the same nonzero number without changing the solution of the equation.

2. By the addition property of equality, the same number may be added to or subtracted from both sides of an equation without changing the solution of the equation.

3. An equation may be solved while an expression may be simplified and evaluated.

4. An equation contains an equal sign (=) while an expression does not.

5. Equivalent equations have the same solution.

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6. A solution of an equation is a number that when substituted for a variable makes the equation a true statement.

7. $3a = 27$
$a = 9$

8. $9c = 54$
$c = 6$

9. $5b = 10$
$b = 2$

10. $7t = 14$
$t = 2$

11. $6x = -30$
$x = -5$

12. $8r = -64$
$r = -8$

13. We can multiply both sides of an equation by the same nonzero number and have an equivalent equation.

14. addition property; multiplication property; answers may vary

15. $(x + 1) + (x + 3) = 2x + 4$

Exercise Set 2.2

2. $-7x = -49$
$\frac{-7x}{-7} = \frac{-49}{-7}$
$x = 7$
Check: $-7x = -49$
$-7(7) \stackrel{?}{=} -49$
$-49 = -49$ True
The solution is 7.

4. $2x = 0$
$\frac{2x}{2} = \frac{0}{2}$
$x = 0$
Check: $2x = 0$
$2(0) \stackrel{?}{=} 0$
$0 = 0$ True
The solution is 0.

6. $-y = 8$
$\frac{-y}{-1} = \frac{8}{-1}$
$y = -8$
Check: $-y = 8$
$-(-8) \stackrel{?}{=} 8$
$8 = 8$ True
The solution is −8.

8. $\frac{3}{4}n = -15$
$\frac{4}{3} \cdot \frac{3}{4}n = \frac{4}{3} \cdot (-15)$
$n = -20$
Check: $\frac{3}{4}n = -15$
$\frac{3}{4}(-20) \stackrel{?}{=} -15$
$-15 = -15$ True
The solution is −20.

10. $\frac{1}{8}v = \frac{1}{4}$
$8 \cdot \frac{1}{8}v = 8 \cdot \frac{1}{4}$
$v = 2$
Check: $\frac{1}{8}v = \frac{1}{4}$
$\frac{1}{8} \cdot 2 \stackrel{?}{=} \frac{1}{4}$
$\frac{1}{4} = \frac{1}{4}$ True
The solution is 2.

12. $\frac{d}{15} = 2$
$15 \cdot \frac{d}{15} = 15 \cdot 2$
$d = 30$
Check: $\frac{d}{15} = 2$
$\frac{30}{15} \stackrel{?}{=} 2$
$2 = 2$ True
The solution is 30.

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

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

$f=0$

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

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

$0=0$ True

The solution is 0.

16. $8.5y=19.55$

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

$y=2.3$

Check: $8.5y=19.55$

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

$19.55=19.55$ True

The solution is 2.3.

18. $3x-1=26$

$3x-1+1=26+1$

$3x=27$

$\frac{3x}{3}=\frac{27}{3}$

$x=9$

Check: $3x-1=26$

$3\cdot 9-1\stackrel{?}{=}26$

$27-1\stackrel{?}{=}26$

$26=26$ True

The solution is 9.

20. $-x+4=-24$

$-x+4-4=-24-4$

$-x=-28$

$\frac{-x}{-1}=\frac{-28}{-1}$

$x=28$

Check: $-x+4=-24$

$-28+4\stackrel{?}{=}-24$

$-24=-24$ True

The solution is 28.

22. $8t+5=5$

$8t+5-5=5-5$

$8t=0$

$\frac{8t}{8}=\frac{0}{8}$

$t=0$

Check: $8t+5=5$

$8\cdot 0+5\stackrel{?}{=}5$

$0+5\stackrel{?}{=}5$

$5=5$ True

The solution is 0.

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

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

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

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

$b=-24$

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

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

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

$-7=-7$ True

The solution is -24.

26. $4a+1+a-11=0$

$5a-10=0$

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

$5a=10$

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

$a=2$

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

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

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

$0=0$ True

The solution is 2.

28. $19=0.4x-0.9x-6$

$19=-0.5x-6$

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

$25=-0.5x$

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

$-50=x$

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

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

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

$19=19$ True

The solution is -50.

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30. $\frac{3}{5}x-14=-8$

$\frac{3}{5}x-14+14=-8+14$

$\frac{3}{5}x=6$

$\frac{5}{3}\cdot\frac{3}{5}x=\frac{5}{3}\cdot 6$

$x=10$

Check: $\frac{3}{5}x-14=-8$

$\frac{3}{5}\cdot 10-14\stackrel{?}{=}-8$

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

$-8=-8$ True

The solution is 10.

32. $\frac{2}{7}z-\frac{1}{5}=\frac{1}{2}$

$\frac{2}{7}z-\frac{1}{5}+\frac{1}{5}=\frac{1}{2}+\frac{1}{5}$

$\frac{2}{7}z=\frac{5}{10}+\frac{2}{10}$

$\frac{2}{7}z=\frac{7}{10}$

$\frac{7}{2}\cdot\frac{2}{7}z=\frac{7}{2}\cdot\frac{7}{10}$

$z=\frac{49}{20}$

Check: $\frac{2}{7}z-\frac{1}{5}=\frac{1}{2}$

$\frac{2}{7}\left(\frac{49}{20}\right)-\frac{1}{5}\stackrel{?}{=}\frac{1}{2}$

$\frac{7}{10}-\frac{1}{5}\stackrel{?}{=}\frac{1}{2}$

$\frac{7}{10}-\frac{2}{10}\stackrel{?}{=}\frac{1}{2}$

$\frac{5}{10}\stackrel{?}{=}\frac{1}{2}$

$\frac{1}{2}=\frac{1}{2}$ True

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

34. $11x+13=9x+9$

$11x+13-9x=9x+9-9x$

$2x+13=9$

$2x+13-13=9-13$

$2x=-4$

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

$x=-2$

36. $2(4x+1)=-12+6$

$8x+2=-12+6$

$8x+2=-6$

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

$8x=-8$

$\frac{8x}{8}=\frac{-8}{8}$

$x=-1$

38. $6x-4=-2x-10$

$6x-4+2x=-2x-10+2x$

$8x-4=-10$

$8x-4+4=-10+4$

$8x=-6$

$\frac{8x}{8}=\frac{-6}{8}$

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

40. $8+4=-6(5x-2)$

$8+4=-30x+12$

$12=-30x+12$

$12-12=-30x+12-12$

$0=-30x$

$\frac{0}{-30}=\frac{-30x}{-30}$

$0=x$

42. $-17z-4=-16z-20$

$17z-17z-4=17z-16z-20$

$-4=z-20$

$-4+20=z-20+20$

$16=z$

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44. $\frac{1}{3}(3x-1) = -\frac{1}{10} - \frac{2}{10}$

$x - \frac{1}{3} = -\frac{3}{10}$

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

$x = -\frac{9}{30} + \frac{10}{30}$

$x = \frac{1}{30}$

46. $-14y - 1.8 = -24y + 3.9$

$-14y - 1.8 + 14y = -24y + 3.9 + 14y$

$-1.8 = -10y + 3.9$

$-1.8 - 3.9 = -10y + 3.9 - 3.9$

$-5.7 = -10y$

$\frac{-5.7}{-10} = \frac{-10y}{-10}$

$0.57 = y$

48. $-3x + 15 = 3x - 15$

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

$-6x + 15 = -15$

$-6x + 15 - 15 = -15 - 15$

$-6x = -30$

$\frac{-6x}{-6} = \frac{-30}{-6}$

$x = 5$

50. $81 = 3x$

$\frac{81}{3} = \frac{3x}{3}$

$27 = x$

52. $6.3 = -0.6x$

$\frac{6.3}{-0.6} = \frac{-0.6x}{-0.6}$

$-10.5 = x$

54. $10y + 15 = -5$

$10y + 15 - 15 = -5 - 15$

$10y = -20$

$\frac{10y}{10} = \frac{-20}{10}$

$y = -2$

56. $2 - 0.4p = 2$

$-2 + 2 - 0.4p = -2 + 2$

$-0.4p = 0$

$\frac{-0.4p}{-0.4} = \frac{0}{-0.4}$

$p = 0$

58. $20x - 20 = 16x - 40$

$20x - 20 + 20 = 16x - 40 + 20$

$20x = 16x - 20$

$20x - 16x = 16x - 20 - 16x$

$4x = -20$

$\frac{4x}{4} = \frac{-20}{4}$

$x = -5$

60. $7(2x+1) = 18x - 19x$

$14x + 7 = -x$

$-14x + 14x + 7 = -14x - x$

$7 = -15x$

$\frac{7}{-15} = \frac{-15x}{-15}$

$-\frac{7}{15} = x$

62. $-\frac{4}{5}r = -5$

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

$r = \frac{25}{4}$

64. $-\frac{10}{3}x = 30$

$-\frac{3}{10} \cdot \left(-\frac{10}{3}x\right) = -\frac{3}{10} \cdot 30$

$x = -9$

66. $-3n - \frac{1}{3} = \frac{8}{3}$

$-3n - \frac{1}{3} + \frac{1}{3} = \frac{8}{3} + \frac{1}{3}$

$-3n = \frac{9}{3}$

$-3n = 3$

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

$n = -1$

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

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

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

74.
$$\begin{aligned} x + \frac{3}{7} &= -x + \frac{1}{3} + \frac{4}{7} \\ x + \frac{3}{7} &= -x + \frac{7}{21} + \frac{12}{21} \\ x + \frac{3}{7} &= -x + \frac{19}{21} \\ x + \frac{3}{7} - \frac{3}{7} &= -x + \frac{19}{21} - \frac{3}{7} \\ x &= -x + \frac{19}{21} - \frac{9}{21} \\ x &= -x + \frac{10}{21} \\ x + x &= -x + \frac{10}{21} + x \\ 2x &= \frac{10}{21} \\ \frac{1}{2} \cdot 2x &= \frac{1}{2} \cdot \frac{10}{21} \\ x &= \frac{5}{21} \end{aligned}$$

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

78. If x represents the first of three consecutive even integers, then $x + 2$ and $x + 4$ represent the second and third even integers, respectively. Thus, the sum is represented by $x + x + 2 + x + 4 = 3x + 6$.

80. If x represents the first integer, then $x + 1$ represents the second consecutive integer. The sum of 20 and the second integer is represented by $20 + x + 1 = x + 21$.

82. If x represents the first odd integer, then $x + 2$ represents the next consecutive odd integer. The sum of the lengths is $x + x + 2 + x + x + 2 = 4x + 4$.

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

86.
$$\begin{aligned} -(3a - 3) + 2a - 6 &= -3a + 3 + 2a - 6 \\ &= -3a + 2a + 3 - 6 \\ &= -a - 3 \end{aligned}$$

88.
$$\begin{aligned} 8(z - 6) + 7z - 1 &= 8z - 48 + 7z - 1 \\ &= 8z + 7z - 48 - 1 \\ &= 15z - 49 \end{aligned}$$

90. If the solution is $\frac{1}{2}$, then replacing x by $\frac{1}{2}$ results in a true statement.

$$\begin{aligned} __ \cdot \frac{1}{2} &= 10 \\ __ \cdot \frac{1}{2} \cdot 2 &= 10 \cdot 2 \\ __ &= 20 \end{aligned}$$

The missing number is 20.

92. answers may vary

94. answers may vary

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96. $0.06y + 2.63 = 2.5562$
$0.06y + 2.63 - 2.63 = 2.5562 - 2.63$
$0.06y = -0.0738$
$\frac{0.06y}{0.06} = \frac{-0.0738}{0.06}$
$y = -1.23$

Section 2.3 Practice Exercises

1. $5(3x-1)+2 = 12x+6$
$15x - 5 + 2 = 12x + 6$
$15x - 3 = 12x + 6$
$15x - 3 - 12x = 12x + 6 - 12x$
$3x - 3 = 6$
$3x - 3 + 3 = 6 + 3$
$3x = 9$
$\frac{3x}{3} = \frac{9}{3}$
$x = 3$

Check: $5(3x-1)+2 = 12x+6$
$5[3(3)-1]+2 \stackrel{?}{=} 12(3)+6$
$5(9-1)+2 \stackrel{?}{=} 36+6$
$5(8)+2 \stackrel{?}{=} 42$
$40+2 \stackrel{?}{=} 42$
$42 = 42$ True

The solution is 3.

2. $9(5-x) = -3x$
$45 - 9x = -3x$
$45 - 9x + 9x = -3x + 9x$
$45 = 6x$
$\frac{45}{6} = \frac{6x}{6}$
$\frac{15}{2} = x$

Check: $9(5-x) = -3x$
$9\left(5 - \frac{15}{2}\right) \stackrel{?}{=} -3\left(\frac{15}{2}\right)$
$9\left(\frac{10}{2} - \frac{15}{2}\right) \stackrel{?}{=} -\frac{45}{2}$
$9\left(-\frac{5}{2}\right) \stackrel{?}{=} -\frac{45}{2}$
$-\frac{45}{2} = -\frac{45}{2}$ True

The solution is $\frac{15}{2}$.

3. $\frac{5}{2}x - 1 = \frac{3}{2}x - 4$
$2\left(\frac{5}{2}x - 1\right) = 2\left(\frac{3}{2}x - 4\right)$
$5x - 2 = 3x - 8$
$5x - 2 - 3x = 3x - 8 - 3x$
$2x - 2 = -8$
$2x - 2 + 2 = -8 + 2$
$2x = -6$
$\frac{2x}{2} = \frac{-6}{2}$
$x = -3$

Check: $\frac{5}{2}x - 1 = \frac{3}{2}x - 4$
$\frac{5}{2}(-3) - 1 \stackrel{?}{=} \frac{3}{2}(-3) - 4$
$-\frac{15}{2} - 1 \stackrel{?}{=} -\frac{9}{2} - 4$
$-\frac{15}{2} - \frac{2}{2} \stackrel{?}{=} -\frac{9}{2} - \frac{8}{2}$
$-\frac{17}{2} = -\frac{17}{2}$ True

The solution is -3.

4. $\frac{3(x-2)}{5} = 3x + 6$
$5 \cdot \frac{3(x-2)}{5} = 5(3x+6)$
$3(x-2) = 5(3x+6)$
$3x - 6 = 15x + 30$
$3x - 6 - 3x = 15x + 30 - 3x$
$-6 = 12x + 30$
$-6 - 30 = 12x + 30 - 30$
$-36 = 12x$
$\frac{-36}{12} = \frac{12x}{12}$
$-3 = x$

Check: $\frac{3(x-2)}{5} = 3x + 6$
$\frac{3(-3-2)}{5} \stackrel{?}{=} 3(-3) + 6$
$\frac{3(-5)}{5} \stackrel{?}{=} -9 + 6$
$\frac{-15}{5} \stackrel{?}{=} -3$
$-3 = -3$

The solution is -3.

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5. $0.06x - 0.10(x-2) = -0.16$
$100[0.06x - 0.10(x-2)] = 100[-0.16]$
$6x - 10(x-2) = -16$
$6x - 10x + 20 = -16$
$-4x + 20 = -16$
$-4x + 20 - 20 = -16 - 20$
$-4x = -36$
$\frac{-4x}{-4} = \frac{-36}{-4}$
$x = 9$
To check, replace x with 9 in the original equation. The solution is 9.

6. $5(2-x) + 8x = 3(x-6)$
$10 - 5x + 8x = 3x - 18$
$10 + 3x = 3x - 18$
$10 + 3x - 3x = 3x - 18 - 3x$
$10 = -18$
Since the statement $10 = -18$ is false, the equation has no solution.

7. $-6(2x+1) - 14 = -10(x+2) - 2x$
$-12x - 6 - 14 = -10x - 20 - 2x$
$-12x - 20 = -12x - 20$
$12x - 12x - 20 = 12x - 12x - 20$
$-20 = -20$
Since $-20 = -20$ is a true statement, every real number is a solution.

Calculator Explorations

1. $2x = 48 + 6x$
2 × (−) 12 = Display: −24
48 + 6 × (−) 12 = Display: −24
Since the left side equals the right side, $x = -12$ is a solution.

2. $-3x - 7 = 3x - 1$
(−) 3 × (−) 1 − 7 = Display: −4
3 × (−) 1 − 1 = Display: −4
Since the left side equals the right side, $x = -1$ is a solution.

3. $5x - 2.6 = 2(x + 0.8)$
5 × 4.4 − 2.6 = Display: 19.4
2 (4.4 + 0.8) = Display: 10.4
Since the left side does not equal the right side, $x = 4.4$ is not a solution.

4. $-1.6x - 3.9 = -6.9x - 25.6$
(−) 1.6 × 5 − 3.9 = Display: −11.9
(−) 6.9 × 5 − 25.6 = Display: −60.1
Since the left side does not equal the right side, $x = 5$ is not a solution.

5. $\frac{564x}{4} = 200x - 11(649)$
(564 × 121) ÷ 4 = Display: 17061
200 × 121 − 11 × 649 = Display: 17061
Since the left side equals the right side, $x = 121$ is a solution.

6. $20(x - 39) = 5x - 432$
20 (23.2 − 39) = Display: −316
5 × 23.2 − 432 = Display: −316
Since the left side equals the right side, $x = 23.2$ is a solution.

Vocabulary, Readiness & Video Check 2.3

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

2. $x - 7$ is an expression.

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

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

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

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

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

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

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

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

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

12. a. If you have a true statement, then the equation has all real numbers as a solution.

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b. If you have a false statement, then the equation has no solutions.

Exercise Set 2.3

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

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

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

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

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

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

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

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

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

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

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

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

30.
$$14x+7=7(2x+1)$$
$$14x+7=14x+7$$
Since both sides of the equation are identical, the equation is an identity and every real number is a solution.

32.
$$\frac{x}{3}-2=\frac{x}{3}$$
$$\frac{x}{3}-2-\frac{x}{3}=\frac{x}{3}-\frac{x}{3}$$
$$-2=0$$
Since the statement $-2 = 0$ is false, the equation has no solution.

34.
$$2(x-5)=2x+10$$
$$2x-10=2x+10$$
$$2x-10-2x=2x+10-2x$$
$$-10=10$$
Since the statement $-10 = 10$ is false, the equation has no solution.

36.
$$-5(4y-3)+2=-20y+17$$
$$-20y+15+2=-20y+17$$
$$-20y+17=-20y+17$$
Since both sides of the equation are identical, the equation is an identity and every real number is a solution.

38.
$$\frac{4(5-w)}{3}=-w$$
$$3\cdot\frac{4(5-w)}{3}=3(-w)$$
$$4(5-w)=-3w$$
$$20-4w=-3w$$
$$20-4w+4w=-3w+4w$$
$$20=w$$

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

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

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

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

48. $3(2x-1)+5=6x+2$
$6x-3+5=6x+2$
$6x+2=6x+2$
Since both sides of the equation are identical, the equation is an identity and every real number is a solution.

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

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

56. $4(2+x)+1=7x-3(x-2)$
$8+4x+1=7x-3x+6$
$9+4x=4x+6$
$9+4x-4x=4x+6-4x$
$9=6$
Since the statement 9 = 6 is false, the equation has no solution.

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58. $-0.01(5x+4) = 0.04 - 0.01(x+4)$
$-1(5x+4) = 4 - 1(x+4)$
$-5x - 4 = 4 - x - 4$
$-5x - 4 = -x$
$-5x - 4 + 5x = -x + 5x$
$-4 = 4x$
$\frac{-4}{4} = \frac{4x}{4}$
$-1 = x$

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

62. $\frac{5}{9}x + 2 - \frac{1}{6}x = \frac{11}{18}x + \frac{1}{3}$
$18\left(\frac{5}{9}x + 2 - \frac{1}{6}x\right) = 18\left(\frac{11}{18}x + \frac{1}{3}\right)$
$10x + 36 - 3x = 11x + 6$
$7x + 36 = 11x + 6$
$7x + 36 - 7x = 11x + 6 - 7x$
$36 = 4x + 6$
$36 - 6 = 4x + 6 - 6$
$30 = 4x$
$\frac{30}{4} = \frac{4x}{4}$
$\frac{15}{2} = x$

64. $2x - \frac{1}{10} = \frac{2}{5} - \frac{1}{4}x - \frac{17}{20}$
$20\left(2x - \frac{1}{10}\right) = 20\left(\frac{2}{5} - \frac{1}{4}x - \frac{17}{20}\right)$
$40x - 2 = 8 - 5x - 17$
$40x - 2 = -9 - 5x$
$40x - 2 + 5x = -9 - 5x + 5x$
$45x - 2 = -9$
$45x - 2 + 2 = -9 + 2$
$45x = -7$
$\frac{45x}{45} = \frac{-7}{45}$
$x = -\frac{7}{45}$

66. The total length is the sum of the two lengths.
$x + (7x - 9) = x + 7x - 9$
$= 8x - 9$
The total length is $(8x - 9)$ feet.

68. Three times a number is $3x$.

70. The difference of 8 and twice a number is $8 - 2x$.

72. The quotient of -12 and the difference of a number and 3 is $\frac{-12}{x-3}$.

74. a. $x + 3 = x + 5$
$x + 3 - x = x + 5 - x$
$3 = 5$
Since the statement $3 = 5$ is false, the equation has no solution.

b. answers may vary

c. answers may vary

76. $3x + 1 = 3x + 2$
$3x + 1 - 3x = 3x + 2 - 3x$
$1 = 2$
Since the statement $1 = 2$ is false, the equation has no solution. The choice is b.

78. $x - 11x - 3 = -10x - 1 - 2$
$-10x - 3 = -10x - 3$
Since both sides of the equation are identical, the equation is an identity and every real number is a solution. The choice is a.

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80. $-x+15=x+15$
$-x+15-15=x+15-15$
$-x=x$
$-x-x=x-x$
$-2x=0$
$\frac{-2x}{-2}=\frac{0}{-2}$
$x=0$
The choice is c.

82. answers may vary

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

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

c. The lengths of the sides are:
$x=6$ meters
$2x+1=2(6)+1=12+1=13$ meters
$3x-2=3(6)-2=18-2=16$ meters

86. answers may vary

88. $1000(x+40)=100(16+7x)$
$1000x+40,000=1600+700x$
$1000x+40,000-700x=1600+700x-700x$
$40,000+300x=1600$
$40,000+300x-40,000=1600-40,000$
$300x=-38,400$
$\frac{300x}{300}=\frac{-38,400}{300}$
$x=-128$

90. $0.127x-2.685=0.027x-2.38$
$127x-2685=27x-2380$
$127x-2685-27x=27x-2380-27x$
$100x-2685=-2380$
$100x-2685+2685=-2380+2685$
$100x=305$
$\frac{100x}{100}=\frac{305}{100}$
$x=3.05$

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. $9y=108$
$\frac{9y}{9}=\frac{108}{9}$
$y=12$

4. $-3x=78$
$\frac{-3x}{-3}=\frac{78}{-3}$
$x=-26$

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

6. $5y-42=-47$
$5y-42+42=-47+42$
$5y=-5$
$\frac{5y}{5}=\frac{-5}{5}$
$y=-1$

7. $\frac{2}{3}x=9$
$\frac{3}{2}\cdot\frac{2}{3}x=\frac{3}{2}\cdot 9$
$x=\frac{27}{2}$

8. $\frac{4}{5}z=10$
$\frac{5}{4}\cdot\frac{4}{5}z=\frac{5}{4}\cdot 10$
$z=\frac{50}{4}$
$z=\frac{25}{2}$

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

$-4 \cdot \dfrac{r}{-4} = -4 \cdot (-2)$

$r = 8$

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

$-8 \cdot \dfrac{y}{-8} = -8 \cdot 8$

$y = -64$

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

$-2x + 14 = 10$

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

$-2x = -4$

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

$x = 2$

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

$-6y + 1 = 19$

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

$-6y = 18$

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

$y = -3$

13. $2x - 7 = 6x - 27$

$2x - 7 + 7 = 6x - 27 + 7$

$2x = 6x - 20$

$2x - 6x = 6x - 20 - 6x$

$-4x = -20$

$\dfrac{-4x}{-4} = \dfrac{-20}{-4}$

$x = 5$

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

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

$3 + 5y = -2$

$-3 + 3 + 5y = -3 - 2$

$5y = -5$

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

$y = -1$

15. $9(3x - 1) = -4 + 49$

$27x - 9 = 45$

$27x - 9 + 9 = 45 + 9$

$27x = 54$

$\dfrac{27x}{27} = \dfrac{54}{27}$

$x = 2$

16. $12(2x + 1) = -6 + 66$

$24x + 12 = 60$

$24x + 12 - 12 = 60 - 12$

$24x = 48$

$\dfrac{24x}{24} = \dfrac{48}{24}$

$x = 2$

17. $-3a + 6 + 5a = 7a - 8a$

$6 + 2a = -a$

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

$6 = -3a$

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

$-2 = a$

18. $4b - 8 - b = 10b - 3b$

$3b - 8 = 7b$

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

$-8 = 4b$

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

$-2 = b$

19. $-\dfrac{2}{3}x = \dfrac{5}{9}$

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

$x = -\dfrac{15}{18}$

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

20. $-\dfrac{3}{8}y = -\dfrac{1}{16}$

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

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

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21. $10 = -6n + 16$
$10 - 16 = -6n + 16 - 16$
$-6 = -6n$
$\frac{-6}{-6} = \frac{-6n}{-6}$
$1 = n$

22. $-5 = -2m + 7$
$-5 - 7 = -2m + 7 - 7$
$-12 = -2m$
$\frac{-12}{-2} = \frac{-2m}{-2}$
$6 = m$

23. $3(5c - 1) - 2 = 13c + 3$
$15c - 3 - 2 = 13c + 3$
$15c - 5 = 13c + 3$
$15c - 5 + 5 = 13c + 3 + 5$
$15c = 13c + 8$
$15c - 13c = 13c + 8 - 13c$
$2c = 8$
$\frac{2c}{2} = \frac{8}{2}$
$c = 4$

24. $4(3t + 4) - 20 = 3 + 5t$
$12t + 16 - 20 = 3 + 5t$
$12t - 4 = 3 + 5t$
$12t - 4 - 5t = 3 + 5t - 5t$
$7t - 4 = 3$
$7t - 4 + 4 = 3 + 4$
$7t = 7$
$\frac{7t}{7} = \frac{7}{7}$
$t = 1$

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

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

27. $-2(2x - 5) = -3x + 7 - x + 3$
$-4x + 10 = -4x + 10$
Since both sides of the equation are identical, the equation is an identity and every real number is a solution.

28. $-4(5x - 2) = -12x + 4 - 8x + 4$
$-20x + 8 = -20x + 8$
Since both sides of the equation are identical, the equation is an identity and every real number is a solution.

29. $0.02(6t - 3) = 0.04(t - 2) + 0.02$
$2(6t - 3) = 4(t - 2) + 2$
$12t - 6 = 4t - 8 + 2$
$12t - 6 = 4t - 6$
$12t - 6 - 4t = 4t - 6 - 4t$
$8t - 6 = -6$
$8t - 6 + 6 = -6 + 6$
$8t = 0$
$\frac{8t}{8} = \frac{0}{8}$
$t = 0$

30. $0.03(m + 7) = 0.02(5 - m) + 0.03$
$3(m + 7) = 2(5 - m) + 3$
$3m + 21 = 10 - 2m + 3$
$3m + 21 = 13 - 2m$
$3m + 21 + 2m = 13 - 2m + 2m$
$5m + 21 = 13$
$5m + 21 - 21 = 13 - 21$
$5m = -8$
$\frac{5m}{5} = \frac{-8}{5}$
$m = -1.6$

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31.
$$-3y = \frac{4(y-1)}{5}$$
$$5(-3y) = 5\left[\frac{4(y-1)}{5}\right]$$
$$-15y = 4(y-1)$$
$$-15y = 4y-4$$
$$-15y-4y = 4y-4-4y$$
$$-19y = -4$$
$$\frac{-19y}{-19} = \frac{-4}{-19}$$
$$y = \frac{4}{19}$$

32.
$$-4x = \frac{5(1-x)}{6}$$
$$6(-4x) = 6\cdot\frac{5(1-x)}{6}$$
$$-24x = 5(1-x)$$
$$-24x = 5-5x$$
$$-24x+5x = 5-5x+5x$$
$$-19x = 5$$
$$\frac{-19x}{-19} = \frac{5}{-19}$$
$$x = -\frac{5}{19}$$

33.
$$\frac{5}{3}x-\frac{7}{3} = x$$
$$3\left(\frac{5}{3}x-\frac{7}{3}\right) = 3x$$
$$5x-7 = 3x$$
$$-5x+5x-7 = -5x+3x$$
$$-7 = -2x$$
$$\frac{-7}{-2} = \frac{-2x}{-2}$$
$$\frac{7}{2} = x$$

34.
$$\frac{7}{5}n+\frac{3}{5} = -n$$
$$5\left(\frac{7}{5}n+\frac{3}{5}\right) = 5(-n)$$
$$7n+3 = -5n$$
$$-7n+7n+3 = -7n-5n$$
$$3 = -12n$$
$$\frac{3}{-12} = \frac{-12n}{-12}$$
$$-\frac{1}{4} = n$$

35.
$$\frac{1}{10}(3x-7) = \frac{3}{10}x+5$$
$$\frac{3}{10}x-\frac{7}{10} = \frac{3}{10}x+5$$
$$-\frac{3}{10}x+\frac{3}{10}x-\frac{7}{10} = -\frac{3}{10}x+\frac{3}{10}x+5$$
$$-\frac{7}{10} = 5$$

Since the statement $-\frac{7}{10} = 5$ is false, the equation has no solution.

36.
$$\frac{1}{7}(2x-5) = \frac{2}{7}x+1$$
$$7\cdot\frac{1}{7}(2x-5) = 7\left(\frac{2}{7}x+1\right)$$
$$2x-5 = 2x+7$$
$$2x-5-2x = 2x+7-2x$$
$$-5 = 7$$

Since the statement $-5 = 7$ is false, the equation has no solution.

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

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

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Section 2.4 Practice Exercises

1. Let x represent the number.

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

The number is 9.

2. Let x represent the number.

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

The number is 12.

3. Let x represent the length of the shorter piece. Then $5x$ represents the length of the longer piece. Their sum is 18 feet.

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

The shorter piece is 3 feet and the longer piece is $5(3) = 15$ feet.

4. Let x represent the number of votes for Texas. Then $x + 17$ represents the number of votes for California. Their sum is 93.

$$\begin{aligned} x+x+17 &= 93 \\ 2x+17 &= 93 \\ 2x+17-17 &= 93-17 \\ 2x &= 76 \\ \frac{2x}{2} &= \frac{76}{2} \\ x &= 38 \end{aligned}$$

Texas has 38 electoral votes and California has $38 + 17 = 55$ electoral votes.

5. Let x represent the number of miles driven. The cost for x miles is $0.15x$. The daily cost is \$28.

$$\begin{aligned} 0.15x+28 &= 52 \\ 0.15x+28-28 &= 52-28 \\ 0.15x &= 24 \\ \frac{0.15x}{0.15} &= \frac{24}{0.15} \\ x &= 160 \end{aligned}$$

You drove 160 miles.

6. Let x represent the measure of the smallest angle. Then $2x$ represents the measure of the second angle and $3x$ represents the measure of the third angle. The sum of the measures of the angles of a triangle equals 180.

$$\begin{aligned} x+2x+3x &= 180 \\ 6x &= 180 \\ \frac{6x}{6} &= \frac{180}{6} \\ x &= 30 \end{aligned}$$

If $x = 30$, then $2x = 2(30) = 60$ and $3x = 3(30) = 90$.

The smallest is 30°, second is 60°, and third is 90°.

7. If x is the first even integer, then $x + 2$ and $x + 4$ are the next two even integers.

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

If $x = 46$, then $x + 2 = 48$ and $x + 4 = 50$. The integers are 46, 48, 50.

Vocabulary, Readiness & Video Check 2.4

1. If x is the number, then "double the number" is $2x$, and "double the number, decreased by 31" is $2x - 31$.

2. If x is the number, then "three times the number" is $3x$, and "three times the number, increased by 17" is $3x + 17$.

3. If x is the number, then "the sum of the number and 5" is $x + 5$, and "twice the sum of the number and 5" is $2(x + 5)$.

4. If x is the number, then "the difference of the number and 11" is $x - 11$, and "seven times the difference of the number and 11" is $7(x - 11)$.

5. If y is the number, then "the difference of 20 and the number" is $20 - y$, and "the difference of 20 and the number, divided by 3" is $\frac{20-y}{3}$ or $(20 - y) \div 3$.

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6. If y is the number, then "the sum of -10 and the number" is $-10 + y$, and "the sum of -10 and the number, divided by 9" is $\frac{(-10+y)}{9}$ or $(-10 + y) \div 9$.

7. in the statement of the application

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

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

Exercise Set 2.4

2.
$$\begin{aligned} 3x-1 &= 2x \\ 3x-1-3x &= 2x-3x \\ -1 &= -x \\ \frac{-1}{-1} &= \frac{-x}{-1} \\ 1 &= x \end{aligned}$$
The number is 1.

4.
$$\begin{aligned} 4x-2 &= 5x-2 \\ 4x-2-4x &= 5x-2-4x \\ -2 &= x-2 \\ -2+2 &= x-2+2 \\ 0 &= x \end{aligned}$$
The number is 0.

6.
$$\begin{aligned} 5[x+(-1)] &= 6x \\ 5(x-1) &= 6x \\ 5x-5 &= 6x \\ 5x-5-5x &= 6x-5x \\ -5 &= x \end{aligned}$$
The number is -5.

8.
$$\begin{aligned} 2(x-4) &= x-\frac{1}{4} \\ 2x-8 &= x-\frac{1}{4} \\ 2x-8-x &= x-\frac{1}{4}-x \\ x-8 &= -\frac{1}{4} \\ x-8+8 &= -\frac{1}{4}+8 \\ x &= -\frac{1}{4}+\frac{32}{4} \\ x &= \frac{31}{4} \end{aligned}$$
The number is $\frac{31}{4}$.

10. The sum of the three lengths is 46 feet.
$$\begin{aligned} x+3x+2+7x &= 46 \\ 11x+2 &= 46 \\ 11x+2-2 &= 46-2 \\ 11x &= 44 \\ \frac{11x}{11} &= \frac{44}{11} \\ x &= 4 \end{aligned}$$
$3x = 3(4) = 12$
$2 + 7x = 2 + 7(4) = 2 + 28 = 30$
The lengths are 4 feet, 12 feet, and 30 feet.

12. Let x be the length of the shorter piece. Then $3x + 1$ is the length of the longer piece. The sum of the lengths is 21 feet.
$$\begin{aligned} x+3x+1 &= 21 \\ 4x+1 &= 21 \\ 4x+1-1 &= 21-1 \\ 4x &= 20 \\ \frac{4x}{4} &= \frac{20}{4} \\ x &= 5 \end{aligned}$$
$3x + 1 = 3(5) + 1 = 15 + 1 = 16$
The shorter piece is 5 feet and the longer piece is 16 feet.

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14. Let x represent the number of gold medals won by the Chinese team. Then $x + 8$ represents the number of gold medals won by the U.S. team.

$$\begin{aligned} x+x+8 &= 84 \\ 2x+8 &= 84 \\ 2x+8-8 &= 84-8 \\ 2x &= 76 \\ \frac{2x}{2} &= \frac{76}{2} \\ x &= 38 \end{aligned}$$

$x + 8 = 38 + 8 = 46$

The Chinese team won 38 gold medals and the U.S. team won 46 gold medals.

16. Let x be the number of hours. Then the total cost is $27x + 80$.

$$\begin{aligned} 27x+80 &= 404 \\ 27x+80-80 &= 404-80 \\ 27x &= 324 \\ \frac{27x}{27} &= \frac{324}{27} \\ x &= 12 \end{aligned}$$

She expects the job to take 12 hours.

18. Let x be the number of hours. Then the total cost is $25.50x + 30$.

$$\begin{aligned} 25.5x+30 &= 119.25 \\ 25.5x+30-30 &= 119.25-30 \\ 25.5x &= 89.25 \\ \frac{25.5x}{25.5} &= \frac{89.25}{25.5} \\ x &= 3.5 \end{aligned}$$

You were charged for 3.5 hours.

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

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

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

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

22. Let angles B and C have measure x. Then angle A has measure $x - 42$. The sum of the measures is 180°.

$$\begin{aligned} x+x+x-42 &= 180 \\ 3x-42 &= 180 \\ 3x-42+42 &= 180+42 \\ 3x &= 222 \\ \frac{3x}{3} &= \frac{222}{3} \\ x &= 74 \end{aligned}$$

$x - 42 = 74 - 42 = 32$

Angles B and C measure 74° and angle A measures 32°.

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	First Integer	Next Integers			Indicated Sum
24.	x	$x+1$	$x+2$		$(x+1)+(x+2)=2x+3$
26.	x	$x+2$	$x+4$		$x+(x+2)+(x+4)=3x+6$
28.	x	$x+1$	$x+2$	$x+3$	$x+(x+3)=2x+3$
30.	x	$x+2$	$x+4$		$x+(x+2)+(x+4)=3x+6$

32. If x is the first even integer, the next consecutive even integer is $x+2$.

$$\begin{aligned} x+x+2&=654\\ 2x+2&=654\\ 2x+2-2&=654-2\\ 2x&=652\\ \frac{2x}{2}&=\frac{652}{2}\\ x&=326 \end{aligned}$$

The room numbers are 326 and 326 + 2 = 328.

34. If x is the first odd integer, the next two odd integers are $x+2$ and $x+4$.

$$\begin{aligned} x+x+2+x+4&=51\\ 3x+6&=51\\ 3x+6-6&=51-6\\ 3x&=45\\ \frac{3x}{3}&=\frac{45}{3}\\ x&=15 \end{aligned}$$

The code is 15, 15 + 2 = 17, 15 + 4 = 19.

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

$$\begin{aligned} x+5x+1&=25\\ 6x+1&=25\\ 6x+1-1&=25-1\\ 6x&=24\\ \frac{6x}{6}&=\frac{24}{6}\\ x&=4 \end{aligned}$$

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

The pieces measure 4 feet and 21 feet.

38. Let x represent the floor space of the Empire State Building in thousands of square feet. Then the floor space of the Pentagon is $3x$.

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

$3x = 3(2175) = 6525$

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

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40. The sum of the measures is 90°.

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

$2x - 3 = 2(31) - 3 = 62 - 3 = 59$

The angles measure 31° and 59°.

42. Let x be the first odd integer. Then the next three consecutive odd integers are $x + 2$, $x + 4$, and $x + 6$. The sum of the measures is 360°.

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

$x + 2 = 87 + 2 = 89$

$x + 4 = 87 + 4 = 91$

$x + 6 = 87 + 6 = 93$

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

44.

$$\begin{aligned} \frac{2}{3}+4x&=5x-\frac{5}{6}\\ 6\cdot\left(\frac{2}{3}+4x\right)&=6\cdot\left(5x-\frac{5}{6}\right)\\ 4+24x&=30x-5\\ 4+24x-24x&=30x-5-24x\\ 4&=6x-5\\ 4+5&=6x-5+5\\ 9&=6x\\ \frac{9}{6}&=\frac{6x}{6}\\ \frac{3}{2}&=x \end{aligned}$$

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

46. Let x be the amount the son receives. Then $2x$ is the amount the husband receives. The sum of the amounts is $15,000.

$$\begin{aligned} x+2x&=15,000\\ 3x&=15,000\\ \frac{3x}{3}&=\frac{15,000}{3}\\ x&=5,000 \end{aligned}$$

$2x = 2(5,000) = 10,000$

The son receives $5000 and the husband receives $10,000.

48. Let x represent the number of Democrat governors. Then the number of Republican governors is $x + 10$. The total number of governors is 50.

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

$x + 10 = 20 + 10 = 30$

There were 20 Democrat governors and 30 Republican governors.

50. Let x be the first even integer. The next two consecutive even integers are $x + 2$ and $x + 4$. The three integers total 48.

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

$x + 2 = 14 + 2 = 16$

$x + 4 = 14 + 4 = 18$

The boards have lengths 14 inches, 16 inches, and 18 inches.

52. Let x represent the width. Then $2x - 70$ represents the height.

$$\begin{aligned} x+2x-70&=335\\ 3x-70&=335\\ 3x-70+70&=335+70\\ 3x&=405\\ \frac{3x}{3}&=\frac{405}{3}\\ x&=135 \end{aligned}$$

$2x - 70 = 2(135) - 70 = 270 - 70 = 200$

The width of an iPad Mini is 135 mm and the height is 200 mm.

54.

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

The number is 0.

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

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

$3x = 3(22) = 66$

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

58. Let x represent the first odd integer. Then $x + 2$ and $x + 4$ represent the next two consecutive odd integers.

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

$x + 2 = 223 + 2 = 225$

$x + 4 = 223 + 4 = 227$

Mali Republic's code is 223, Côte d'Ivoire's code is 225, and Niger's code is 227.

60. Let x represent the number, in millions, of middle-sized cars sold. Then $x - 1.1$ represents the number of pickups sold.

$$x+x-1.1=4.9$$
$$2x-1.1=4.9$$
$$2x-1.1+1.1=4.9+1.1$$
$$2x=6.0$$
$$\frac{2x}{2}=\frac{6.0}{2}$$
$$x=3.0$$

$x - 1.1 = 3.0 - 1.1 = 1.9$

There were 3.0 million middle-sized cars sold and 1.9 million pickups sold.

62. Let x be the measure of the smallest angle. Then the two larger angles both measure $4x$.

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

$4x = 4(20) = 80$

The angles measure 20°, 80°, and 80°.

64. The bar ending between 30 and 40 represents Texas, so Texas spent between \$30 million and \$40 million on tourism.

66. Let x represent the amount, in millions of dollars, that Texas spent. Then $2x - 19$ represents the amount Illinois spent.

$$x+2x-19=92$$
$$3x-19=92$$
$$3x-19+19=92+19$$
$$3x=111$$
$$\frac{3x}{3}=\frac{111}{3}$$
$$x=37$$

$2x - 19 = 2(37) - 19 = 74 - 19 = 55$

Texas spent \$37 million on tourism and Illinois spent \$55 million.

68. answers may vary

70. Replace B by 14 and h by 22.

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

72. Replace r by 15 and t by 2.

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

74. Let x be the measure of the first angle. Then $2x$ is the measure of the second angle and $5x$ is the measure of the third angle. The measures sum to 180°.

$$x+2x+5x=180$$
$$8x=180$$
$$\frac{8x}{8}=\frac{180}{8}$$
$$x=22.5$$

$2x = 2(22.5) = 45$

$5x = 5(22.5) = 112.5$

Yes, the triangle exists and has angles that measure 22.5°, 45°, and 112.5°.

76. One blink every 5 seconds is $\frac{1 \text{ blink}}{5 \text{ sec}}$.

There are $60 \cdot 60 = 3600$ seconds in one hour.

$$\frac{1 \text{ blink}}{5 \text{ sec}} \cdot 3600 \text{ sec} = 720 \text{ blinks}$$

The average eye blinks 720 times each hour.

$16 \cdot 720 = 11{,}520$

The average eye blinks 11,520 times while awake for a 16-hour day.

$11{,}520 \cdot 365 = 4{,}204{,}800$

The average eye blinks 4,204,800 times in one year.

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78. answers may vary

80. answers may vary

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

Section 2.5 Practice Exercises

1. Use $d = rt$ when $d = 1180$ and $r = 50$.

$$d = rt$$
$$1180 = 50t$$
$$\frac{1180}{50} = \frac{50t}{50}$$
$$23.6 = t$$

They will spend 23.6 hours driving.

2. Use $A = lw$ when $w = 18$.

$$A = lw$$
$$450 = l \cdot 18$$
$$\frac{450}{18} = \frac{18l}{18}$$
$$25 = l$$

The length of the deck is 25 feet.

3. Use $F = \frac{9}{5}C + 32$ with $C = 5$.

$$F = \frac{9}{5}C + 32$$
$$F = \frac{9}{5} \cdot 5 + 32$$
$$F = 9 + 32$$
$$F = 41$$

Thus, 5°C is equivalent to 41°F.

4. Let x be the width. Then $4x + 1$ is the length. The perimeter is 52 meters.

$$P = 2l + 2w$$
$$52 = 2(4x + 1) + 2x$$
$$52 = 8x + 2 + 2x$$
$$52 = 10x + 2$$
$$52 - 2 = 10x + 2 - 2$$
$$50 = 10x$$
$$\frac{50}{10} = \frac{10x}{10}$$
$$5 = x$$

$4x + 1 = 4(5) + 1 = 20 + 1 = 21$
The width is 5 meters and the length is 21 meters.

5.
$$C = 2\pi r$$
$$\frac{C}{2\pi} = \frac{2\pi r}{2\pi}$$
$$\frac{C}{2\pi} = r \text{ or } r = \frac{C}{2\pi}$$

6.
$$P = 2l + 2w$$
$$P - 2w = 2l + 2w - 2w$$
$$P - 2w = 2l$$
$$\frac{P - 2w}{2} = \frac{2l}{2}$$
$$\frac{P - 2w}{2} = l \text{ or } l = \frac{P - 2w}{2}$$

7.
$$P = 2a + b - c$$
$$P + c = 2a + b - c + c$$
$$P + c = 2a + b$$
$$P + c - b = 2a + b - b$$
$$P + c - b = 2a$$
$$\frac{P + c - b}{2} = a \text{ or } a = \frac{P - b - c}{2}$$

8.
$$A = \frac{a + b}{2}$$
$$2A = 2 \cdot \frac{a + b}{2}$$
$$2A = a + b$$
$$2A - a = a + b - a$$
$$2A - a = b \text{ or } b = 2A - a$$

Vocabulary, Readiness & Video Check 2.5

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

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

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

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Exercise Set 2.5

2. Use $d = rt$ when $d = 195$ and $t = 3$.

$$\begin{aligned} d &= rt \\ 195 &= r \cdot 3 \\ \frac{195}{3} &= \frac{3r}{3} \\ 65 &= r \end{aligned}$$

4. Use $V = lwh$ when $l = 14$, $w = 8$, and $h = 3$.

$$\begin{aligned} V &= lwh \\ V &= 14 \cdot 8 \cdot 3 \\ V &= 336 \end{aligned}$$

6. Use $A = \frac{1}{2}h(B+b)$ when $A = 60$, $B = 7$, and $b = 3$.

$$\begin{aligned} A &= \frac{1}{2}h(B+b) \\ 60 &= \frac{1}{2}h(7+3) \\ 60 &= \frac{1}{2}h(10) \\ 60 &= 5h \\ \frac{60}{5} &= \frac{5h}{5} \\ 12 &= h \end{aligned}$$

8. Use $V = \frac{1}{3}Ah$ when $V = 45$ and $h = 5$.

$$\begin{aligned} V &= \frac{1}{3}Ah \\ 45 &= \frac{1}{3}A \cdot 5 \\ 45 &= \frac{5}{3}A \\ \frac{3}{5} \cdot 45 &= \frac{3}{5} \cdot \frac{5}{3}A \\ 27 &= A \end{aligned}$$

10. Use $A = \pi r^2$ when $r = 4$ and 3.14 is used as an approximation for π.

$$\begin{aligned} A &= \pi r^2 \\ A &= 3.14 \cdot 4^2 \\ A &= 3.14 \cdot 16 \\ A &= 50.24 \end{aligned}$$

12.

$$\begin{aligned} C &= 2\pi r \\ \frac{C}{2\pi} &= \frac{2\pi r}{2\pi} \\ \frac{C}{2\pi} &= r \end{aligned}$$

14.

$$\begin{aligned} T &= mnr \\ \frac{T}{mr} &= \frac{mnr}{mr} \\ \frac{T}{mr} &= n \end{aligned}$$

16.

$$\begin{aligned} -x + y &= 13 \\ x - x + y &= x + 13 \\ y &= x + 13 \end{aligned}$$

18.

$$\begin{aligned} A &= P + PRT \\ A - P &= P + PRT - P \\ A - P &= PRT \\ \frac{A-P}{PR} &= \frac{PRT}{PR} \\ \frac{A-P}{PR} &= T \end{aligned}$$

20.

$$\begin{aligned} D &= \frac{1}{4}fk \\ 4D &= 4 \cdot \frac{1}{4}fk \\ 4D &= fk \\ \frac{4D}{f} &= \frac{fk}{f} \\ \frac{4D}{f} &= k \end{aligned}$$

22.

$$\begin{aligned} PR &= x + y + z + w \\ PR - x - y - w &= x + y + z - x - y - w \\ PR - x - y - w &= z \end{aligned}$$

24.

$$\begin{aligned} S &= 4lw + 2wh \\ S - 4lw &= 4lw + 2wh - 4lw \\ S - 4lw &= 2wh \\ \frac{S-4lw}{2w} &= \frac{2wh}{2w} \\ \frac{S-4lw}{2w} &= h \end{aligned}$$

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26. Use $A = lw$ when $A = 52{,}400$ and $l = 400$.

$$A = lw$$
$$52{,}400 = 400 \cdot w$$
$$\frac{52{,}400}{400} = \frac{400w}{400}$$
$$131 = w$$

The width of the sign is 131 feet.

28. a. Area $= bh = 9.3(7) = 65.1$

Perimeter $= 2(11.7) + 2(9.3)$
$= 23.4 + 18.6$
$= 42$

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

b. The border goes around the edges, so it involves perimeter. The paint covers the wall, so it involves area.

30. a. Area $= \frac{1}{2}bh = \frac{1}{2}(36)(27) = 486$

Perimeter = 27 + 36 + 45 = 108

The area is 486 square feet and the perimeter is 108 feet.

b. The fence goes around the edges of the yard, so it involves perimeter. The grass seed covers the yard, so it involves area.

32. Use $F = \frac{9}{5}C + 32$ when $C = -5$.

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

Thus, −5°C is equivalent to 23°F.

34. Use $d = rt$ when $d = 303$ and $t = 8\frac{1}{2}$.

$$d = rt$$
$$303 = r \cdot 8\frac{1}{2}$$
$$303 = \frac{17}{2}r$$
$$\frac{2}{17} \cdot 303 = \frac{2}{17} \cdot \frac{17}{2}r$$
$$\frac{606}{17} = r$$
$$35\frac{11}{17} = r$$

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

36. Let x be the width. Then $2x - 10$ is the length. Use $P = 2 \cdot$ length $+ 2 \cdot$ width when $P = 400$.

$$P = 2 \cdot \text{length} + 2 \cdot \text{width}$$
$$400 = 2(2x - 10) + 2x$$
$$400 = 4x - 20 + 2x$$
$$400 = 6x - 20$$
$$400 + 20 = 6x - 20 + 20$$
$$420 = 6x$$
$$\frac{420}{6} = \frac{6x}{6}$$
$$70 = x$$

The width is 70 meters and the length is $2(70) - 10 = 140 - 10 = 130$ meters.

38. Let x represent the length of each of the equal sides. Then the shortest side is $x - 2$. The perimeter is the sum of the lengths of the sides.

$$x + x + x - 2 = 22$$
$$3x - 2 = 22$$
$$3x - 2 + 2 = 22 + 2$$
$$3x = 24$$
$$\frac{3x}{3} = \frac{24}{3}$$
$$x = 8$$

The shortest side is 6 feet.

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40. Use $d = rt$ when $d = 700$ and $r = 55$.

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

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

42. Use $N = 94$.

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

The temperature is 63.5° Fahrenheit.

44. Use $T = 65$.

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

There are 100 chirps per minute.

46. As the air temperature of their environment decreases, the number of cricket chirps per minute decreases.

48. To find the amount of water in the tank, use

$V = \pi r^2 h$ with $r = \frac{8}{2} = 4$, $h = 3$, and $\pi \approx 3.14$.

$$V = \pi r^2 h = 3.14(4)^2 \cdot 3 = 3.14(16) \cdot 3 = 150.72$$

The tank holds 150.72 cubic meters of water. Let x represent the number of goldfish the tank could hold. Then $2x = 150.72$.

$$2x = 150.72$$
$$\frac{2x}{2} = \frac{150.72}{2}$$
$$x = 75.36$$

The tank could hold 75 goldfish.

50. Use $A = \frac{1}{2}bh$ when $A = 20$ and $b = 5$.

$$A = \frac{1}{2}bh$$
$$20 = \frac{1}{2} \cdot 5 \cdot h$$
$$\frac{2}{5} \cdot 20 = \frac{2}{5} \cdot \frac{5}{2} \cdot h$$
$$8 = h$$

The height of the sail is 8 feet.

52. Use $C = 2\pi r$ when $r = 4000$ and $\pi \approx 3.14$.

$$C = 2\pi r$$
$$C = 2 \cdot 3.14 \cdot 4000$$
$$C = 25{,}120$$

Thus, 25,120 miles of rope is needed to wrap around the Earth.

54. Use $d = rt$ when $r = 0.5$ and $d = 6$.

$$d = rt$$
$$6 = 0.5t$$
$$\frac{6}{0.5} = \frac{0.5t}{0.5}$$
$$12 = t$$

It took roughly 12 hours.

56. Let x be the length of the sides of the square pen. Then $2x - 15$ is the length of the sides of the triangular pen. The perimeters are equal.

$$4x = 3(2x - 15)$$
$$4x = 6x - 45$$
$$4x - 6x = 6x - 45 - 6x$$
$$-2x = -45$$
$$\frac{-2x}{-2} = \frac{-45}{-2}$$
$$x = 22.5$$

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

The square's side length is 22.5 units and the triangle's side length is 30 units.

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58. Use $d = rt$ when $d = 150$ and $r = 45$.

$$d = rt$$
$$150 = 45t$$
$$\frac{150}{45} = \frac{45t}{45}$$
$$3\frac{1}{3} = t \text{ or } t = 3 \text{ hr } 20 \text{ min}$$

If he left at 4 A.M., then he will arrive at 4 A.M. + 3 hr 20 min = 7:20 A.M.

60. Let x be the number of times the bolt can travel around the world in one second.

$$25{,}120x = 270{,}000$$
$$\frac{25{,}120x}{25{,}120} = \frac{270{,}000}{25{,}120}$$
$$x = 10.7$$

The bolt can travel 10.7 times around the world.

62. Use $F = \frac{9}{5}C + 32$ when $C = -10$.

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

Thus, −10°C is equivalent to 14°F.

64. Use $d = rt$ when $d = 2810$ and $r = 105$.

$$2810 = 105t$$
$$\frac{2810}{105} = \frac{105t}{105}$$
$$26.8 \approx t$$

It would take about 26.8 hours.

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

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

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

68. Use $F = \frac{9}{5}C + 32$ when $F = -227$.

$$F = \frac{9}{5}C + 32$$
$$-227 = \frac{9}{5}C + 32$$
$$-227 - 32 = \frac{9}{5}C + 32 - 32$$
$$-259 = \frac{9}{5}C$$
$$-259 \cdot \frac{5}{9} = \frac{5}{9} \cdot \frac{9}{5}C$$
$$-144 \approx C$$

The average temperature on Jupiter is −144°C.

70. 8% = 0.08

72. 0.5% = 0.005

74. 0.03 = 0.03(100%) = 3%

76. 5 = 5(100%) = 500%

78.
$$B = \frac{F}{P - V}$$
$$B(P - V) = \frac{F}{P - V}(P - V)$$
$$B(P - V) = F$$
$$BP - BV = F$$
$$BP - BV - BP = F - BP$$
$$-BV = F - BP$$
$$\frac{-BV}{-B} = \frac{F - BP}{-B}$$
$$V = \frac{BP - F}{B}$$
$$V = \frac{BP}{B} - \frac{F}{B}$$
$$V = P - \frac{F}{B}$$

80. Use $A = bh$. If the base is doubled, the new base is $2b$. If the height is doubled, the new height is $2h$.

$A = (2b)(2h) = 2 \cdot 2 \cdot b \cdot h = 4bh$

The area is multiplied by 4.

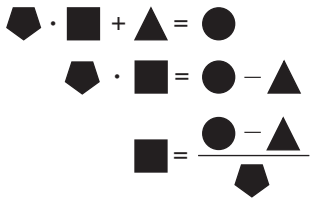
82. Let x be the temperature. Use $F = \frac{9}{5}C + 32$ when $F = C = x$.

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

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

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84. 

$$\blacksquare = \frac{\bullet - \blacktriangle}{\pentagon}$$

86. $\dfrac{20 \text{ inches}}{1 \text{ day}} \cdot \dfrac{1 \text{ foot}}{12 \text{ inches}} \cdot \dfrac{365 \text{ days}}{1 \text{ year}}$

$= \dfrac{20 \cdot 365 \text{ feet}}{12 \text{ year}}$

≈ 608.33 feet/year

The glacier moves 608.33 feet per year.

88. Use $I = PRT$ when $I = 3750$, $P = 25{,}000$ and $R = 0.05$.

$I = PRT$

$3750 = 25{,}000(0.05)T$

$3750 = 1250T$

$\dfrac{3750}{1250} = \dfrac{1250T}{1250}$

$3 = T$

90. Use $V = \dfrac{1}{3}\pi r^2 h$ when $V = 565.2$ and $r = 6$.

$V = \dfrac{1}{3}\pi r^2 h$

$565.2 = \dfrac{1}{3}\pi \cdot 6^2 h$

$\dfrac{3}{\pi \cdot 6^2} \cdot 565.2 = \dfrac{3}{\pi \cdot 6^2} \cdot \dfrac{1}{3}\pi \cdot 6^2 h$

$15 \approx h$

Section 2.6 Practice Exercises

1. Let x be the unknown percent.

$22 = x \cdot 40$

$22 = 40x$

$\dfrac{22}{40} = \dfrac{40x}{40}$

$0.55 = x$

$55\% = x$

The number 22 is 55% of 40.

2. Let x be the unknown number.

$150 = 40\% \cdot x$

$150 = 0.4x$

$\dfrac{150}{0.4} = \dfrac{0.4x}{0.4}$

$375 = x$

The number 150 is 40% of 375.

3. a. From the graph, we see 66% are for solely pleasure.

b. From the graph, 66% are for pleasure and 4% are for combined business/pleasure. The sum is 66% + 4% = 70%.

c. Find 66% of 250.

$0.66(250) = 165$

We expect 165 people to be traveling solely for pleasure.

4. $\text{discount} = \text{percent} \cdot \text{original price}$

$= 40\% \cdot \$400$

$= 0.40 \cdot \$400$

$= \$160$

$\text{new price} = \text{original price} - \text{discount}$

$= \$400 - \$160$

$= \$240$

The discount in price is \$160 and the new price is \$240.

5. $\text{increase} = \text{new} - \text{old} = 200 - 120 = 80$

Let x be the percent of increase.

$80 = x \cdot 120$

$\dfrac{80}{120} = \dfrac{120x}{120}$

$0.667 \approx x$

$66.7\% \approx x$

The percent of increase is 66.7%.

6. Let x be the original price.

$x - 0.20x = 46$

$0.8x = 46$

$\dfrac{0.8x}{0.8} = \dfrac{46}{0.8}$

$x = 57.5$

The original price is \$57.50.

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7. Let x represent the liters of 20% solution.

	Number of Liters	Dye Strength	Amount
20% solution	x	20%	$0.2x$
50% solution	$6 - x$	50%	$0.5(6 - x)$
40% solution	6	40%	0.4(6)

$$0.2x + 0.5(6 - x) = 0.4(6)$$
$$0.2x + 3 - 0.5x = 2.4$$
$$-0.3x + 3 = 2.4$$
$$-0.3x + 3 - 3 = 2.4 - 3$$
$$-0.3x = -0.6$$
$$\frac{-0.3x}{-0.3} = \frac{-0.6}{-0.3}$$
$$x = 2$$

$6 - x = 6 - 2 = 4$

If 2 liters of 20% solution are mixed with 4 liters of 50% solution, the result is 6 liters of 40% solution.

Vocabulary, Readiness & Video Check 2.6

1. no; 25% + 25% + 40% ≠ 100%

2. no; 30% + 30% + 30% ≠ 100%

3. yes; 25% + 25% + 25% + 25% = 100%

4. yes; 40% + 50% + 10% = 100%

5. a. equals; =

b. multiplication; ·

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

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

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

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

8.

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

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

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Exercise Set 2.6

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

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

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

8. From the graph, 23% of overnight stays involved tent camping.

10. 13% of overnight stays involved back-country camping.
$13\% \cdot 1{,}732{,}000 = 0.13 \cdot 1{,}732{,}000 = 225{,}160$
You would expect 225,160 of the stays to involve back-country camping.

12. $\text{discount} = \text{percent} \cdot \text{original price}$
$= 25\% \cdot \$12.50$
$= 0.25 \cdot \$12.50$
$\approx \$3.13$
$\text{new price} = \text{original price} - \text{discount}$
$= \$12.50 - \$3.13$
$= \$9.37$
The discount is \$3.13 and the new price is \$9.37.

14. $20\% \cdot 65.40 = 0.20 \cdot 65.4 = 13.08$
The tip is \$13.08.
65.4 + 13.08 = 78.48
The total cost of the dinner is \$78.48.

16. $\text{percent of decrease} = \frac{\text{amount of decrease}}{\text{original amount}}$
$= \frac{314 - 290}{314}$
$= \frac{24}{314}$
≈ 0.076
The number of complaints decreased by 7.6%.

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18. $\text{percent of increase} = \dfrac{\text{amount of increase}}{\text{original amount}}$

$$= \frac{100-81}{81}$$
$$= \frac{19}{81}$$
$$\approx 0.235$$

The area increased by 23.5%.

20. Let x represent the original price.

$$x + 25\% \cdot x = 80$$
$$x + 0.25x = 80$$
$$1.25x = 80$$
$$\frac{1.25x}{1.25} = \frac{80}{1.25}$$
$$x = 64$$

The original price of the shoes was \$65.

22. Let x represent last year's salary.

$$x + 3\% \cdot x = 55,620$$
$$x + 0.03x = 55,620$$
$$1.03x = 55,620$$
$$\frac{1.03x}{1.03} = \frac{55,620}{1.03}$$
$$x = 54,000$$

Last year's salary was \$54,000.

24. Let x represent the cubic centimeters of 25% solution.

	Number of Cubic cm	· Antibiotic Strength	= Amount of Antibiotic
25% Antibiotic Solution	x	25%	$0.25x$
60% Antibiotic Solution	10	60%	$0.6(10)$
30% Antibiotic Solution Needed	$x + 10$	30%	$0.3(x + 10)$

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

$$0.25x + 0.6(10) = 0.3(x + 10)$$
$$0.25x + 6 = 0.3x + 3$$
$$0.25x + 6 - 3 = 0.3x + 3 - 3$$
$$0.25x + 3 = 0.3x$$
$$0.25x + 3 - 0.25x = 0.3x - 0.25x$$
$$3 = 0.05x$$
$$\frac{3}{0.05} = \frac{0.05x}{0.05}$$
$$60 = x$$

Thus, 60 cubic centimeters should be used.

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26. Let x represent the number of pounds of cashews.

	Number of pounds	· Cost per pound	= Value
\$3 per lb Peanuts	20	3	$3 \cdot 20 = 60$
\$5 per lb Cashews	x	5	$5x$
\$3.50 per lb Mixture Wanted	$20 + x$	3.5	$3.5(20 + x)$

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

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

Mix $6\frac{2}{3}$ pounds of cashews with the peanuts.

28. $140\% \cdot 86 = 1.4 \cdot 86 = 120.4$

30. Let x represent the unknown number.

$$56.25 = 45\% \cdot x$$
$$56.25 = 0.45 \cdot x$$
$$\frac{56.25}{0.45} = \frac{0.45x}{0.45}$$
$$125 = x$$

56.25 is 45% of 125.

32. Let x represent the unknown percent.

$$42 = x \cdot 35$$
$$\frac{42}{35} = \frac{35x}{35}$$
$$1.2 = x$$
$$120\% = x$$

42 is 120% of 35.

34. From the graph, it appears that 65% of the population of Charlottesville, Virginia shops by catalog.

36. $81\% \text{ of } 31{,}275 = 0.81 \cdot 31{,}275 \approx 25{,}333$

We predict 25,333 catalog shoppers live in Juneau.

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38.

The Gap, Inc. Brands North American Stores in 2014		
Store Brand	Number of Stores	Percent of Total (round to nearest percent)
Gap	968	$\frac{968}{2670} \approx 0.363 \approx 36\%$
Athleta	65	$\frac{65}{2670} \approx 0.024 \approx 2\%$
Banana Republic	596	$\frac{596}{2670} \approx 22\%$
Intermix	37	$\frac{37}{2670} \approx 0.014 \approx 1\%$
Old Navy	1004	$\frac{1004}{2670} \approx 0.376 \approx 38\%$
Total	2670	

40. $$\text{percent of decrease} = \frac{\text{amount of decrease}}{\text{original amount}}$$
$$= \frac{24,440 - 22,000}{24,440}$$
$$= \frac{2440}{24,440}$$
$$\approx 0.0998$$
The percent of decrease was 10%.

42. Let x represent the number of people expected to be employed as physician assistants in 2020.
$$83,600 + 0.30 \cdot 83,600 = x$$
$$83,600 + 25,080 = x$$
$$108,680 = x$$
108,680 people are expected to be employed as physician assistants in 2020.

44. $$\text{percent of increase} = \frac{\text{amount of increase}}{\text{original amount}}$$
$$= \frac{24 - 6}{6}$$
$$= \frac{18}{6}$$
$$= 3$$
The area increased by 300%.

46. Markup = $10\% \cdot 89.90 = 0.10 \cdot 89.9 = 8.99$
New price = 89.90 + 8.99 = 98.89
The markup is \$8.99 and the new price is \$98.89.

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48. Let x be the gallons of water.

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

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

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

Thus, 5 gallons of water should be used.

50.
$$\begin{aligned} \text{percent of decrease} &= \frac{\text{amount of decrease}}{\text{original amount}} \\ &= \frac{443 - 421}{443} \\ &= \frac{22}{443} \\ &\approx 0.0497 \end{aligned}$$

The percent of decrease in the size of privately-owned farms was 5.0%.

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

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

There were 3.4 children per woman in 1920.

54. decrease = $15\% \cdot 0.95 = 0.15 \cdot 0.95 \approx 0.14$

$0.95 - 0.14 = 0.81$

The decrease in price was \$0.14. The new price was \$0.81.

56. Let x represent the number of cell phone tower sites in 2012.

$$\begin{aligned} x &= 195,613 + 0.543 \cdot 195,613 \\ &= 195,613 + 106,217.859 \\ &\approx 301,831 \end{aligned}$$

There were 301,831 cell phone tower sites in 2012.

58. $52\% \cdot 225$ million $= 0.52 \cdot 225$ million $= 117$ million

In 2012, approximately 117 million females attended the movies in the United States and Canada.

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

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

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

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

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

62. $\frac{12}{3} = 4, \quad 2^2 = 4$

$\frac{12}{3} = 2^2$ since $4 = 4$.

64. $-3^3 = -3 \cdot 3 \cdot 3 = -27$

$(-3)^3 = (-3)(-3)(-3) = -27$

$-3^3 = (-3)^3$ since $-27 = -27$.

66. $|-2| = 2$

$-|-2| = -2$

$|-2| > -|-2|$ since 2 is to the right of -2 on a number line.

68. yes; answers may vary

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

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

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

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

54 of the 280 calories come from fat.

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

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

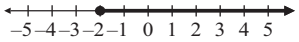
74. answers may vary

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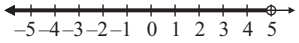
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Section 2.7 Practice Exercises

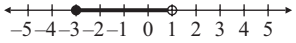
1. $x \geq -2$



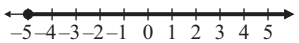
2. $5 > x$ or $x < 5$



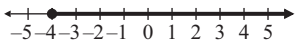
3. $-3 \leq x < 1$



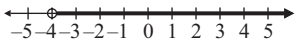
4.
$$x - 6 \geq -11$$
$$x - 6 + 6 \geq -11 + 6$$
$$x \geq -5$$



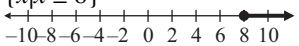
5.
$$-3x \leq 12$$
$$\frac{-3x}{-3} \geq \frac{12}{-3}$$
$$x \geq -4$$



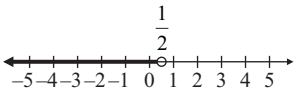
6.
$$5x > -20$$
$$\frac{5x}{5} > \frac{-20}{5}$$
$$x > -4$$



7.
$$-3x + 11 \leq -13$$
$$-3x + 11 - 11 \leq -13 - 11$$
$$-3x \leq -24$$
$$\frac{-3x}{-3} \geq \frac{-24}{-3}$$
$$x \geq 8$$
$$\{x | x \geq 8\}$$



8.
$$2x - 3 > 4(x - 1)$$
$$2x - 3 > 4x - 4$$
$$2x - 3 - 4x > 4x - 4 - 4x$$
$$-2x - 3 > -4$$
$$-2x - 3 + 3 > -4 + 3$$
$$-2x > -1$$
$$\frac{-2x}{-2} < \frac{-1}{-6}$$
$$x < \frac{1}{2}$$
$$\left\{x \middle| x < \frac{1}{2}\right\}$$



9.
$$3(x + 5) - 1 \geq 5(x - 1) + 7$$
$$3x + 15 - 1 \geq 5x - 5 + 7$$
$$3x + 14 \geq 5x + 2$$
$$3x + 14 - 5x \geq 5x + 2 - 5x$$
$$-2x + 14 \geq 2$$
$$-2x + 14 - 14 \geq 2 - 14$$
$$-2x \geq -12$$
$$\frac{-2x}{-2} \leq \frac{-12}{-2}$$
$$x \leq 6$$
$$\{x | x \leq 6\}$$

10. Let x be the unknown number.
$$35 - 2x > 15$$
$$35 - 2x - 35 > 15 - 35$$
$$-2x > -20$$
$$\frac{-2x}{-2} < \frac{-20}{-2}$$
$$x < 10$$
All numbers less than 10 make the statement true.

11. Let x represent the minimum sales.
$$600 + 0.04x \geq 3000$$
$$0.04x \geq 2400$$
$$x \geq 60,000$$
Alex must have minimum sales of $60,000.

Vocabulary, Readiness & Video Check 2.7

1. $6x - 7(x + 9)$ is an expression.

2. $6x = 7(x + 9)$ is an equation.

3. $6x < 7(x + 9)$ is an inequality.

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4. $5y - 2 \geq -38$ 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. $x \geq -3$
-5 is not a solution.

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

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

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

11. An open circle indicates > or <; a closed circle indicates ≥ or ≤.

12. addition property of equality

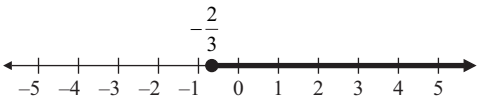
13. $\{x|x \geq -2\}$

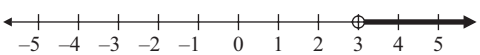
14. The multiplication property of inequality is applied at this step when we divide by the coefficient of x. The coefficient is positive and so the inequality symbol remains the same, but if the coefficient had been negative, the direction of the inequality symbol would have been reversed.

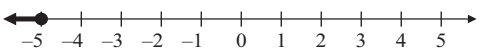
15. is greater than; >

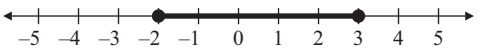
Exercise Set 2.7

2.

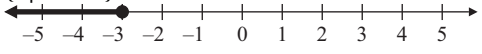

4.


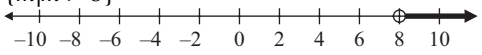
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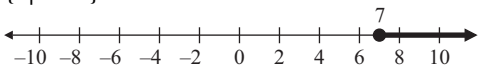
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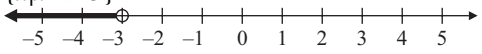
10.


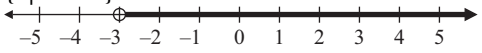
12.

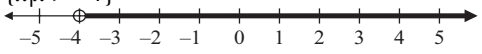

14.
$$x + 4 \leq 1$$
$$x + 4 - 4 \leq 1 - 4$$
$$x \leq -3$$
$$\{x|x \leq -3\}$$


16.
$$-3 + m > 5$$
$$3 - 3 + m > 3 + 5$$
$$m > 8$$
$$\{m|m > 8\}$$


18.
$$3 - 7x \geq 10 - 8x$$
$$3 - 7x + 8x \geq 10 - 8x + 8x$$
$$3 + x \geq 10$$
$$3 + x - 3 \geq 10 - 3$$
$$x \geq 7$$
$$\{x|x \geq 7\}$$


20.
$$7x + 3 < 9x - 3x$$
$$7x + 3 < 6x$$
$$7x + 3 - 7x < 6x - 7x$$
$$3 < -x$$
$$\frac{3}{-1} > \frac{-x}{-1}$$
$$-3 > x \text{ or } x < -3$$
$$\{x|x < -3\}$$


22.
$$3x > -9$$
$$\frac{3x}{3} > \frac{-9}{3}$$
$$x > -3$$
$$\{x|x > -3\}$$


24.
$$-5x < 20$$
$$\frac{-5x}{-5} > \frac{20}{-5}$$
$$x > -4$$
$$\{x|x > -4\}$$


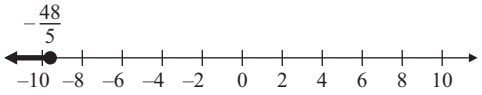
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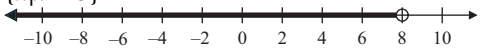
26.
$$-y \ge 0$$
$$(-1)(-y) \le (-1)(0)$$
$$y \le 0$$
$$\{y \mid y \le 0\}$$



28.
$$\frac{5}{6}x \le -8$$
$$\frac{6}{5}\cdot\frac{5}{6}x \le \frac{6}{5}\cdot(-8)$$
$$x \le -\frac{48}{5}$$
$$\left\{x \,\middle|\, x \le -\frac{48}{5}\right\}$$



30.
$$-0.3x > -2.4$$
$$\frac{-0.3x}{-0.3} < \frac{-2.4}{-0.3}$$
$$x < 8$$
$$\{x \mid x < 8\}$$



32.
$$-11 > x + 4$$
$$-11 - 4 > x + 4 - 4$$
$$-15 > x$$
$$\{x \mid x < -15\}$$

34.
$$10(x+2) - 9x \le -1$$
$$10x + 20 - 9x \le -1$$
$$x + 20 \le -1$$
$$x + 20 - 20 \le -1 - 20$$
$$x \le -21$$
$$\{x \mid x \le -21\}$$

36.
$$6x < 5$$
$$\frac{6x}{6} < \frac{5}{6}$$
$$x < \frac{5}{6}$$
$$\left\{x \,\middle|\, x < \frac{5}{6}\right\}$$

38.
$$-\frac{3}{4}y \ge 9$$
$$-\frac{4}{3}\left(-\frac{3}{4}y\right) \le -\frac{4}{3}\cdot 9$$
$$y \le -12$$
$$\{y \mid y \le -12\}$$

40.
$$6(2-z) \ge 12$$
$$12 - 6z \ge 12$$
$$12 - 6z - 12 \ge 12 - 12$$
$$-6z \ge 0$$
$$\frac{-6z}{-6} \le \frac{0}{-6}$$
$$z \le 0$$
$$\{z \mid z \le 0\}$$

42.
$$2x - 1 \ge 4x - 5$$
$$2x - 1 - 4x \ge 4x - 5 - 4x$$
$$-2x - 1 \ge -5$$
$$-2x - 1 + 1 \ge -5 + 1$$
$$-2x \ge -4$$
$$\frac{-2x}{-2} \le \frac{-4}{-2}$$
$$x \le 2$$
$$\{x \mid x \le 2\}$$

44.
$$4 - x < 8x + 2x$$
$$4 - x < 10x$$
$$4 - x + x < 10x + x$$
$$4 < 11x$$
$$\frac{4}{11} < \frac{11x}{11}$$
$$\frac{4}{11} < x$$
$$\left\{x \,\middle|\, x > \frac{4}{11}\right\}$$

46.
$$-7x + 4 > 3(4 - x)$$
$$-7x + 4 > 12 - 3x$$
$$-7x + 4 + 3x > 12 - 3x + 3x$$
$$-4x + 4 > 12$$
$$-4x + 4 - 4 > 12 - 4$$
$$-4x > 8$$
$$\frac{-4x}{-4} < \frac{8}{-4}$$
$$x < -2$$
$$\{x \mid x < -2\}$$

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48.
$$\begin{aligned} 5(x-2) &\le 3(2x-1) \\ 5x-10 &\le 6x-3 \\ 5x-10-5x &\le 6x-3-5x \\ -10 &\le x-3 \\ -10+3 &\le x-3+3 \\ -7 &\le x \end{aligned}$$
$\{x \mid x \ge -7\}$

50.
$$\begin{aligned} 3(5x-4) &\le 4(3x-2) \\ 15x-12 &\le 12x-8 \\ 15x-12-12x &\le 12x-8-12x \\ 3x-12 &\le -8 \\ 3x-12+12 &\le -8+12 \\ 3x &\le 4 \\ \frac{3x}{3} &\le \frac{4}{3} \\ x &\le \frac{4}{3} \end{aligned}$$
$\left\{x \middle| x \le \frac{4}{3}\right\}$

52.
$$\begin{aligned} 7(x-2)+x &\le -4(5-x)-12 \\ 7x-14+x &\le -20+4x-12 \\ 8x-14 &\le 4x-32 \\ 8x-14-4x &\le 4x-32-4x \\ 4x-14 &\le -32 \\ 4x-14+14 &\le -32+14 \\ 4x &\le -18 \\ \frac{4x}{4} &\le \frac{-18}{4} \\ x &\le -\frac{9}{2} \end{aligned}$$
$\left\{x \middle| x \le -\frac{9}{2}\right\}$

54.
$$\begin{aligned} -2(x-4)-3x &< -(4x+1)+2x \\ -2x+8-3x &< -4x-1+2x \\ -5x+8 &< -2x-1 \\ -5x+8+2x &< -2x-1+2x \\ -3x+8 &< -1 \\ -3x+8-8 &< -1-8 \\ -3x &< -9 \\ \frac{-3x}{-3} &> \frac{-9}{-3} \\ x &> 3 \end{aligned}$$
$\{x \mid x > 3\}$

56.
$$\begin{aligned} \frac{1}{2}(x-5) &< \frac{1}{3}(2x-1) \\ 6\cdot\frac{1}{2}(x-5) &< 6\cdot\frac{1}{3}(2x-1) \\ 3(x-5) &< 2(2x-1) \\ 3x-15 &< 4x-2 \\ 3x-15-3x &< 4x-2-3x \\ -15 &< x-2 \\ -15+2 &< x-2+2 \\ -13 &< x \end{aligned}$$
$\{x \mid x > -13\}$

58.
$$\begin{aligned} -6x+2 &< -3(x+4) \\ -6x+2 &< -3x-12 \\ -6x+2+3x &< -3x-12+3x \\ -3x+2 &< -12 \\ -3x+2-2 &< -12-2 \\ -3x &< -14 \\ \frac{-3x}{-3} &> \frac{-14}{-3} \\ x &> \frac{14}{3} \end{aligned}$$
$\left\{x \middle| x > \frac{14}{3}\right\}$

60. Let x be the number.
$$\begin{aligned} 5x+1 &\le 10 \\ 5x+1-1 &\le 10-1 \\ 5x &\le 9 \\ \frac{5x}{5} &\le \frac{9}{5} \\ x &\le \frac{9}{5} \end{aligned}$$
All numbers less than or equal to $\frac{9}{5}$ make this statement true.

62. Use $P = a + b + c$ when $a = x$, $b = 3x$, $c = 12$, and $P \le 32$.
$$\begin{aligned} x+3x+12 &\le 32 \\ 4x+12 &\le 32 \\ 4x+12-12 &\le 32-12 \\ 4x &\le 20 \\ \frac{4x}{4} &\le \frac{20}{4} \\ x &\le 5 \end{aligned}$$
$3x \le 3(5) = 15$
The maximum lengths of the other two sides are 5 inches and 15 inches.

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64. Convert heights to inches.

$6'8" = 6 \cdot 12 + 8 = 80$
$6'6" = 6 \cdot 12 + 6 = 78$
$6'0" = 6 \cdot 12 + 0 = 72$
$5'9" = 5 \cdot 12 + 9 = 69$
$6'5" = 6 \cdot 12 + 5 = 77$

Let x be the height of the center.

$$\frac{x + 80 + 78 + 72 + 69}{5} \geq 77$$
$$\frac{x + 299}{5} \geq 77$$
$$5 \cdot \frac{x + 299}{5} \geq 5 \cdot 77$$
$$x + 299 \geq 385$$
$$x + 299 - 299 \geq 385 - 299$$
$$x \geq 86$$

$86" = 7'2"$

The center should be at least $7'2"$.

66. Let x represent the number of people. Then the cost is $40 + 15x$.

$$40 + 15x \leq 860$$
$$40 + 15x - 40 \leq 860 - 40$$
$$15x \leq 820$$
$$\frac{15x}{15} \leq \frac{820}{15}$$
$$x \leq \frac{820}{15} \approx 54$$

They can invite at most 54 people.

68. Let x represent the number of minutes.

$$5.3x \geq 200$$
$$\frac{5.3x}{5.3} \geq \frac{200}{5.3}$$
$$x \geq \frac{200}{5.3} \approx 38$$

The person must bicycle at least 38 minutes.

70. $4^3 = 4 \cdot 4 \cdot 4 = 64$

72. $0^7 = 0 \cdot 0 \cdot 0 \cdot 0 \cdot 0 \cdot 0 \cdot 0 = 0$

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

76. The highest point on the graph corresponds to 2013, so there were the most Starbucks locations in 2013.

78. The points for 2009 and 2010 are at approximately the same height, so the number of Starbucks locations remained about the same between 2009 and 2010.

80. The number of Starbucks locations rose above 12,000 in 2013.

82. Since $m \leq n$, then $2m \leq 2n$.

84. If $-x < y$, then $x > -y$.

86. No; answers may vary

88. Let x be the score on her final exam. Since the final counts as two tests, her final course average is $\frac{85 + 95 + 92 + 3x}{6}$.

$$\frac{85 + 95 + 92 + 3x}{6} \geq 90$$
$$\frac{272 + 3x}{6} \geq 90$$
$$6\left(\frac{272 + 3x}{6}\right) \geq 6(90)$$
$$272 + 3x \geq 540$$
$$272 + 2x - 272 \geq 540 - 272$$
$$3x \geq 268$$
$$\frac{3x}{3} \geq \frac{268}{3}$$
$$x \geq 89.3$$

Her final exam score must be at least 89.3 for her to get an A.

Chapter 2 Vocabulary Check

1. A linear equation in one variable can be written in the form $Ax + B = C$.

2. Equations that have the same solution are called equivalent equations.

3. An equation that describes a known relationship among quantities is called a formula.

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

5. The solutions to the equation $x + 5 = x + 5$ are all real numbers.

6. The solution to the equation $x + 5 = x + 4$ is no solution.

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7. If both sides of an inequality are multiplied or divided by the same positive number, the direction of the inequality symbol is the same.

8. If both sides of an inequality are multiplied or divided by the same negative number, the direction of the inequality symbol is reversed.

Chapter 2 Review

1.
$$\begin{aligned} 8x+4 &= 9x \\ 8x+4-8x &= 9x-8x \\ 4 &= x \end{aligned}$$

2.
$$\begin{aligned} 5y-3 &= 6y \\ 5y-3-5y &= 6y-5y \\ -3 &= y \end{aligned}$$

3.
$$\begin{aligned} \frac{2}{7}x+\frac{5}{7}x &= 6 \\ \frac{7}{7}x &= 6 \\ 1x &= 6 \\ x &= 6 \end{aligned}$$

4.
$$\begin{aligned} 3x-5 &= 4x+1 \\ 3x-5-3x &= 4x+1-3x \\ -5 &= x+1 \\ -5-1 &= x+1-1 \\ -6 &= x \end{aligned}$$

5.
$$\begin{aligned} 2x-6 &= x-6 \\ 2x-6-x &= x-6-x \\ x-6 &= -6 \\ x-6+6 &= -6+6 \\ x &= 0 \end{aligned}$$

6.
$$\begin{aligned} 4(x+3) &= 3(1+x) \\ 4x+12 &= 3+3x \\ 4x+12-3x &= 3+3x-3x \\ 12+x &= 3 \\ -12+12+x &= -12+3 \\ x &= -9 \end{aligned}$$

7.
$$\begin{aligned} 6(3+n) &= 5(n-1) \\ 18+6n &= 5n-5 \\ 18+6n-5n &= 5n-5-5n \\ 18+n &= -5 \\ -18+18+n &= -18-5 \\ n &= -23 \end{aligned}$$

8.
$$\begin{aligned} 5(2+x)-3(3x+2) &= -5(x-6)+2 \\ 10+5x-9x-6 &= -5x+30+2 \\ -4x+4 &= -5x+32 \\ 5x-4x+4 &= 5x-5x+32 \\ x+4 &= 32 \\ x+4-4 &= 32-4 \\ x &= 28 \end{aligned}$$

9. If the sum is 10 and one number is x, then the other number is $10 - x$. The choice is b.

10. Since Mandy is 5 inches taller than Melissa, and x represents Mandy's height, then $x - 5$ represents Melissa's height. The choice is a.

11. Complementary angles sum to 90°. The complement of angle x is $90 - x$. The choice is b.

12. Supplementary angles sum to 180°. The supplement to $(x + 5)°$ is $180 - (x + 5) = 180 - x - 5 = 175 - x$. The choice is c.

13.
$$\begin{aligned} \frac{3}{4}x &= -9 \\ \frac{4}{3}\cdot\frac{3}{4}x &= \frac{4}{3}\cdot(-9) \\ x &= -12 \end{aligned}$$

14.
$$\begin{aligned} \frac{x}{6} &= \frac{2}{3} \\ 6\cdot\frac{x}{6} &= 6\cdot\frac{2}{3} \\ x &= 4 \end{aligned}$$

15.
$$\begin{aligned} -5x &= 0 \\ \frac{-5x}{-5} &= \frac{0}{-5} \\ x &= 0 \end{aligned}$$

16.
$$\begin{aligned} -y &= 7 \\ \frac{-y}{-1} &= \frac{7}{-1} \\ y &= -7 \end{aligned}$$

17.
$$\begin{aligned} 0.2x &= 0.15 \\ 20x &= 15 \\ \frac{20x}{20} &= \frac{15}{20} \\ x &= 0.75 \end{aligned}$$

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18.
$$\frac{-x}{3}=1$$
$$-3\left(\frac{-x}{3}\right)=-3(1)$$
$$x=-3$$

19.
$$-3x+1=19$$
$$-3x+1-1=19-1$$
$$-3x=18$$
$$\frac{-3x}{-3}=\frac{18}{-3}$$
$$x=-6$$

20.
$$5x+25=20$$
$$5x+25-25=20-25$$
$$5x=-5$$
$$\frac{5x}{5}=\frac{-5}{5}$$
$$x=-1$$

21.
$$7(x-1)+9=5x$$
$$7x-7+9=5x$$
$$7x+2=5x$$
$$-7x+7x+2=-7x+5x$$
$$2=-2x$$
$$\frac{2}{-2}=\frac{-2x}{-2}$$
$$-1=x$$

22.
$$7x-6=5x-3$$
$$7x-6-5x=5x-3-5x$$
$$2x-6=-3$$
$$2x-6+6=-3+6$$
$$2x=3$$
$$\frac{2x}{2}=\frac{3}{2}$$
$$x=\frac{3}{2} \text{ or } 1\frac{1}{2}$$

23.
$$-5x+\frac{3}{7}=\frac{10}{7}$$
$$7\left(-5x+\frac{3}{7}\right)=7\cdot\frac{10}{7}$$
$$-35x+3=10$$
$$-35x+3-3=10-3$$
$$-35x=7$$
$$\frac{-35x}{-35}=\frac{7}{-35}$$
$$x=-\frac{1}{5}$$

24.
$$5x+x=9+4x-1+6$$
$$6x=4x+14$$
$$6x-4x=4x+14-4x$$
$$2x=14$$
$$\frac{2x}{2}=\frac{14}{2}$$
$$x=7$$

25. Let x be the first integer. Then $x + 1$ and $x + 2$ are the next two consecutive integers. Their sum is $x + x + 1 + x + 2 = 3x + 3$.

26. Let x be the first even integer. Then $x + 2$, $x + 4$, and $x + 6$ are the 2nd, 3rd, and 4th consecutive even integers. The sum of the first and fourth is $x + x + 6 = 2x + 6$.

27.
$$\frac{5}{3}x+4=\frac{2}{3}x$$
$$3\left(\frac{5}{3}x+4\right)=3\left(\frac{2}{3}x\right)$$
$$5x+12=2x$$
$$5x+12-5x=2x-5x$$
$$12=-3x$$
$$\frac{12}{-3}=\frac{-3x}{-3}$$
$$-4=x$$

28.
$$\frac{7}{8}x+1=\frac{5}{8}x$$
$$8\left(\frac{7}{8}x+1\right)=8\left(\frac{5}{8}x\right)$$
$$7x+8=5x$$
$$7x+8-7x=5x-7x$$
$$8=-2x$$
$$\frac{8}{-2}=\frac{-2x}{-2}$$
$$-4=x$$

29.
$$-(5x+1)=-7x+3$$
$$-5x-1=-7x+3$$
$$-5x-1+7x=-7x+3+7x$$
$$2x-1=3$$
$$2x-1+1=3+1$$
$$2x=4$$
$$\frac{2x}{2}=\frac{4}{2}$$
$$x=2$$

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30. $-4(2x+1) = -5x+5$
$-8x-4 = -5x+5$
$-8x-4+8x = -5x+5+8x$
$-4 = 3x+5$
$-4-5 = 3x+5-5$
$-9 = 3x$
$\frac{-9}{3} = \frac{3x}{3}$
$-3 = x$

31. $-6(2x-5) = -3(9+4x)$
$-12x+30 = -27-12x$
$12x-12x+30 = 12x-27-12x$
$30 = -27$
Since the statement $30 = -27$ is false, the equation has no solution.

32. $3(8y-1) = 6(5+4y)$
$24y-3 = 30+24y$
$24y-3-24y = 30+24y-24y$
$-3 = 30$
Since the statement $-3 = 30$ is false, the equation has no solution.

33. $\frac{3(2-z)}{5} = z$
$5\left[\frac{3(2-z)}{5}\right] = 5 \cdot z$
$3(2-z) = 5z$
$6-3z = 5z$
$6-3z+3z = 5z+3z$
$6 = 8z$
$\frac{6}{8} = \frac{8z}{8}$
$\frac{3}{4} = z$

34. $\frac{4(n+2)}{5} = -n$
$5\left[\frac{4(n+2)}{5}\right] = 5(-n)$
$4(n+2) = -5n$
$4n+8 = -5n$
$4n+8-4n = -5n-4n$
$8 = -9n$
$\frac{8}{-9} = \frac{-9n}{-9}$
$-\frac{8}{9} = n$

35. $0.5(2n-3)-0.1 = 0.4(6+2n)$
$5(2n-3)-1 = 4(6+2n)$
$10n-15-1 = 24+8n$
$10n-16 = 24+8n$
$10n-16-8n = 24+8n-8n$
$2n-16 = 24$
$2n-16+16 = 24+16$
$2n = 40$
$\frac{2n}{2} = \frac{40}{2}$
$n = 20$

36. $-9-5a = 3(6a-1)$
$-9-5a = 18a-3$
$9-5a+5a = 18a-3+5a$
$-9 = 23a-3$
$-9+3 = 23a-3+3$
$-6 = 23a$
$\frac{-6}{23} = \frac{23a}{23}$
$-\frac{6}{23} = a$

37. $\frac{5(c+1)}{6} = 2c-3$
$6\left[\frac{5(c+1)}{6}\right] = 6(2c-3)$
$5(c+1) = 6(2c-3)$
$5c+5 = 12c-18$
$5c+5-5c = 12c-18-5c$
$5 = 7c-18$
$5+18 = 7c-18+18$
$23 = 7c$
$\frac{23}{7} = \frac{7c}{7}$
$\frac{23}{7} = c$

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38.
$$\frac{2(8-a)}{3} = 4-4a$$
$$3\left[\frac{2(8-a)}{3}\right] = 3(4-4a)$$
$$2(8-a) = 3(4-4a)$$
$$16-2a = 12-12a$$
$$16-2a+12a = 12-12a+12a$$
$$16+10a = 12$$
$$16+10a-16 = 12-16$$
$$10a = -4$$
$$\frac{10a}{10} = \frac{-4}{10}$$
$$a = -\frac{2}{5}$$

39.
$$200(70x-3560) = -179(150x-19,300)$$
$$14,000x-712,000 = -26,850x+3,454,700$$
$$14,000x-712,000+26,850x = -26,850x+3,454,700+26,850x$$
$$40,850x-712,000 = 3,454,700$$
$$40,850x-712,000+712,000 = 3,454,700+712,000$$
$$40,850x = 4,166,700$$
$$\frac{40,850x}{40,850} = \frac{4,166,700}{40,850}$$
$$x = 102$$

40.
$$1.72y-0.04y = 0.42$$
$$172y-4y = 42$$
$$168y = 42$$
$$\frac{168y}{168} = \frac{42}{168}$$
$$y = 0.25$$

41. Let x be the length of the side of the square base. Then the height is $10x + 50.5$. The sum is 7327.
$$x+10x+50.5 = 7327$$
$$11x+50.5 = 7327$$
$$11x+50.5-50.5 = 7327-50.5$$
$$11x = 7276.5$$
$$\frac{11x}{11} = \frac{7276.5}{11}$$
$$x = 661.5$$
$$10x+50.5 = 10(661.5)+50.5$$
$$= 6615+50.5$$
$$= 6665.5$$
The height is 6665.5 inches.

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42. Let x be the length of the short piece. Then $2x$ is the length of the long piece. The lengths sum to 12.

$$x + 2x = 12$$
$$3x = 12$$
$$\frac{3x}{3} = \frac{12}{3}$$
$$x = 4$$

$2x = 2(4) = 8$

The short piece is 4 feet and the long piece is 8 feet.

43. Let x represent the number of national battlefields. Then there were $3x - 4$ national memorials. The total is 40.

$$x + 3x - 4 = 40$$
$$4x - 4 = 40$$
$$4x - 4 + 4 = 40 + 4$$
$$4x = 44$$
$$\frac{4x}{4} = \frac{44}{4}$$
$$x = 11$$

$3x - 4 = 3(11) - 4 = 33 - 4 = 29$

There were 11 national battlefields and 29 national memorials in 2013.

44. Let x be the first integer. Then $x + 1$ and $x + 2$ are the next two consecutive integers. Their sum is -114.

$$x + x + 1 + x + 2 = -114$$
$$3x + 3 = -114$$
$$3x + 3 - 3 = -114 - 3$$
$$3x = -117$$
$$\frac{3x}{3} = \frac{-117}{3}$$
$$x = -39$$

$x + 1 = -39 + 1 = -38$

$x + 2 = -39 + 2 = -37$

The integers are -39, -38, and -37.

45.
$$\frac{x}{3} = x - 2$$
$$3 \cdot \frac{x}{3} = 3(x - 2)$$
$$x = 3x - 6$$
$$x - 3x = 3x - 6 - 3x$$
$$-2x = -6$$
$$\frac{-2x}{-2} = \frac{-6}{-2}$$
$$x = 3$$

The number is 3.

46.
$$2(x + 6) = -x$$
$$2x + 12 = -x$$
$$-2x + 2x + 12 = -2x - x$$
$$12 = -3x$$
$$\frac{12}{-3} = \frac{-3x}{-3}$$
$$-4 = x$$

The number is -4.

47. Use $P = 2l + 2w$ when $P = 46$ and $l = 14$.

$$P = 2l + 2w$$
$$46 = 2(14) + 2w$$
$$46 = 28 + 2w$$
$$46 - 28 = 28 + 2w - 28$$
$$18 = 2w$$
$$\frac{18}{2} = \frac{2w}{2}$$
$$9 = w$$

48. Use $V = lwh$ when $V = 192$, $l = 8$, and $w = 6$.

$$V = lwh$$
$$192 = 8 \cdot 6 \cdot h$$
$$192 = 48h$$
$$\frac{192}{48} = \frac{48h}{48}$$
$$4 = h$$

49.
$$y = mx + b$$
$$y - b = mx + b - b$$
$$y - b = mx$$
$$\frac{y - b}{x} = \frac{mx}{x}$$
$$\frac{y - b}{x} = m$$

50.
$$r = vst - 5$$
$$r + 5 = vst - 5 + 5$$
$$r + 5 = vst$$
$$\frac{r + 5}{vt} = \frac{vst}{vt}$$
$$\frac{r + 5}{vt} = s$$

51.
$$2y - 5x = 7$$
$$-2y + 2y - 5x = -2y + 7$$
$$-5x = -2y + 7$$
$$\frac{-5x}{-5} = \frac{-2y + 7}{-5}$$
$$x = \frac{2y - 7}{5}$$

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52.
$$\begin{aligned} 3x-6y &= -2 \\ -3x+3x-6y &= -3x-2 \\ -6y &= -3x-2 \\ \frac{-6y}{-6} &= \frac{-3x-2}{-6} \\ y &= \frac{3x+2}{6} \end{aligned}$$

53.
$$\begin{aligned} C &= \pi D \\ \frac{C}{D} &= \frac{\pi D}{D} \\ \frac{C}{D} &= \pi \end{aligned}$$

54.
$$\begin{aligned} C &= 2\pi r \\ \frac{C}{2r} &= \frac{2\pi r}{2r} \\ \frac{C}{2r} &= \pi \end{aligned}$$

55. Use $V = lwh$ when $V = 900$, $l = 20$ and $h = 3$.
$$\begin{aligned} V &= lwh \\ 900 &= 20 \cdot w \cdot 3 \\ 900 &= 60w \\ \frac{900}{60} &= \frac{60w}{60} \\ 15 &= w \end{aligned}$$
The width is 15 meters.

56. Let x be the width. Then the length is $x + 6$. Use $P = 2 \cdot \text{length} + 2 \cdot \text{width}$ when $P = 60$.
$$\begin{aligned} P &= 2 \cdot \text{length} + 2 \cdot \text{width} \\ 60 &= 2(x+6) + 2x \\ 60 &= 2x + 12 + 2x \\ 60 &= 4x + 12 \\ 60-12 &= 4x + 12 - 12 \\ 48 &= 4x \\ \frac{48}{4} &= \frac{4x}{4} \\ 12 &= x \end{aligned}$$
$x + 6 = 12 + 6 = 18$
The dimensions of the billboard are 12 feet by 18 feet.

57. Use $d = rt$ when $d = 10\text{K}$ or 10,000 m and $r = 125$.
$$\begin{aligned} d &= rt \\ 10{,}000 &= 125t \\ \frac{10{,}000}{125} &= \frac{125t}{125} \\ 80 &= t \end{aligned}$$
The time is 80 minutes or $\frac{80}{60} = 1\frac{1}{3}$ hours or 1 hour and 20 minutes.

58. Use $F = \frac{9}{5}C + 32$ when $F = 113$.
$$\begin{aligned} F &= \frac{9}{5}C + 32 \\ 113 &= \frac{9}{5}C + 32 \\ 113-32 &= \frac{9}{5}C + 32 - 32 \\ 81 &= \frac{9}{5}C \\ \frac{5}{9} \cdot 81 &= \frac{5}{9} \cdot \frac{9}{5}C \\ 45 &= C \end{aligned}$$
Thus, 113°F is equivalent to 45°C.

59. Let x be the unknown percent.
$$\begin{aligned} 9 &= x \cdot 45 \\ \frac{9}{45} &= \frac{45x}{45} \\ 0.2 &= x \\ 20\% &= x \end{aligned}$$
9 is 20% of 45.

60. Let x be the unknown percent.
$$\begin{aligned} 59.5 &= x \cdot 85 \\ \frac{59.5}{85} &= \frac{85x}{85} \\ 0.7 &= x \\ 70\% &= x \end{aligned}$$
59.5 is 70% of 85.

61. Let x be the unknown number.
$$\begin{aligned} 137.5 &= 125\% \cdot x \\ 137.5 &= 1.25x \\ \frac{137.5}{1.25} &= \frac{1.25x}{1.25} \\ 110 &= x \end{aligned}$$
137.5 is 125% of 110.

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62. Let x be the unknown number.

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

768 is 60% of 1280.

63. increase = $11\% \cdot 1900 = 0.11 \cdot 1900 = 209$
new price = $1900 + 209 = 2109$
The mark-up is \$209 and the new price is \$2109.

64. Find 85% of 108,000.
$85\% \cdot 108{,}000 = 0.85 \cdot 108{,}000 = 91{,}800$
You would expect 91,800 motion picture and television industry businesses to have fewer than 10 employees.

65. Let x be the number of gallons of 40% solution. Then $30 - x$ is the number of gallons of 10% solution.

	gallons	concentration	amount
40% solution	x	40%	$0.4x$
10% solution	$30 - x$	10%	$0.1(30 - x)$
20% solution	30	20%	$0.2(30)$

The amount of acid in the combined solutions must be the same as in the mixture.

$$0.4x + 0.1(30 - x) = 0.2(30)$$
$$0.4x + 3 - 0.1x = 6$$
$$3 + 0.3x = 6$$
$$3 + 0.3x - 3 = 6 - 3$$
$$0.3x = 3$$
$$\frac{0.3x}{0.3} = \frac{3}{0.3}$$
$$x = 10$$

$30 - x = 30 - 10 = 20$
Mix 10 gallons of 40% solution with 20 gallons of 10% solution.

66.
$$\text{percent of increase} = \frac{\text{amount of increase}}{\text{original amount}}$$
$$= \frac{7.96 - 6.03}{6.03}$$
$$= \frac{1.93}{6.03}$$
$$\approx 0.320$$

The percent of increase was 32%.

67. From the graph, 18% of motorists who use a cell phone while driving have almost hit another car.

68. The tallest bar represents the most common effect. Therefore, swerving is the most common effect of cell phone use on driving.

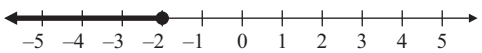
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69. 21% of drivers cut off someone. Find 21% of 4600.
$21\% \cdot 4600 = 0.21 \cdot 4600 = 966$
You expect 966 customers to cut someone off while driving and talking on their cell phones.

70. $46\% + 41\% + 21\% + 18\% = 126\%$
No, the percents do not sum to 100%.
Answers may vary.

71.



72.



73.
$$\begin{aligned} x-5 &\le -4 \\ x-5+5 &\le -4+5 \\ x &\le 1 \end{aligned}$$
$\{x \mid x \le 1\}$

74.
$$\begin{aligned} x+7 &> 2 \\ x+7-7 &> 2-7 \\ x &> -5 \end{aligned}$$
$\{x \mid x > -5\}$

75.
$$\begin{aligned} -2x &\ge -20 \\ \frac{-2x}{-2} &\le \frac{-20}{-2} \\ x &\le 10 \end{aligned}$$
$\{x \mid x \le 10\}$

76.
$$\begin{aligned} -3x &> 12 \\ \frac{-3x}{-3} &< \frac{12}{-3} \\ x &< -4 \end{aligned}$$
$\{x \mid x < -4\}$

77.
$$\begin{aligned} 5x-7 &> 8x+5 \\ 5x-7-8x &> 8x+5-8x \\ -3x-7 &> 5 \\ -3x-7+7 &> 5+7 \\ -3x &> 12 \\ \frac{-3x}{-3} &< \frac{12}{-3} \\ x &< -4 \end{aligned}$$
$\{x \mid x < -4\}$

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78.
$$\begin{aligned} x+4 &\geq 6x-16 \\ x+4-6x &\geq 6x-16-6x \\ -5x+4 &\geq -16 \\ -5x+4-4 &\geq -16-4 \\ -5x &\geq -20 \\ \frac{-5x}{-5} &\leq \frac{-20}{-5} \\ x &\leq 4 \end{aligned}$$
$\{x|x \leq 4\}$

79.
$$\begin{aligned} \frac{2}{3}y &> 6 \\ \frac{3}{2}\cdot\frac{2}{3}y &> \frac{3}{2}\cdot 6 \\ y &> 9 \end{aligned}$$
$\{y|y > 9\}$

80.
$$\begin{aligned} -0.5y &\leq 7.5 \\ \frac{-0.5y}{-0.5} &\geq \frac{7.5}{-0.5} \\ y &\geq -15 \end{aligned}$$
$\{y|y \geq -15\}$

81.
$$\begin{aligned} -2(x-5) &> 2(3x-2) \\ -2x+10 &> 6x-4 \\ -2x+10-6x &> 6x-4-6x \\ -8x+10 &> -4 \\ -8x+10-10 &> -4-10 \\ -8x &> -14 \\ \frac{-8x}{-8} &< \frac{-14}{-8} \\ x &< \frac{7}{4} \end{aligned}$$
$\left\{x\middle|x < \frac{7}{4}\right\}$

82.
$$\begin{aligned} 4(2x-5) &\leq 5x-1 \\ 8x-20 &\leq 5x-1 \\ 8x-20-5x &\leq 5x-1-5x \\ 3x-20 &\leq -1 \\ 3x-20+20 &\leq -1+20 \\ 3x &\leq 19 \\ \frac{3x}{3} &\leq \frac{19}{3} \\ x &\leq \frac{19}{3} \end{aligned}$$
$\left\{x\middle|x \leq \frac{19}{3}\right\}$

83. Let x be the sales. Her weekly earnings are $175 + 0.05x$.
$$\begin{aligned} 175+0.05x &\geq 300 \\ 175+0.05x-175 &\geq 300-175 \\ 0.05x &\geq 125 \\ \frac{0.05x}{0.05} &\geq \frac{125}{0.05} \\ x &\geq 2500 \end{aligned}$$
She must have weekly sales of at least \$2500.

84. Let x be his score on the fourth round.
$$\begin{aligned} \frac{76+82+79+x}{4} &< 80 \\ \frac{237+x}{4} &< 80 \\ 4\cdot\frac{237+x}{4} &< 4\cdot 80 \\ 237+x &< 320 \\ 237+x-237 &< 320-237 \\ x &< 83 \end{aligned}$$
His score must be less than 83.

85.
$$\begin{aligned} 6x+2x-1 &= 5x+11 \\ 8x-1 &= 5x+11 \\ 8x-1-5x &= 5x+11-5x \\ 3x-1 &= 11 \\ 3x-1+1 &= 11+1 \\ 3x &= 12 \\ \frac{3x}{3} &= \frac{12}{3} \\ x &= 4 \end{aligned}$$

86.
$$\begin{aligned} 2(3y-4) &= 6+7y \\ 6y-8 &= 6+7y \\ 6y-8-6y &= 6+7y-6y \\ -8 &= 6+y \\ -8-6 &= 6+y-6 \\ -14 &= y \end{aligned}$$

87.
$$\begin{aligned} 4(3-a)-(6a+9) &= -12a \\ 12-4a-6a-9 &= -12a \\ 3-10a &= -12a \\ 3-10a+10a &= -12a+10a \\ 3 &= -2a \\ \frac{3}{-2} &= \frac{-2a}{-2} \\ -\frac{3}{2} &= a \end{aligned}$$

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

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

$\frac{x}{3}=7$

$3\cdot\frac{x}{3}=3\cdot 7$

$x=21$

89. $2(y+5)=2y+10$

$2y+10=2y+10$

Since both sides of the equation are identical, the equation is an identity and every real number is a solution.

90. $7x-3x+2=2(2x-1)$

$4x+2=4x-2$

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

$2=-2$

Since the statement $2 = -2$ is false, there is no solution.

91. Let x be the number.

$6+2x=x-7$

$6+2x-x=x-7-x$

$6+x=-7$

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

$x=-13$

The number is -13.

92. Let x be the length of the shorter piece. Then $4x + 3$ is the length of the longer piece. The lengths sum to 23.

$x+4x+3=23$

$5x+3=23$

$5x+3-3=23-3$

$5x=20$

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

$x=4$

$4x + 3 = 4(4) + 3 = 16 + 3 = 19$

The shorter piece is 4 inches and the longer piece is 19 inches.

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

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

$3V=Ah$

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

$\frac{3V}{A}=h$

94. Let x be the number.

$x = 26\% \cdot 85$

$x = 0.26 \cdot 85$

$x = 22.1$

22.1 is 26% of 85.

95. Let x be the unknown number.

$72 = 45\% \cdot x$

$72 = 0.45x$

$\frac{72}{0.45}=\frac{0.45x}{0.45}$

$160 = x$

72 is 45% of 160.

96. $\text{percent of increase}=\frac{\text{amount of increase}}{\text{original amount}}$

$=\frac{282-235}{235}$

$=\frac{47}{235}$

$=0.2$

The percent of increase is 20%.

97. $4x-7>3x+2$

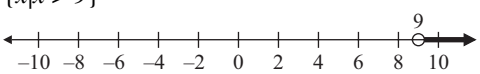
$4x-7-3x>3x+2-3x$

$x-7>2$

$x-7+7>2+7$

$x>9$

$\{x|x>9\}$

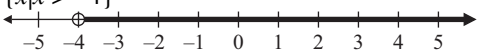


98. $-5x<20$

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

$x>-4$

$\{x|x>-4\}$



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99. $-3(1+2x)+x \geq -(3-x)$

$-3-6x+x \geq -3+x$

$-3-5x \geq -3+x$

$-3-5x-x \geq -3+x-x$

$-3-6x \geq -3$

$-3-6x+3 \geq -3+3$

$-6x \geq 0$

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

$x \leq 0$

$\{x|x \leq 0\}$



Chapter 2 Test

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

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

$x = -5$

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

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

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

$2n-20 = -4$

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

$2n = 16$

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

$n = 8$

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

$6y-7 = -y-3y$

$6y-7 = -4y$

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

$-7 = -10y$

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

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

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

$3z+1 = 1+z$

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

$2z+1 = 1$

$2z+1-1 = 1-1$

$2z = 0$

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

$z = 0$

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

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

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

$2x+12 = 3x-15$

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

$12 = x-15$

$12+15 = x-15+15$

$27 = x$

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

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

$4(y-1) = 5(2y+3)$

$4y-4 = 10y+15$

$4y-4-10y = 10y+15-10y$

$-6y-4 = 15$

$-6y-4+4 = 15+4$

$-6y = 19$

$\frac{-6y}{-6} = \frac{19}{-6}$

$y = -\frac{19}{6}$

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

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

$-x+2 = x-4$

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

$2 = 2x-4$

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

$6 = 2x$

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

$3 = x$

8. $\frac{1}{3}(y+3) = 4y$

$3\cdot\frac{1}{3}(y+3) = 3\cdot 4y$

$y+3 = 12y$

$y+3-y = 12y-y$

$3 = 11y$

$\frac{3}{11} = \frac{11y}{11}$

$\frac{3}{11} = y$

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9. $-0.3(x-4)+x=0.5(3-x)$
$-0.3(x-4)+1.0x=0.5(3-x)$
$-3(x-4)+10x=5(3-x)$
$-3x+12+10x=15-5x$
$7x+12=15-5x$
$7x+12+5x=15-5x+5x$
$12x+12=15$
$12x+12-12=15-12$
$12x=3$
$\frac{12x}{12}=\frac{3}{12}$
$x=\frac{1}{4}=0.25$

10. $-4(a+1)-3a=-7(2a-3)$
$-4a-4-3a=-14a+21$
$-4-7a=-14a+21$
$-4-7a+14a=-14a+21+14a$
$-4+7a=21$
$-4+7a+4=21+4$
$7a=25$
$\frac{7a}{7}=\frac{25}{7}$
$a=\frac{25}{7}$

11. $-2(x-3)=x+5-3x$
$-2x+6=-2x+5$
$2x-2x+6=2x-2x+5$
$6=5$
Since the statement 6 = 5 is false, there is no solution.

12. Let x be the number.
$x+\frac{2}{3}x=35$
$\frac{3}{3}x+\frac{2}{3}x=35$
$\frac{5}{3}x=35$
$\frac{3}{5}\cdot\frac{5}{3}x=\frac{3}{5}\cdot 35$
$x=21$
The number is 21.

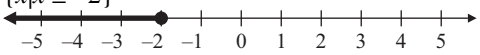
13. $A = lw = (35)(20) = 700$
The area of the deck is 700 square feet. To paint two coats of water seal means covering
$2 \cdot 700 = 1400$ square feet.
$1400 \text{ sq ft} \cdot \frac{1 \text{ gal}}{200 \text{ sq ft}} = 7 \text{ gal}$
7 gallons of water seal are needed.

14. Use $y = mx + b$ when $y = -14$, $m = -2$, and $b = -2$.
$y=mx+b$
$-14=-2x+(-2)$
$-14+2=-2x+(-2)+2$
$-12=-2x$
$\frac{-12}{-2}=\frac{-2x}{-2}$
$6=x$

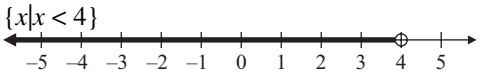
15. $V=\pi r^2 h$
$\frac{V}{\pi r^2}=\frac{\pi r^2 h}{\pi r^2}$
$\frac{V}{\pi r^2}=h$

16. $3x-4y=10$
$3x-4y-3x=10-3x$
$-4y=10-3x$
$\frac{-4y}{-4}=\frac{10-3x}{-4}$
$y=\frac{3x-10}{4}$

17. $3x-5\ge 7x+3$
$3x-5-3x\ge 7x+3-3x$
$-5\ge 4x+3$
$-5-3\ge 4x+3-3$
$-8\ge 4x$
$\frac{-8}{4}\ge\frac{4x}{4}$
$-2\ge x$
$\{x|x\le -2\}$



18. $x+6>4x-6$
$x+6-4x>4x-6-4x$
$-3x+6>-6$
$-3x+6-6>-6-6$
$-3x>-12$
$\frac{-3x}{-3}<\frac{-12}{-3}$
$x<4$
$\{x|x<4\}$



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19. $-0.3x \geq 2.4$

$$\frac{-0.3x}{-0.3} \leq \frac{2.4}{-0.3}$$

$$x \leq -8$$

$\{x|x \leq -8\}$

20. $-5(x-1)+6 \leq -3(x+4)+1$

$$-5x+5+6 \leq -3x-12+1$$

$$-5x+11 \leq -3x-11$$

$$-5x+11+3x \leq -3x-11+3x$$

$$-2x+11 \leq -11$$

$$-2x+11-11 \leq -11-11$$

$$-2x \leq -22$$

$$\frac{-2x}{-2} \geq \frac{-22}{-2}$$

$$x \geq 11$$

$\{x|x \geq 11\}$

21. $\frac{2(5x+1)}{3} > 2$

$$3 \cdot \frac{2(5x+1)}{3} > 3(2)$$

$$2(5x+1) > 6$$

$$10x+2 > 6$$

$$10x+2-2 > 6-2$$

$$10x > 4$$

$$\frac{10x}{10} > \frac{4}{10}$$

$$x > \frac{2}{5}$$

$\left\{x \middle| x > \frac{2}{5}\right\}$

22. From the graph, 69% are classified as weak.
Find 69% of 800.
$69\% \cdot 800 = 0.69 \cdot 800 = 552$
You would expect 552 of the 800 to be classified as weak.

23. Let x be the unknown percent.

$$72 = x \cdot 180$$

$$\frac{72}{180} = \frac{180x}{180}$$

$$0.4 = x$$

72 is 40% of 180.

24. Let x = area code 1, then $2x$ = area code 2.

$$x + 2x = 1203$$

$$3x = 1203$$

$$\frac{3x}{3} = \frac{1203}{3}$$

$$x = 401$$

$2x = 2(401) = 802$
The area codes are 401 and 802.

25. Let x represent the number of public libraries in Ohio. Then there are $x + 387$ public libraries in California.

$$x + x + 387 = 1827$$

$$2x + 387 = 1827$$

$$2x + 387 - 387 = 1827 - 387$$

$$2x = 1440$$

$$\frac{2x}{2} = \frac{1440}{2}$$

$$x = 720$$

$x + 387 = 720 + 387 = 1107$
Ohio has 720 public libraries and California has 1107.

Cumulative Review Chapters 1–2

1. Since 8 = 8, the statement $8 \geq 8$ is true.

2. Since −4 is to the right of −6 on a number line, the statement $-4 < -6$ is false.

3. Since 8 = 8, the statement $8 \leq 8$ is true.

4. Since 3 is to the right of −3 on a number line, the statement $3 > -3$ is true.

5. Since neither $23 < 0$ nor $23 = 0$ is true, the statement $23 \leq 0$ is false.

6. Since −8 = −8, the statement $-8 \geq -8$ is true.

7. Since $0 < 23$ is true, the statement $0 \leq 23$ is true.

8. Since −8 = −8, the statement $-8 \leq -8$ is true.

9. a. $|0| < 2$ since $|0| = 0$ and $0 < 2$.

b. $|-5| = 5$

c. $|-3| > |-2|$ since $3 > 2$.

d. $|-9| < |-9.7|$ since $9 < 9.7$.

e. $\left|-7\frac{1}{6}\right| > |7|$ since $7\frac{1}{6} > 7$.

10. a. $|5| = 5$ since 5 is 5 units from 0 on a number line.

b. $|-8| = 8$ since −8 is 8 units from 0 on a number line.

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c. $\left|-\frac{2}{3}\right| = \frac{2}{3}$ since $-\frac{2}{3}$ is $\frac{2}{3}$ unit from 0 on a number line.

11. $$\frac{3+|4-3|+2^2}{6-3} = \frac{3+|1|+2^2}{6-3}$$
$$= \frac{3+1+2^2}{3}$$
$$= \frac{3+1+4}{3}$$
$$= \frac{8}{3}$$

12. $$1+2(9-7)^3+4^2 = 1+2(2)^3+4^2$$
$$= 1+2(8)+16$$
$$= 1+16+16$$
$$= 33$$

13. $(-8) + (-11) = -19$

14. $-2 + (-8) = -10$

15. $(-2) + 10 = 8$

16. $-10 + 20 = 10$

17. $0.2 + (-0.5) = -0.3$

18. $1.2 + (-1.2) = 0$

19. a. $$-3+[(-2-5)-2] = -3+[(-2+(-5))-2]$$
$$= -3+[(-7)-2]$$
$$= -3+[-7+(-2)]$$
$$= -3+[-9]$$
$$= -12$$

b. $$2^3-10+[-6-(-5)] = 2^3-10+[-6+5]$$
$$= 2^3-10+[-1]$$
$$= 8-10+(-1)$$
$$= 8+(-10)+(-1)$$
$$= -2+(-1)$$
$$= -3$$

20. a. $-(-5) = 5$

b. $-\left(-\frac{2}{3}\right) = \frac{2}{3}$

c. $-(-a) = a$

d. $-|-3| = -3$

21. a. $7(0)(-6) = 0(-6) = 0$

b. $(-2)(-3)(-4) = (6)(-4) = -24$

c. $$(-1)(-5)(-9)(-2) = 5(-9)(-2)$$
$$= (-45)(-2)$$
$$= 90$$

22. a. $-2.7 - 8.4 = -2.7 + (-8.4) = -11.1$

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

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

23. a. $-18 \div 3 = -18 \cdot \frac{1}{3} = -6$

b. $\frac{-14}{-2} = -14 \cdot -\frac{1}{2} = 7$

c. $\frac{20}{-4} = 20 \cdot -\frac{1}{4} = -5$

24. a. $(4.5)(-0.08) = -0.36$

b. $-\frac{3}{4} \cdot -\frac{8}{17} = \frac{3 \cdot 8}{4 \cdot 17} = \frac{6}{17}$

25. $-5(-3+2z) = -5(-3)+(-5)(2z) = 15-10z$

26. $$2(y-3x+4) = 2(y)-2(3x)+2(4)$$
$$= 2y-6x+8$$

27. $$\frac{1}{2}(6x+14)+10 = \frac{1}{2}(6x)+\frac{1}{2}(14)+10$$
$$= 3x+7+10$$
$$= 3x+17$$

28. $$-(x+4)+3(x+4) = -1(x+4)+3(x+4)$$
$$= -1 \cdot x+(-1)(4)+3 \cdot x+3 \cdot 4$$
$$= -x-4+3x+12$$
$$= -x+3x-4+12$$
$$= 2x+8$$

29. a. $2x$ and $3x^2$ are unlike terms, since the exponents on x are not the same.

b. $4x^2y$, xy^2, and $-2x^2y$ are like terms, since each variable and its exponent match.

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c. $-2yz$ and $-3zy$ are like terms, since $zy = yz$ by the commutative property.

d. $-x^4$ and x^4 are like terms. The variable and its exponent match.

e. $-8a^5$ and $8a^5$ are like terms. The variable and its exponent match.

30. a. $\dfrac{-32}{8} = -4$

b. $\dfrac{-108}{-12} = 9$

c. $\dfrac{-5}{7} \div \left(\dfrac{-9}{2}\right) = \dfrac{-5}{7} \cdot \left(\dfrac{2}{-9}\right) = \dfrac{5 \cdot 2}{7 \cdot 9} = \dfrac{10}{63}$

31. $(2x - 3) - (4x - 2) = 2x - 3 - 4x + 2 = -2x - 1$

32. $(-5x+1)-(10x+3) = -5x+1-10x-3$
$= -15x-2$

33. $x-7=10$
$x-7+7=10+7$
$x=17$

34. $\dfrac{5}{6}+x=\dfrac{2}{3}$
$\dfrac{5}{6}+x-\dfrac{5}{6}=\dfrac{2}{3}-\dfrac{5}{6}$
$x=\dfrac{4}{6}-\dfrac{5}{6}$
$x=-\dfrac{1}{6}$

35. $-z-4=6$
$-z-4+4=6+4$
$-z=10$
$\dfrac{-z}{-1}=\dfrac{10}{-1}$
$z=-10$

36. $-3x+1-(-4x-6)=10$
$-3x+1+4x+6=10$
$x+7=10$
$x+7-7=10-7$
$x=3$

37. $\dfrac{2(a+3)}{3}=6a+2$
$3\cdot\dfrac{2(a+3)}{3}=3(6a+2)$
$2(a+3)=3(6a+2)$
$2a+6=18a+6$
$2a+6-18a=18a+6-18a$
$-16a+6=6$
$-16a+6-6=6-6$
$-16a=0$
$\dfrac{-16a}{-16}=\dfrac{0}{-16}$
$a=0$

38. $\dfrac{x}{4}=18$
$4\cdot\dfrac{x}{4}=4\cdot 18$
$x=72$

39. Let x be the number of Democrats. Then $x + 34$ is the number of Republicans. The total number is 432.
$x+x+34=432$
$2x+34=432$
$2x+34-34=432-34$
$2x=398$
$\dfrac{2x}{2}=\dfrac{398}{2}$
$x=199$
$x + 34 = 199 + 34 = 233$
There were 199 Democrats and 233 Republicans.

40. $6x+5=4(x+4)-1$
$6x+5=4x+16-1$
$6x+5=4x+15$
$6x+5-4x=4x+15-4x$
$2x+5=15$
$2x+5-5=15-5$
$2x=10$
$\dfrac{2x}{2}=\dfrac{10}{2}$
$x=5$

41. Use $d = rt$ when $d = 31{,}680$ and $r = 400$.
$d=rt$
$31{,}680=400t$
$\dfrac{31{,}680}{400}=\dfrac{400t}{400}$
$79.2=t$
It will take the ice 79.2 years to reach the lake.

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42.
$$\begin{aligned} x+4 &= 3x-8 \\ x+4-3x &= 3x-8-3x \\ -2x+4 &= -8 \\ -2x+4-4 &= -8-4 \\ -2x &= -12 \\ \frac{-2x}{-2} &= \frac{-12}{-2} \\ x &= 6 \end{aligned}$$
The number is 6.

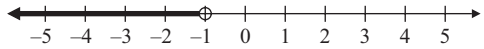
43. Let x be the unknown percent.
$$\begin{aligned} 63 &= x \cdot 72 \\ \frac{63}{72} &= \frac{72x}{72} \\ 0.875 &= x \\ 87.5\% &= x \end{aligned}$$
63 is 87.5% of 72.

44.
$$\begin{aligned} C &= 2\pi r \\ \frac{C}{2\pi} &= \frac{2\pi r}{2\pi} \\ \frac{C}{2\pi} &= r \text{ or } r = \frac{C}{2\pi} \end{aligned}$$

45.
$$\begin{aligned} 5(2x+3) &= -1+7 \\ 5(2x)+5(3) &= -1+7 \\ 10x+15 &= 6 \\ 10x+15-15 &= 6-15 \\ 10x &= -9 \\ \frac{10x}{10} &= \frac{-9}{10} \\ x &= -\frac{9}{10} \end{aligned}$$

46.
$$\begin{aligned} x-3 &> 2 \\ x-3+3 &> 2+3 \\ x &> 5 \end{aligned}$$
$\{x|x > 5\}$

47. $-1 > x$ or $x < -1$



48.
$$\begin{aligned} 3x-4 &\le 2x-14 \\ 3x-4-2x &\le 2x-14-2x \\ x-4 &\le -14 \\ x-4+4 &\le -14+4 \\ x &\le -10 \end{aligned}$$
$\{x|x \le -10\}$

49.
$$\begin{aligned} 2(x-3)-5 &\le 3(x+2)-18 \\ 2x-6-5 &\le 3x+6-18 \\ 2x-11 &\le 3x-12 \\ -x-11 &\le -12 \\ -x &\le -1 \\ \frac{-x}{-1} &\ge \frac{-1}{-1} \\ x &\ge 1 \end{aligned}$$
$\{x|x \ge 1\}$

50.
$$\begin{aligned} -3x &\ge 9 \\ \frac{-3x}{-3} &\le \frac{9}{-3} \\ x &\le -3 \end{aligned}$$
$\{x|x \le -3\}$

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