Chapter 2

2.1 Exercises

1. A conditional linear equation in one variable is characterized by an exponent of positive one on the variable.

2. A solution to an equation is a value, which, when substituted for the variable causes the original statement to hold true.

3. To solve a linear equation of the form $a+bx=cx$, where x is the variable, we must first gather the variables to one side.

4. To solve a linear equation of the form $\frac{a}{b}x+c=d$, where x is the variable, we need to use the addition property of equality to isolate the variable quantity on the left side.

5. This is a linear equation in one variable because the exponent on x is positive one.

6. This is not a linear equation in one variable because the highest power of x is two.

7. This is a linear equation in one variable because the highest power of x is one.

8. This is not a linear equation in one variable because the equation contains both x and y.

9. This is not a linear equation in one variable because the equation contains both x and y. The power of y is three.

10. This is not a linear equation in one variable because the exponent on x is in the denominator.

11.
$$3x-5=2$$
$$3(1)-5=2$$
$$3-5=2$$
$$-2=2$$
No, 1 is not a solution.

12.
$$5x-7=-3$$
$$5(2)-7=-3$$
$$10-7=-3$$
$$3=-3$$
No, 2 is not a solution.

13.
$$2(s-1)+5=s+3(2s-4)$$
$$2((3)-1)+5=(3)+3(2(3)-4)$$
$$2(2)+5=3+3(6-4)$$
$$4+5=3+3(2)$$
$$9=3+6$$
$$9=9$$
Yes, 3 is a solution.

14.
$$6(2t-3)+13=t+4(t-3)$$
$$6(2(-1)-3)+13=(-1)+4((-1)-3)$$
$$6(-2-3)+13=-1+4(-4)$$
$$6(-5)+13=-1-16$$
$$-30+13=-17$$
$$-17=-17$$
Yes, -1 is a solution.

15.
$$\frac{1}{2}(n+4)=\frac{2}{3}n-\frac{5}{6}$$
$$\frac{1}{2}((17)+4)=\frac{2}{3}(17)-\frac{5}{6}$$
$$\frac{1}{2}(21)=\frac{34}{3}-\frac{5}{6}$$
$$\frac{21}{2}=\frac{63}{6}$$
$$\frac{21}{2}=\frac{21}{2}$$
Yes, 17 is a solution.

16.
$$\frac{2}{3}(p-3)=\frac{1}{2}p-\frac{4}{3}$$
$$\frac{2}{3}((4)-3)=\frac{1}{2}(4)-\frac{4}{3}$$
$$\frac{2}{3}(1)=2-\frac{4}{3}$$
$$\frac{2}{3}=\frac{2}{3}$$
Yes, 4 is a solution.

17.
$$0.1x-0.03=2.1x-1.03$$
$$0.1(2)-0.03=2.1(2)-1.03$$
$$0.2-0.03=4.2-1.03$$
$$0.17=3.17$$
No, 2 is not a solution.

18. $-0.01x + 0.42 = 3.2x - 2.79$

$-0.01(-1) + 0.42 = 3.2(-1) - 2.79$

$0.01 + 0.42 = -3.2 - 2.79$

$0.43 = -5.99$

No, -1 is not a solution.

19. $x + 17 = -10$

$x + 17 - 17 = -10 - 17$

$x + 0 = -27$

$x = -27$

Solution Set: $\{-27\}$

20. $x + 21 = -38$

$x + 21 - 21 = -38 - 21$

$x + 0 = -59$

$x = -59$

Solution Set: $\{-59\}$

21. $m - 42 = 10$

$m - 42 + 42 = 10 + 42$

$m + 0 = 52$

$m = 52$

Solution Set: $\{52\}$

22. $n - 28 = 15$

$n - 28 + 28 = 15 + 28$

$n + 0 = 43$

$n = 43$

Solution Set: $\{43\}$

23. $168 + p = 3$

$168 - 168 + p = 3 - 168$

$0 + p = -165$

$p = -165$

Solution Set: $\{-165\}$

24. $140 + h = 22$

$140 - 140 + h = 22 - 140$

$0 + h = -118$

$h = -118$

Solution Set: $\{-118\}$

25. $28 = t - \frac{2}{3}$

$28 + \frac{2}{3} = t - \frac{2}{3} + \frac{2}{3}$

$28\frac{2}{3} = t + 0$

$28\frac{2}{3} = t$

Solution Set: $\left\{28\frac{2}{3}\right\}$

26. $32 = k - \frac{3}{4}$

$32 + \frac{3}{4} = k - \frac{3}{4} + \frac{3}{4}$

$32\frac{3}{4} = k + 0$

$32\frac{3}{4} = k$

Solution Set: $\left\{32\frac{3}{4}\right\}$

27. $1.5 + x = 4.5$

$1.5 - 1.5 + x = 4.5 - 1.5$

$0 + x = 3$

$x = 3$

Solution Set: $\{3\}$

28. $2.3 + x = 6.3$

$2.3 - 2.3 + x = 6.3 - 2.3$

$0 + x = 4$

$x = 4$

Solution Set: $\{4\}$

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

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

$\frac{2}{15} = x + 0$

$\frac{2}{15} = x$

Solution Set: $\left\{\frac{2}{15}\right\}$

30. $-\frac{1}{4}=x-\frac{2}{7}$

$-\frac{1}{4}+\frac{2}{7}=x-\frac{2}{7}+\frac{2}{7}$

$\frac{1}{28}=x+0$

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

Solution Set: $\left\{\frac{1}{28}\right\}$

31. $3x=-18$

$\frac{1}{3}(3x)=\frac{1}{3}(-18)$

$1\cdot x=-6$

$x=-6$

Solution Set: $\{-6\}$

32. $6x=-24$

$\frac{1}{6}(6x)=\frac{1}{6}(-24)$

$1\cdot x=-4$

$x=-4$

Solution Set: $\{-4\}$

33. $3.5w=10.5$

$\frac{3.5w}{3.5}=\frac{10.5}{3.5}$

$1\cdot w=3$

$w=3$

Solution Set: $\{3\}$

34. $2.7u=13.5$

$\frac{2.7u}{2.7}=\frac{13.5}{2.7}$

$1\cdot u=5$

$u=5$

Solution Set: $\{5\}$

35. $\frac{x}{15}=-20$

$\frac{15}{1}\left(\frac{x}{15}\right)=15(-20)$

$1\cdot x=-300$

$x=-300$

Solution Set: $\{-300\}$

36. $\frac{x}{12}=-10$

$\frac{12}{1}\left(\frac{x}{12}\right)=12(-10)$

$1\cdot x=-120$

$x=-120$

Solution Set: $\{-120\}$

37. $\frac{2}{7}x=-\frac{3}{14}$

$\frac{7}{2}\left(\frac{2}{7}x\right)=\frac{7}{2}\left(-\frac{3}{14}\right)$

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

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

Solution Set: $\left\{-\frac{3}{4}\right\}$

38. $\frac{3}{5}x=-\frac{8}{25}$

$\frac{5}{3}\left(\frac{3}{5}x\right)=\frac{5}{3}\left(-\frac{8}{25}\right)$

$1\cdot x=-\frac{8}{15}$

$x=-\frac{8}{15}$

Solution Set: $\left\{-\frac{8}{15}\right\}$

39. $-6x=3\frac{1}{2}$

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

$1\cdot x=-\frac{1}{6}\left(\frac{7}{2}\right)$

$x=-\frac{7}{12}$

Solution Set: $\left\{-\frac{7}{12}\right\}$

40. $-10x = 5\frac{1}{2}$

$$-\frac{1}{10}(-10x) = -\frac{1}{10}\left(5\frac{1}{2}\right)$$

$$1 \cdot x = -\frac{1}{10}\left(\frac{11}{2}\right)$$

$$x = -\frac{11}{20}$$

Solution Set: $\left\{-\frac{11}{20}\right\}$

41. $0 = \frac{t}{7}$

$$7(0) = \frac{7}{1}\left(\frac{t}{7}\right)$$

$$0 = 1 \cdot t$$

$$0 = t$$

Solution Set: $\{0\}$

42. $0 = \frac{m}{12}$

$$12(0) = \frac{12}{1}\left(\frac{m}{12}\right)$$

$$0 = 1 \cdot m$$

$$0 = m$$

Solution Set: $\{0\}$

43. $8d + 5 = 29$

$$8d + 5 - 5 = 29 - 5$$

$$8d = 24$$

$$\frac{8d}{8} = \frac{24}{8}$$

$$d = 3$$

Solution Set: $\{3\}$

44. $6f + 11 = 47$

$$6f + 11 - 11 = 47 - 11$$

$$6f = 36$$

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

$$f = 6$$

Solution Set: $\{6\}$

45. $32 = 2x - 22$

$$32 + 22 = 2x - 22 + 22$$

$$54 = 2x$$

$$\frac{54}{2} = \frac{2x}{2}$$

$$27 = x$$

Solution Set: $\{27\}$

46. $18 = 3x - 21$

$$18 + 21 = 3x - 21 + 21$$

$$39 = 3x$$

$$\frac{39}{3} = \frac{3x}{3}$$

$$13 = x$$

Solution Set: $\{13\}$

47. $-4x + 1.6 = 3.2$

$$-4x + 1.6 - 1.6 = 3.2 - 1.6$$

$$-4x = 1.6$$

$$\frac{-4x}{-4} = \frac{1.6}{-4}$$

$$x = -0.4$$

Solution Set: $\{-0.4\}$

48. $-9x + 1.2 = 7.5$

$$-9x + 1.2 - 1.2 = 7.5 - 1.2$$

$$-9x = 6.3$$

$$\frac{-9x}{-9} = \frac{6.3}{-9}$$

$$x = -0.7$$

Solution Set: $\{-0.7\}$

49. $3x + 15 = 15$

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

$$3x = 0$$

$$\frac{3x}{3} = \frac{0}{3}$$

$$x = 0$$

Solution Set: $\{0\}$

50. $6x+12=12$

$6x+12-12=12-12$

$6x=0$

$\frac{6x}{6}=\frac{0}{6}$

$x=0$

Solution Set: $\{0\}$

51. $-51-7d=5$

$-51+51-7d=5+51$

$-7d=56$

$\frac{-7d}{-7}=\frac{56}{-7}$

$d=-8$

Solution Set: $\{-8\}$

52. $-45-11b=21$

$-45+45-11b=21+45$

$-11b=66$

$\frac{-11b}{-11}=\frac{66}{-11}$

$b=-6$

Solution Set: $\{-6\}$

53. $-102=14-2x$

$-102-14=14-14-2x$

$-116=-2x$

$\frac{-116}{-2}=\frac{-2x}{-2}$

$58=x$

Solution Set: $\{58\}$

54. $-98=16-3x$

$-98-16=16-16-3x$

$-114=-3x$

$\frac{-114}{-3}=\frac{-3x}{-3}$

$38=x$

Solution Set: $\{38\}$

55. $\frac{1}{2}x-18=52$

$\frac{1}{2}x-18+18=52+18$

$\frac{1}{2}x=70$

$2\left(\frac{1}{2}x\right)=2(70)$

$x=140$

Solution Set: $\{140\}$

56. $\frac{1}{5}x-34=71$

$\frac{1}{5}x-34+34=71+34$

$\frac{1}{5}x=105$

$5\left(\frac{1}{5}x\right)=5(105)$

$x=525$

Solution Set: $\{525\}$

57. $30=\frac{9}{2}x+12$

$30-12=\frac{9}{2}x+12-12$

$18=\frac{9}{2}x$

$\frac{2}{9}(18)=\frac{2}{9}\left(\frac{9}{2}x\right)$

$4=x$

Solution Set: $\{4\}$

58. $40=\frac{7}{3}x-9$

$40+9=\frac{7}{3}x-9+9$

$49=\frac{7}{3}x$

$\frac{3}{7}(49)=\frac{3}{7}\left(\frac{7}{3}x\right)$

$21=x$

Solution Set: $\{21\}$

59. $-14h+42=0$

$-14h+42-42=0-42$

$-14h=-42$

$\frac{-14h}{-14}=\frac{-42}{-14}$

$h=3$

Solution Set: $\{3\}$

60. $-16g+32=0$

$-16g+32-32=0-32$

$-16g=-32$

$\frac{-16g}{-16}=\frac{-32}{-16}$

$g=2$

Solution Set: $\{2\}$

61. $21x+5=13x+53$

$21x-13x+5=13x-13x+53$

$8x+5=53$

$8x+5-5=53-5$

$8x=48$

$\frac{8x}{8}=\frac{48}{8}$

$x=6$

Solution Set: $\{6\}$

62. $5x-16=-4x+2$

$5x+4x-16=-4x+4x+2$

$9x-16=2$

$9x-16+16=2+16$

$9x=18$

$\frac{9x}{9}=\frac{18}{9}$

$x=2$

Solution Set: $\{2\}$

63. $6x+3-x=15x-8+x$

$5x+3=16x-8$

$5x-16x+3=16x-16x-8$

$-11x+3=-8$

$-11x+3-3=-8-3$

$-11x=-11$

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

$x=1$

Solution Set: $\{1\}$

64. $-7x+4-x=13x-19+2x$

$-8x+4=15x-19$

$-8x-15x+4=15x-15x-19$

$-23x+4=-19$

$-23x+4-4=-19-4$

$-23x=-23$

$\frac{-23x}{-23}=\frac{-23}{-23}$

$x=1$

Solution Set: $\{1\}$

65. $6.2x+0.6=5.6-3.8x$

$6.2x+3.8x+0.6=5.6-3.8x+3.8x$

$10x+0.6=5.6$

$10x+0.6-0.6=5.6-0.6$

$10x=5$

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

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

Solution Set: $\left\{\frac{1}{2}\right\}$

66. $3.8x-0.3=-4.3-2.2x$

$3.8x+2.2x-0.3=-4.3-2.2x+2.2x$

$6x-0.3=-4.3$

$6x-0.3+0.3=-4.3+0.3$

$6x=-4$

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

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

Solution Set: $\left\{-\frac{2}{3}\right\}$

67. $8x-3x=-20$

$5x=-20$

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

$x=-4$

Solution Set: $\{-4\}$

68. $-7x+4x=33$

$-3x=33$

$\frac{-3x}{-3}=\frac{33}{-3}$

$x=-11$

Solution Set: $\{-11\}$

69. $\frac{x}{3}+5=-9$

$\frac{x}{3}+5-5=-9-5$

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

$\frac{3}{1}\left(\frac{x}{3}\right)=3(-14)$

$x=-42$

Solution Set: $\{-42\}$

70. $\frac{x}{5}-8=7$

$\frac{x}{5}-8+8=7+8$

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

$\frac{5}{1}\left(\frac{x}{5}\right)=5(15)$

$x=75$

Solution Set: $\{75\}$

71. $14x+\frac{5}{6}=-\frac{2}{6}$

$14x+\frac{5}{6}-\frac{5}{6}=-\frac{2}{6}-\frac{5}{6}$

$14x=-\frac{7}{6}$

$\frac{1}{14}(14x)=\frac{1}{14}\left(-\frac{7}{6}\right)$

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

Solution Set: $\left\{-\frac{1}{12}\right\}$

72. $-15x+\frac{4}{7}=-\frac{21}{7}$

$-15x+\frac{4}{7}-\frac{4}{7}=-\frac{21}{7}-\frac{4}{7}$

$-15x=-\frac{25}{7}$

$-\frac{1}{15}(-15x)=-\frac{1}{15}\left(-\frac{25}{7}\right)$

$x=\frac{5}{21}$

Solution Set: $\left\{\frac{5}{21}\right\}$

73. $n-18=3n-18$

$n-3n-18=3n-3n-18$

$-2n-18=-18$

$-2n-18+18=-18+18$

$-2n=0$

$\frac{-2n}{-2}=\frac{0}{-2}$

$n=0$

Solution Set: $\{0\}$

74. $-12n+16=16+10n$

$-12n-10n+16=16+10n-10n$

$-22n+16=16$

$-22n+16-16=16-16$

$-22n=0$

$\frac{-22n}{-22}=\frac{0}{-22}$

$n=0$

Solution Set: $\{0\}$

75. $-10=-105x+35+20x$

$-10=-85x+35$

$-10-35=-85x+35-35$

$-45=-85x$

$\frac{-45}{-85}=\frac{-85x}{-85}$

$\frac{9}{17}=x$

Solution Set: $\left\{\frac{9}{17}\right\}$

76.
$$\begin{aligned} 5 &= -95x + 15 + 30x \\ 5 &= -65x + 15 \\ 5 - 15 &= -65x + 15 - 15 \\ -10 &= -65x \\ \frac{-10}{-65} &= \frac{-65x}{-65} \\ \frac{2}{13} &= x \end{aligned}$$

Solution Set: $\left\{\frac{2}{13}\right\}$

77.
$$\begin{aligned} 2.4x - 16 &= 8 \\ 2.4x - 16 + 16 &= 8 + 16 \\ 2.4x &= 24 \\ \frac{2.4x}{2.4} &= \frac{24}{2.4} \\ x &= 10 \end{aligned}$$

Solution Set: $\{10\}$

78.
$$\begin{aligned} -3.5x + 21 &= -14 \\ -3.5x + 21 - 21 &= -14 - 21 \\ -3.5x &= -35 \\ \frac{-3.5x}{-3.5} &= \frac{-35}{-3.5} \\ x &= 10 \end{aligned}$$

Solution Set: $\{10\}$

79.
$$\begin{aligned} -66 &= -33x + 231 \\ -66 - 231 &= -33x + 231 - 231 \\ -297 &= -33x \\ \frac{-297}{-33} &= \frac{-33x}{-33} \\ 9 &= x \end{aligned}$$

Solution Set: $\{9\}$

80.
$$\begin{aligned} 78 &= -37x - 181 \\ 78 + 181 &= -37x - 181 + 181 \\ 259 &= -37x \\ \frac{259}{-37} &= \frac{-37x}{-37} \\ -7 &= x \end{aligned}$$

Solution Set: $\{-7\}$

81.
$$\begin{aligned} -x - 0.35 + 0.5x &= -4 \\ -0.5x - 0.35 &= -4 \\ -0.5x - 0.35 + 0.35 &= -4 + 0.35 \\ -0.5x &= -3.65 \\ \frac{-0.5x}{-0.5} &= \frac{-3.65}{-0.5} \\ x &= 7.3 \end{aligned}$$

Solution Set: $\{7.3\}$

82.
$$\begin{aligned} x + 0.48 - 0.6x &= -2 \\ 0.4x + 0.48 &= -2 \\ 0.4x + 0.48 - 0.48 &= -2 - 0.48 \\ 0.4x &= -2.48 \\ \frac{0.4x}{0.4} &= \frac{-2.48}{0.4} \\ x &= -6.2 \end{aligned}$$

Solution Set: $\{-6.2\}$

83. Answers will vary; one example is: $x^2 + 3x = 6$ (the exponent does not equal one).

84. Answers will vary; one example is: $0.3x + 0.9$ (there is only one variable).

85. Answers will vary; one example is: $23x - 7 = 16$ (one variable) and $2x - 3y = 6$ (two variables).

86. Answers will vary; one example is: $x + 6 = 10$. $x = 4$

87. Answers will vary; one example is: $3x = 9$. $x = 3$

88. Answers will vary; one example is: $3x + 1 = 2x - 4$. Collect x's on one side and constant terms on the other.

89.
$$\begin{aligned} x + x - 14 + x + 1 &= 59 \\ 3x - 13 &= 59 \\ 3x - 13 + 13 &= 59 + 13 \\ 3x &= 72 \\ \frac{3x}{3} &= \frac{72}{3} \\ x &= 24 \end{aligned}$$

The sides are 10m, 24m, and 25m.

90. $x+x+4+x-4=48$

$$3x=48$$
$$\frac{3x}{3}=\frac{48}{3}$$
$$x=16$$

The sides are 12in, 16in, and 20in.

91. $8x=162.4$

$$\frac{8x}{8}=\frac{162.4}{8}$$
$$x=20.3$$

Each side is 20.3cm.

92. $4x=243.84$

$$\frac{4x}{4}=\frac{243.84}{4}$$
$$x=60.96$$

Each side is 60.96cm.

93. Prepare We must solve the linear equation for s to determine how much Lucinda Smeeds must sell at L & C Electronics so that she earns as much as her current $12.50 per hour wage.

Plan Solve the linear equation for s by using the Strategy for Solving Linear Equations.

Process

$$0.05s+350=500$$
$$0.05s+350-350=500-350$$
$$0.05s=150$$
$$\frac{0.05s}{0.05}=\frac{150}{0.05}$$
$$s=3000$$

Therefore, Lucinda would have to sell $3000 worth of electronics per week to make the same salary she makes earning $12.50 per hour based on a 40-hour week.

Ponder Does our answer seem reasonable? We can check our answer. The hourly wage for one week would be $12.50(40) = $500. The commission plus $350 would be (0.05)(3,000)+350 = $500.

94. Prepare We must solve the linear equation for s to determine how much Dean Silver must sell so that the wages of the two jobs are equal.

Plan Solve the linear equation for s by using the Strategy for Solving Linear Equations.

Process

$$0.02s+1800=0.04s+1200$$
$$0.02s-0.04s+1800=0.04s-0.04s+1200$$
$$-0.02s+1800=1200$$
$$-0.02s+1800-1800=1200-1800$$
$$-0.02s=-600$$
$$\frac{-0.02s}{-0.02}=\frac{-600}{-0.02}$$
$$s=30000$$

Therefore, Dean would have to sell $30,000 worth of motorcycles per month so that the wages of the two jobs are equal.

Ponder Does our answer seem reasonable? We can check our answer. The wages at the first dealer would be (0.02)(30,000)+1800 = $2,400. The wages at the second dealer would be (0.04)(30,000)+1200 = $2,400.

95. $6x+\left[-15x-3(x-1)\right]=11$

$$6\left(-\frac{2}{3}\right)+\left[-15\left(-\frac{2}{3}\right)-3\left(\left(-\frac{2}{3}\right)-1\right)\right]=11$$
$$-4+\left[10-3\left(-\frac{5}{3}\right)\right]=11$$
$$-4+\left[10+5\right]=11$$
$$-4+15=11$$
$$11=11$$

Yes, $-\frac{2}{3}$ is a solution.

96. $-6x+2\left[-10-(3x-1)\right]=-14$

$$-6\left(-\frac{1}{3}\right)+2\left[-10-\left(3\left(-\frac{1}{3}\right)-1\right)\right]=-14$$
$$2+2\left[-10-(-1-1)\right]=-14$$
$$2+2\left[-10+2\right]=-14$$
$$2+2\left[-8\right]=-14$$
$$2-16=-14$$
$$-14=-14$$

Yes, $-\frac{1}{3}$ is a solution.

97.
$$-2x+\left[-6x+2(x-3)\right]=-15$$
$$-2\left(\frac{3}{2}\right)+\left[-6\left(\frac{3}{2}\right)+2\left(\left(\frac{3}{2}\right)-3\right)\right]=-15$$
$$-3+\left[-9+2\left(-\frac{3}{2}\right)\right]=-15$$
$$-3+\left[-9-3\right]=-15$$
$$-3+\left[-12\right]=-15$$
$$-15=-15$$

Yes, $\frac{3}{2}$ is a solution.

98.
$$10x+8\left[-5(x-4)-11\right]=24$$
$$10\left(\frac{-1}{2}\right)+8\left[-5\left(\left(\frac{-1}{2}\right)-4\right)-11\right]=24$$
$$-5+8\left[-5\left(-\frac{9}{2}\right)-11\right]=24$$
$$-5+8\left[\frac{45}{2}-11\right]=24$$
$$-5+8\left[\frac{23}{2}\right]=24$$
$$-5+92=24$$
$$87=24$$

No, $\frac{-1}{2}$ is not a solution.

99.
$$-\frac{1}{3}x+0.05=-0.2$$
$$-\frac{1}{3}x+0.05-0.05=-0.2-0.05$$
$$-\frac{1}{3}x=-0.25$$
$$-3\left(-\frac{1}{3}x\right)=-3(-0.25)$$
$$x=0.75$$

Solution Set: $\{0.75\}$

100.
$$\frac{1}{5}x-0.7=0.04$$
$$\frac{1}{5}x-0.7+0.7=0.04+0.7$$
$$\frac{1}{5}x=0.74$$
$$5\left(\frac{1}{5}x\right)=5(0.74)$$
$$x=3.7$$

Solution Set: $\{3.7\}$

101.
$$0.6x-\frac{1}{4}=3.2$$
$$0.6x-0.25=3.2$$
$$0.6x-0.25+0.25=3.2+0.25$$
$$0.6x=3.45$$
$$\frac{0.6x}{0.6}=\frac{3.45}{0.6}$$
$$x=5.75$$

Solution Set: $\{5.75\}$

102.
$$0.8x+\frac{1}{5}=9.6$$
$$0.8x+0.2=9.6$$
$$0.8x+0.2-0.2=9.6-0.2$$
$$0.8x=9.4$$
$$x=11.75$$

Solution Set: $\{11.75\}$

Extension Activity

Answers will vary; one example is: Flat fee of \$50.00 and \$3.00 per mile. To tow your car 19 miles from your college campus to home will cost \$107.00. Let x represent the number of miles your car must be towed. Then, the equation is given by $3x+50=200$ and your car can be towed 50 miles for \$200.00.

2.2 Exercises

1. When solving a linear equation involving fractions, if clearing fractions is necessary, we multiply both sides of the equation by the least common denominator of all the denominators present.

2. When solving a linear equation involving decimals, if clearing the decimals is necessary, we multiply both sides of the equation by the LCD that will be a multiple of 10.

3. An equation that does not have a solution is called an inconsistent equation.

4. An equation that has all real numbers as its solution is called an identity.

5. The equation $5(x-1)=5(x+2)$ is an inconsistent equation.

6. The equation $-2(3x+2)=-3(x+2)-3x+2$ is an identity equation.

7. Yes, because there are three different denominators.

8. No, because the constant terms combine to become a whole number.

9. No, because the constant terms combine to become a whole number.

10. Yes, because each term contains a decimal.

11.
$$\begin{aligned} 5(x+2)&=45\\ 5x+10&=45\\ 5x+10-10&=45-10\\ 5x&=35\\ \frac{5x}{5}&=\frac{35}{5}\\ x&=7 \end{aligned}$$
Solution Set: $\{7\}$

12.
$$\begin{aligned} 8(x+3)&=72\\ 8x+24&=72\\ 8x+24-24&=72-24\\ 8x&=48\\ \frac{8x}{8}&=\frac{48}{8}\\ x&=6 \end{aligned}$$
Solution Set: $\{6\}$

13.
$$\begin{aligned} 6(4-w)&=12\\ 24-6w&=12\\ 24-24-6w&=12-24\\ -6w&=-12\\ \frac{-6w}{-6}&=\frac{-12}{-6}\\ w&=2 \end{aligned}$$
Solution Set: $\{2\}$

14.
$$\begin{aligned} 4(3-p)&=4\\ 12-4p&=4\\ 12-12-4p&=4-12\\ -4p&=-8\\ \frac{-4p}{-4}&=\frac{-8}{-4}\\ p&=2 \end{aligned}$$
Solution Set: $\{2\}$

15.
$$\begin{aligned} 18&=4(d-2)\\ 18&=4d-8\\ 18+8&=4d-8+8\\ 26&=4d\\ \frac{26}{4}&=\frac{4d}{4}\\ \frac{13}{2}&=d \end{aligned}$$
Solution Set: $\left\{\frac{13}{2}\right\}$

16.
$$\begin{aligned} 16&=8(h-3)\\ 16&=8h-24\\ 16+24&=8h-24+24\\ 40&=8h\\ \frac{40}{8}&=\frac{8h}{8}\\ 5&=h \end{aligned}$$
Solution Set: $\{5\}$

17. $x-5(2x+1)=58$

$x-10x-5=58$

$-9x-5=58$

$-9x-5+5=58+5$

$-9x=63$

$\frac{-9x}{-9}=\frac{63}{-9}$

$x=-7$

Solution Set: $\{-7\}$

18. $x-2(3x+1)=18$

$x-6x-2=18$

$-5x-2=18$

$-5x-2+2=18+2$

$-5x=20$

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

$x=-4$

Solution Set: $\{-4\}$

19. $60=5-(2x+9)$

$60=5-2x-9$

$60=-2x-4$

$60+4=-2x-4+4$

$64=-2x$

$\frac{64}{-2}=\frac{-2x}{-2}$

$-32=x$

Solution Set: $\{-32\}$

20. $53=7-(3x+8)$

$53=-3x-1$

$53+1=-3x-1+1$

$54=-3x$

$\frac{54}{-3}=\frac{-3x}{-3}$

$-18=x$

Solution Set: $\{-18\}$

21. $12(3x-5)=10x-8$

$36x-60=10x-8$

$36x-10x-60=10x-10x-8$

$26x-60=-8$

$26x-60+60=-8+60$

$26x=52$

$\frac{26x}{26}=\frac{52}{26}$

$x=2$

Solution Set: $\{2\}$

22. $-3(2x+1)=4x+7$

$-6x-3=4x+7$

$-6x-4x-3=4x-4x+7$

$-10x-3=7$

$-10x-3+3=7+3$

$-10x=10$

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

$x=-1$

Solution Set: $\{-1\}$

23. $-12+5(2s-1)=20s+3$

$-12+10s-5=20s+3$

$10s-17=20s+3$

$10s-20s-17=20s-20s+3$

$-10s-17=3$

$-10s-17+17=3+17$

$-10s=20$

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

$x=-2$

Solution Set: $\{-2\}$

24. $5+2(3s+1)=s+12$

$5+6s+2=s+12$

$6s+7=s+12$

$6s-s+7=s-s+12$

$5s+7=12$

$5s+7-7=12-7$

$5s=5$

$\frac{5s}{5}=\frac{5}{5}$

$s=1$

Solution Set: $\{1\}$

25. $-7(m-1)=11(2m-2)$

$-7m+7=22m-22$

$-7m-22m+7=22m-22m-22$

$-29m+7=-22$

$-29m+7-7=-22-7$

$-29m=-29$

$\frac{-29m}{-29}=\frac{-29}{-29}$

$m=1$

Solution Set: $\{1\}$

26. $5(m+3)=2(3m+1)$

$5m+15=6m+2$

$5m-6m+15=6m-6m+2$

$-m+15=2$

$-m+15-15=2-15$

$-m=-13$

$\frac{-m}{-1}=\frac{-13}{-1}$

$m=13$

Solution Set: $\{13\}$

27. $4.5+0.1x=1.5$

$10(4.5+0.1x)=10(1.5)$

$45+x=15$

$45-45+x=15-45$

$x=-30$

Solution Set: $\{-30\}$

28. $2.8+0.2x=10.8$

$10(2.8+0.2x)=10(10.8)$

$28+2x=108$

$28-28+2x=108-28$

$2x=80$

$\frac{2x}{2}=\frac{80}{2}$

$x=40$

Solution Set: $\{40\}$

29. $2.3x-0.11=0.8x+34.39$

$100(2.3x-0.11)=100(0.8x+34.39)$

$230x-11=80x+3439$

$230x-80x-11=80x-80x+3439$

$150x-11=3439$

$150x-11+11=3439+11$

$150x=3450$

$\frac{150x}{150}=\frac{3450}{150}$

$x=23$

Solution Set: $\{23\}$

30. $1.2x-0.66=0.3x+1.14$

$100(1.2x-0.66)=100(0.3x+1.14)$

$120x-66=30x+114$

$120x-30x-66=30x-30x+114$

$90x-66=114$

$90x-66+66=114+66$

$90x=180$

$\frac{90x}{90}=\frac{180}{90}$

$x=2$

Solution Set: $\{2\}$

31. $0.25x+0.1(x+5)=2.25$

$0.25x+0.1x+0.5=2.25$

$0.35x+0.5=2.25$

$100(0.35x+0.5)=100(2.25)$

$35x+50=225$

$35x+50-50=225-50$

$35x=175$

$\frac{35x}{35}=\frac{175}{35}$

$x=5$

Solution Set: $\{5\}$

32. $0.7x+0.25(2x+5)=8.75$

$0.7x+0.5x+1.25=8.75$

$1.2x+1.25=8.75$

$100(1.2x+1.25)=100(8.75)$

$120x+125=875$

$120x+125-125=875-125$

$120x=750$

$\frac{120x}{120}=\frac{750}{120}$

$x=6.25$

Solution Set: $\{6.25\}$

33. $6x+0.8(2x-0.1)=151.92$

$6x+1.6x-0.08=151.92$

$7.6x-0.08=151.92$

$100(7.6x-0.08)=100(151.92)$

$760x-8=15192$

$760x-8+8=15192+8$

$760x=15200$

$\frac{760x}{760}=\frac{15200}{760}$

$x=20$

Solution Set: $\{20\}$

34. $4x-0.3(5x-0.2)=75.06$

$4x-1.5x+0.06=75.06$

$2.5x+0.06=75.06$

$100(2.5x+0.06)=100(75.06)$

$250x+6=7506$

$250x+6-6=7506-6$

$250x=7500$

$\frac{250x}{250}=\frac{7500}{250}$

$x=30$

Solution Set: $\{30\}$

35. $-\frac{7}{6}-3x=\frac{1}{6}+x$

$\frac{6}{1}\left(-\frac{7}{6}-3x\right)=\frac{6}{1}\left(\frac{1}{6}+x\right)$

$-7-18x=1+6x$

$-7-18x-6x=1+6x-6x$

$-7-24x=1$

$-7+7-24x=1+7$

$-24x=8$

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

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

Solution Set: $\left\{-\frac{1}{3}\right\}$

36. $-\frac{11}{10}+4x=-\frac{7}{10}+8x$

$\frac{10}{1}\left(-\frac{11}{10}+4x\right)=\frac{10}{1}\left(-\frac{7}{10}+8x\right)$

$-11+40x=-7+80x$

$-11+40x-80x=-7+80x-80x$

$-11-40x=-7$

$-11+11-40x=-7+11$

$-40x=4$

$\frac{-40x}{-40}=\frac{4}{-40}$

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

Solution Set: $\left\{-\frac{1}{10}\right\}$

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

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

$6x+4=18x-5$

$6x-18x+4=18x-18x-5$

$-12x+4=-5$

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

$-12x=-9$

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

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

Solution Set: $\left\{\frac{3}{4}\right\}$

38. $x+\frac{4}{5}=2x-\frac{3}{10}$

$\frac{10}{1}\left(x+\frac{4}{5}\right)=\frac{10}{1}\left(2x-\frac{3}{10}\right)$

$10x+8=20x-3$

$10x-20x+8=20x-20x-3$

$-10x+8=-3$

$-10x+8-8=-3-8$

$-10x=-11$

$\frac{-10x}{-10}=\frac{-11}{-10}$

$x=\frac{11}{10}$

Solution Set: $\left\{\frac{11}{10}\right\}$

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

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

$3x+2x=36-x$

$5x=36-x$

$5x+x=36-x+x$

$6x=36$

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

$x=6$

Solution Set: $\{6\}$

40. $\frac{x}{4}+\frac{x}{2}=5-\frac{x}{8}$

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

$2x+4x=40-x$

$6x=40-x$

$6x+x=40-x+x$

$7x=40$

$\frac{7x}{7}=\frac{40}{7}$

$x=\frac{40}{7}$

Solution Set: $\left\{\frac{40}{7}\right\}$

41. $\frac{2}{3}x+40=\frac{x}{2}-\frac{x}{6}-\frac{2x}{9}$

$\frac{18}{1}\left(\frac{2}{3}x+40\right)=\frac{18}{1}\left(\frac{x}{2}-\frac{x}{6}-\frac{2x}{9}\right)$

$12x+720=9x-3x-4x$

$12x+720=2x$

$12x-2x+720=2x-2x$

$10x+720=0$

$10x+720-720=0-720$

$10x=-720$

$\frac{10x}{10}=\frac{-720}{10}$

$x=-72$

Solution Set: $\{-72\}$

42. $\frac{3}{2}x+78=\frac{2x}{3}+\frac{x}{12}-\frac{3x}{4}$

$\frac{12}{1}\left(\frac{3}{2}x+78\right)=\frac{12}{1}\left(\frac{2x}{3}+\frac{x}{12}-\frac{3x}{4}\right)$

$18x+936=8x+x-9x$

$18x+936=0$

$18x+936-936=0-936$

$18x=-936$

$\frac{18x}{18}=\frac{-936}{18}$

$x=-52$

Solution Set: $\{-52\}$

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

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

$2x-10=3x+1$

$2x-3x-10=3x-3x+1$

$-x-10=1$

$-x-10+10=1+10$

$-x=11$

$\frac{-x}{-1}=\frac{11}{-1}$

$x=-11$

Solution Set: $\{-11\}$

44. $\dfrac{x-7}{4}=\dfrac{5x+1}{2}$

$\dfrac{4}{1}\left(\dfrac{x-7}{4}\right)=\dfrac{4}{1}\left(\dfrac{5x+1}{2}\right)$

$x-7=10x+2$

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

$-9x-7=2$

$-9x-7+7=2+7$

$-9x=9$

$\dfrac{-9x}{-9}=\dfrac{9}{-9}$

$x=-1$

Solution Set: $\{-1\}$

45. $\dfrac{x-3}{3}+\dfrac{x+2}{4}=\dfrac{11}{6}$

$\dfrac{12}{1}\left(\dfrac{x-3}{3}+\dfrac{x+2}{4}\right)=\dfrac{12}{1}\left(\dfrac{11}{6}\right)$

$4x-12+3x+6=22$

$7x-6=22$

$7x-6+6=22+6$

$7x=28$

$\dfrac{7x}{7}=\dfrac{28}{7}$

$x=4$

Solution Set: $\{4\}$

46. $\dfrac{x+5}{5}+\dfrac{x-2}{4}=\dfrac{41}{10}$

$\dfrac{20}{1}\left(\dfrac{x+5}{5}+\dfrac{x-2}{4}\right)=\dfrac{20}{1}\left(\dfrac{41}{10}\right)$

$4x+20+5x-10=82$

$9x+10=82$

$9x+10-10=82-10$

$9x=72$

$\dfrac{9x}{9}=\dfrac{72}{9}$

$x=8$

Solution Set: $\{8\}$

47. $5x+3(x+2)=2x+6(3x-3)$

$5x+3x+6=2x+18x-18$

$8x+6=20x-18$

$8x-20x+6=20x-20x-18$

$-12x+6=-18$

$-12x+6-6=-18-6$

$-12x=-24$

$\dfrac{-12x}{-12}=\dfrac{-24}{-12}$

$x=2$

Solution Set: $\{2\}$

48. $-13x+4(x-4)=23x+8(2x+1)$

$-13x+4x-16=23x+16x+8$

$-9x-16=39x+8$

$-9x-39x-16=39x-39x+8$

$-48x-16=8$

$-48x-16+16=8+16$

$-48x=24$

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

$x=-\dfrac{1}{2}$

Solution Set: $\left\{-\dfrac{1}{2}\right\}$

49. $-3(a+2)+7(-2a-1)=6a-6(3a+5)$

$-3a-6-14a-7=6a-18a-30$

$-17a-13=-12a-30$

$-17a+12a-13=-12a+12a-30$

$-5a-13=-30$

$-5a-13+13=-30+13$

$-5a=-17$

$\dfrac{-5a}{-5}=\dfrac{-17}{-5}$

$a=\dfrac{17}{5}$

Solution Set: $\left\{\dfrac{17}{5}\right\}$

50. $-5(a-1)+2(3a+4)=10a-3(2a+5)$

$$-5a+5+6a+8=10a-6a-15$$
$$a+13=4a-15$$
$$a-4a+13=4a-4a-15$$
$$-3a+13=-15$$
$$-3a+13-13=-15-13$$
$$-3a=-28$$
$$\frac{-3a}{-3}=\frac{-28}{-3}$$
$$a=\frac{28}{3}$$

Solution Set: $\left\{\frac{28}{3}\right\}$

51. $14m-2\{3+5m-[6-(m-2)]\}=-10$

$$14m-2\{3+5m-[6-m+2]\}=-10$$
$$14m-2\{3+5m-[-m+8]\}=-10$$
$$14m-2\{3+5m+m-8\}=-10$$
$$14m-2\{6m-5\}=-10$$
$$14m-12m+10=-10$$
$$2m+10=-10$$
$$2m+10-10=-10-10$$
$$2m=-20$$
$$\frac{2m}{2}=\frac{-20}{2}$$
$$m=-10$$

Solution Set: $\{-10\}$

52. $25m-3\{-2+6m-[7-(m-5)]\}=-58$

$$25m-3\{-2+6m-[7-m+5]\}=-58$$
$$25m-3\{-2+6m-[-m+12]\}=-58$$
$$25m-3\{-2+6m+m-12\}=-58$$
$$25m-3\{7m-14\}=-58$$
$$25m-21m+42=-58$$
$$4m+42=-58$$
$$4m+42-42=-58-42$$
$$4m=-100$$
$$\frac{4m}{4}=\frac{-100}{4}$$
$$m=-25$$

Solution Set: $\{-25\}$

53. $-\frac{1}{2}x+5(x-3)=x-1$

$$-\frac{1}{2}x+5x-15=x-1$$
$$\frac{9}{2}x-15=x-1$$
$$\frac{9}{2}x-x-15=x-x-1$$
$$\frac{7}{2}x-15=-1$$
$$\frac{7}{2}x-15+15=-1+15$$
$$\frac{7}{2}x=14$$
$$\frac{2}{7}\left(\frac{7}{2}x\right)=\frac{2}{7}\left(\frac{14}{1}\right)$$
$$x=4$$

Solution Set: $\{4\}$

54. $-\frac{4}{5}x+3(2x-1)=4x-\frac{3}{5}$

$$-\frac{4}{5}x+6x-3=4x-\frac{3}{5}$$
$$\frac{5}{1}\left(-\frac{4}{5}x+6x-3\right)=\frac{5}{1}\left(4x-\frac{3}{5}\right)$$
$$-4x+30x-15=20x-3$$
$$26x-15=20x-3$$
$$26x-20x-15=20x-20x-3$$
$$6x-15=-3$$
$$6x-15+15=-3+15$$
$$6x=12$$
$$\frac{6x}{6}=\frac{12}{6}$$
$$x=2$$

Solution Set: $\{2\}$

55. $-9\left(2x-\frac{1}{3}\right)=4\left(-\frac{1}{2}x+\frac{1}{4}\right)$

$-18x+3=-2x+1$

$-18x+2x+3=-2x+2x+1$

$-16x+3=1$

$-16x+3-3=1-3$

$-16x=-2$

$\frac{-16x}{-16}=\frac{-2}{-16}$

$x=\frac{1}{8}$

Solution Set: $\left\{\frac{1}{8}\right\}$

56. $-6\left(5x-\frac{1}{3}\right)=4\left(-\frac{1}{4}x+\frac{1}{4}\right)$

$-30x+2=-x+1$

$-30x+x+2=-x+x+1$

$-29x+2=1$

$-29x+2-2=1-2$

$-29x=-1$

$\frac{-29x}{-29}=\frac{-1}{-29}$

$x=\frac{1}{29}$

Solution Set: $\left\{\frac{1}{29}\right\}$

57. $5-2a=8-6a+4a$

$5-2a=8-2a$

$5-2a+2a=8-2a+2a$

$5=8$

This equation is inconsistent. Solution Set: $\{\ \}$ or $\varnothing$

58. $7+6c=9c-3c+4$

$7+6c=6c+4$

$7+6c-6c=6c-6c+4$

$7=4$

This equation is inconsistent. Solution Set: $\{\ \}$ or $\varnothing$

59. $6+2(3x-3)=6x$

$6+6x-6=6x$

$6x=6x$

$6x-6x=6x-6x$

$0=0$

This equation is an identity. Solution Set: $\{x\,|\,x\in R\}$

60. $8+4(5x-2)=20x$

$8+20x-8=20x$

$20x=20x$

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

$0=0$

This equation is an identity. Solution Set: $\{x\,|\,x\in R\}$

61. $\frac{3}{5}+x=x-\frac{2}{7}$

$\frac{3}{5}+x-x=x-x-\frac{2}{7}$

$\frac{3}{5}=-\frac{2}{7}$

This equation is inconsistent. Solution Set: $\{\ \}$ or $\varnothing$

62. $\frac{7}{3}+2x=2x-\frac{5}{2}$

$\frac{7}{3}+2x-2x=2x-2x-\frac{5}{2}$

$\frac{7}{3}=-\frac{5}{2}$

This equation is inconsistent. Solution Set: $\{\ \}$ or $\varnothing$

63. $2+3(4x-1)=6(2x-5)+29$

$2+12x-3=12x-30+29$

$12x-1=12x-1$

$12x-12x-1=12x-12x-1$

$-1=-1$

This equation is an identity. Solution Set: $\{x\,|\,x\in R\}$

64. $-10x+2(x-7)=-6-8(x+1)$

$-10x+2x-14=-6-8x-8$

$-8x-14=-8x-14$

$-8x+8x-14=-8x+8x-14$

$-14=-14$

This equation is an identity. Solution Set: $\{x\,|\,x\in R\}$

65. $4(5x+2)-3(x-2)=10x+(7x+9)$

$20x+8-3x+6=17x+9$

$17x+14=17x+9$

$17x-17x+14=17x-17x+9$

$14=9$

This equation is inconsistent. Solution Set: $\{\ \}$ or $\varnothing$

66. $13x-(-11x+8)=-5(-3x-1)+3(3x-7)$

$13x+11x-8=15x+5+9x-21$

$24x-8=24x-16$

$24x-24x-8=24x-24x-16$

$-8=-16$

This equation is inconsistent. Solution Set: $\{\ \}$ or $\varnothing$

67. $0.3+0.85x=0.5(1.7x+4)-1.7$

$0.3+0.85x=0.85x+2-1.7$

$0.3+0.85x=0.85x+0.3$

$0.3+0.85x-0.85x=0.85x-0.85x+0.3$

$0.3=0.3$

This equation is an identity. Solution Set: $\{x\,|\,x\in R\}$

68. $0.3(2x+3.2)-0.46=0.2(x+2)+0.4x+0.1$

$0.6x+0.96-0.46=0.2x+0.4+0.4x+0.1$

$0.6x+0.5=0.6x+0.5$

$0.6x-0.6x+0.5=0.6x-0.6x+0.5$

$0.5=0.5$

This equation is an identity. Solution Set: $\{x\,|\,x\in R\}$

69. An equation that has all real numbers as its solutions is an identity.

70. The solution of an inconsistent equation is the empty set.

71. We clear fractions from an equation by multiplying every term by the LCD of all the denominators. The Multiplication Property of Equality allows us to do this step.

72. We simplify the grouping symbols working from the innermost out.

73. $3(x-2)+5=2x-(5-x)$

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

$3x-1=3x-5$

$3x-3x-1=3x-3x-5$

$-1=-5$

Solution Set: $\{\ \}$ This equation is inconsistent.

74. $-2(3x-1)+4=6(2-x)$

$-6x+2+4=12-6x$

$-6x+6=12-6x$

$-6x+6x+6=12-6x+6x$

$6=12$

Solution Set: $\{\ \}$ This equation is inconsistent.

75. $12x-7(x+2)=10(x-1)-(5x+4)$

$12x-7x-14=10x-10-5x-4$

$5x-14=5x-14$

$5x-5x-14=5x-5x-14$

$-14=-14$

Solution Set: $\{x\,|\,x\in R\}$ This equation is an identity.

76. $21x-3(4-x)=2(10x-1)+2(2x-5)$

$21x-12+3x=20x-2+4x-10$

$24x-12=24x-12$

$24x-24x-12=24x-24x-12$

$-12=-12$

Solution Set: $\{x\,|\,x\in R\}$ This equation is an identity.

77. Let x represent the number.

$0.5x=0.24$

$\dfrac{0.5x}{0.5}=\dfrac{0.24}{0.5}$

$x=0.48$

The number is 0.48.

78. Let x represent the number.

$\dfrac{1}{3}x=0.36$

$\dfrac{3}{1}\left(\dfrac{1}{3}x\right)=3(0.36)$

$x=1.08$

The number is 1.08.

79. Let x represent the number.

$$4x = -\frac{3}{4}$$
$$\frac{1}{4}(4x) = \frac{1}{4}\left(-\frac{3}{4}\right)$$
$$x = -\frac{3}{16}$$

The number is $-\frac{3}{16}$.

80. Let x represent the number.

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

The number is $-\frac{2}{15}$.

81. Let x represent the number.

$$\frac{1}{2}x + 7 = \frac{2}{3}x$$
$$\frac{6}{1}\left(\frac{1}{2}x + 7\right) = \frac{6}{1}\left(\frac{2}{3}x\right)$$
$$3x + 42 = 4x$$
$$3x - 4x + 42 = 4x - 4x$$
$$-x + 42 = 0$$
$$-x + 42 - 42 = 0 - 42$$
$$-x = -42$$
$$\frac{-x}{-1} = \frac{-42}{-1}$$
$$x = 42$$

The number is 42.

82. Let x represent the number.

$$\frac{5}{6}x = \frac{1}{3}x + 27$$
$$\frac{6}{1}\left(\frac{5}{6}x\right) = \frac{6}{1}\left(\frac{1}{3}x + 27\right)$$
$$5x = 2x + 162$$
$$5x - 2x = 2x - 2x + 162$$
$$3x = 162$$
$$\frac{3x}{3} = \frac{162}{3}$$
$$x = 54$$

The number is 54.

83. Let x represent the number.

$$\frac{2x+3}{5} = -\frac{17}{5}$$
$$\frac{5}{1}\left(\frac{2x+3}{5}\right) = \frac{5}{1}\left(-\frac{17}{5}\right)$$
$$2x + 3 = -17$$
$$2x + 3 - 3 = -17 - 3$$
$$2x = -20$$
$$\frac{2x}{2} = \frac{-20}{2}$$
$$x = -10$$

The number is -10.

84. Let x represent the number.

$$\frac{6+3x}{5} = -\frac{6}{5}$$
$$\frac{5}{1}\left(\frac{6+3x}{5}\right) = \frac{5}{1}\left(-\frac{6}{5}\right)$$
$$6 + 3x = -6$$
$$6 - 6 + 3x = -6 - 6$$
$$3x = -12$$
$$\frac{3x}{3} = \frac{-12}{3}$$
$$x = -4$$

The number is -4.

85. a) Let t represent the sales tax on the vehicle.

$$\text{sales tax} = (\text{retail price})(\text{tax rate})$$
$$t = (15{,}350)(0.065)$$
$$t = 997.75$$

The sales tax on the vehicle is \$997.75.

b) Let p represent the total purchase price of the vehicle.

$$p = (\text{retail price}) + (\text{sales tax}) + (\text{title}) + (\text{license})$$
$$= 15{,}350 + 997.75 + 150 + 35$$
$$= 16{,}532.75$$

The purchase price of the vehicle is \$16,532.75.

86. a) Let p represent the cost of the points.

$$p = (\text{purchase price})\left(1\frac{1}{2}\%\right)$$
$$= (125{,}000)(0.015)$$
$$= 1{,}875$$

The points will cost \$1,875.

b) Let d represent the amount of the down payment.

$$\text{down payment} = (\text{purchase price})(5\%)$$
$$d = (125{,}000)(0.05)$$
$$d = 6{,}250$$

The down payment is \$6,250.

c) Let t represent the closing cost.

$$\text{closing cost} = (\text{down payment}) + (\text{points})$$
$$t = 6{,}250 + 1{,}875$$
$$t = 8{,}125$$

87. Let p represent the original price of the boots.

$$\begin{pmatrix}\text{Original}\\ \text{Price}\end{pmatrix} - \begin{pmatrix}\text{Amount of}\\ \text{Discount}\end{pmatrix} = \text{Sale Price}$$
$$p - 0.3p = 73.50$$
$$0.7p = 73.50$$
$$\frac{0.7p}{0.7} = \frac{73.50}{0.7}$$
$$p = 105$$

The original price of the boots was \$105.

88. Let p represent the original price of the computer.

$$\begin{pmatrix}\text{Original}\\ \text{Price}\end{pmatrix} - \begin{pmatrix}\text{Amount of}\\ \text{Discount}\end{pmatrix} = \text{Sale Price}$$
$$p - 0.2p = 1440$$
$$0.8p = 1440$$
$$\frac{0.8p}{0.8} = \frac{1440}{0.8}$$
$$p = 1800$$

The original price of the computer was \$1,800.

89. Let s represent the sale price of the blouse.

$$\begin{pmatrix}\text{Original}\\ \text{Price}\end{pmatrix} - \begin{pmatrix}\text{Amount of}\\ \text{Discount}\end{pmatrix} = \text{Sale Price}$$
$$40 - (0.15)(40) = s$$
$$40 - 6 = s$$
$$34 = s$$

The sale price of the blouse is \$34.

90. Let s represent the sale price of the coat.

$$\begin{pmatrix}\text{Original}\\ \text{Price}\end{pmatrix} - \begin{pmatrix}\text{Amount of}\\ \text{Discount}\end{pmatrix} = \text{Sale Price}$$
$$125 - (0.25)(125) = s$$
$$125 - 31.25 = s$$
$$93.75 = s$$

The sale price of the coat is \$93.75.

91. Let x be the measure of the first angle $(m\angle 1)$. Then, the measure of the second angle $(m\angle 2)$ is $3x - 4.2$.

$$m\angle 1 + m\angle 2 = 90$$
$$x + 3x - 4.2 = 90$$
$$4x - 4.2 = 90$$
$$4x - 4.2 + 4.2 = 90 + 4.2$$
$$4x = 94.2$$
$$\frac{4x}{4} = \frac{94.2}{4}$$
$$x = 23.55$$

The measure of the first angle is $m\angle 1 = 23.55^\circ$, and the measure of the second angle is $m\angle 2 = 66.45^\circ$.

92. Let x be the measure of the first angle $(m\angle 1)$. Then, the measure of the second angle $(m\angle 2)$ is $\frac{2}{3}x$.

$$m\angle 1 + m\angle 2 = 90$$
$$x + \frac{2}{3}x = 90$$
$$\frac{5}{3}x = 90$$
$$\frac{3}{5}\left(\frac{5}{3}x\right) = \frac{3}{5}\left(\frac{90}{1}\right)$$
$$x = 54$$

The measure of the first angle is $m\angle 1 = 54^\circ$, and the measure of the second angle is $m\angle 2 = 36^\circ$

93. Let x be the measure of the first angle $(m\angle 1)$. Then, the measure of the second angle $(m\angle 2)$ is $\frac{3}{5}x + 4$.

$$m\angle 1 + m\angle 2 = 180$$
$$x + \frac{3}{5}x + 4 = 180$$
$$\frac{8}{5}x + 4 = 180$$
$$\frac{8}{5}x + 4 - 4 = 180 - 4$$
$$\frac{8}{5}x = 176$$
$$\frac{5}{8}\left(\frac{8}{5}x\right) = \frac{5}{8}\left(\frac{176}{1}\right)$$
$$x = 110$$

The measure of the first angle is $m\angle 1 = 110^\circ$, and the measure of the second angle is $m\angle 2 = 70^\circ$

94. Let x be the measure of the first angle $(m\angle 1)$. Then, the measure of the second angle $(m\angle 2)$ is $2x-6.9$.

$$\begin{aligned} m\angle 1 + m\angle 2 &= 180 \\ x + 2x - 6.9 &= 180 \\ 3x - 6.9 &= 180 \\ 3x - 6.9 + 6.9 &= 180 + 6.9 \\ 3x &= 186.9 \\ \frac{3x}{3} &= \frac{186.9}{3} \\ x &= 62.3 \end{aligned}$$

The measure of the first angle is $m\angle 1 = 62.3^\circ$, and the measure of the second angle is $m\angle 2 = 117.7^\circ$

95. Prepare We are asked to solve the linear equation for x in order to determine the number of microwaves Harlow Builders should purchase from L & C in order for the cost to be equal.

Plan Solve the linear equation for x by using the Strategy for Solving Linear Equations.

Process

$$\begin{aligned} 580 + 130x &= 950 + 75(x-2) \\ 580 + 130x &= 950 + 75x - 150 \\ 580 + 130x &= 800 + 75x \\ 580 + 130x - 75x &= 800 + 75x - 75x \\ 580 + 55x &= 800 \\ 580 - 580 + 55x &= 800 - 580 \\ 55x &= 220 \\ \frac{55x}{55} &= \frac{220}{55} \\ x &= 4 \end{aligned}$$

Harlow Builders should purchase 4 microwaves from L & C in order for the cost to be equal.

Ponder Does our answer seem reasonable? Yes, because we can check that the purchase of 4 microwaves does indeed give the same cost.

96. Prepare We are asked to solve the linear equation for x in order to determine the number of miles a customer would have to travel with each company for the cost of their rides to be equal.

Plan Solve the linear equation for x by using the Strategy for Solving Linear Equations.

Process

$$\begin{aligned} 2.25 + 0.5x &= 1.50 + 0.75(x-2) \\ 2.25 + 0.5x &= 1.50 + 0.75x - 1.50 \\ 2.25 + 0.5x &= 0.75x \\ 2.25 + 0.5x - 0.5x &= 0.75x - 0.5x \\ 2.25 &= 0.25x \\ \frac{2.25}{0.25} &= \frac{0.25x}{0.25} \\ 9 &= x \end{aligned}$$

A customer would have to travel 9 miles with each company for the cost of their rides to be equal.

Ponder Does our answer seem reasonable? Yes, because we can check that traveling 9 miles would give the same cost.

97. Prepare We are asked to determine the lengths of the three pieces of the board.

Plan Let x represent the length of the first piece. Then the length of the second piece of wood is $\frac{1}{3}x+2$ and the length of the third piece of wood is $x+4$. We can use these expressions and the fact that the total length of the three pieces is 20 feet to set up an equation.

Process

$$\begin{aligned} x + \frac{1}{3}x + 2 + x + 4 &= 20 \\ \frac{7}{3}x + 6 &= 20 \\ \frac{7}{3}x + 6 - 6 &= 20 - 6 \\ \frac{7}{3}x &= 14 \\ \frac{3}{7}\left(\frac{7}{3}x\right) &= \frac{3}{7}(14) \\ x &= 6 \end{aligned}$$

The first piece of wood is 6 feet long, the second piece is 4 feet long, and the third piece is 10 feet long.

Ponder Does our answer seem reasonable? Yes, because the sum of the lengths of the three boards is 20.

98. Prepare We are asked to determine the lengths of the three pieces of the board.

Plan Let x represent the length of the second piece. Then the length of the first piece of wood is $\frac{1}{5}x$ and the length of the third piece of wood is $x-13$. We can use these expressions and the fact that the total length of the three pieces is 20 feet to set up an equation.

Process

$$\frac{1}{5}x+x+x-13=20$$
$$\frac{11}{5}x-13=20$$
$$\frac{11}{5}x-13+13=20+13$$
$$\frac{11}{5}x=33$$
$$\frac{5}{11}\left(\frac{11}{5}x\right)=\frac{5}{11}(33)$$
$$x=15$$

The first piece of wood is 3 feet long, the second piece is 15 feet long, and the third piece is 2 feet long.

Ponder Does our answer seem reasonable? Yes, because the sum of the lengths of the three boards is 20.

99.
$$-\frac{5}{3}x+0.2=\frac{1}{2}-0.4x$$
$$\frac{6}{1}\left(-\frac{5}{3}x+0.2\right)=\frac{6}{1}\left(\frac{1}{2}-0.4x\right)$$
$$-10x+1.2=3-2.4x$$
$$-10x+2.4x+1.2=3-2.4x+2.4x$$
$$-7.6x+1.2=3$$
$$-7.6x+1.2-1.2=3-1.2$$
$$-7.6x=1.8$$
$$\frac{-7.6x}{-7.6}=\frac{1.8}{-7.6}$$
$$x=-\frac{9}{38}$$

Solution Set: $\left\{-\frac{9}{38}\right\}$

100.
$$\frac{2}{5}x-0.3=\frac{1}{15}x+\frac{7}{150}$$
$$\frac{150}{1}\left(\frac{2}{5}x-0.3\right)=\frac{150}{1}\left(\frac{1}{15}x+\frac{7}{150}\right)$$
$$60x-45=10x+7$$
$$60x-10x-45=10x-10x+7$$
$$50x-45=7$$
$$50x-45+45=7+45$$
$$50x=52$$
$$\frac{50x}{50}=\frac{52}{50}$$
$$x=\frac{26}{25}$$

Solution Set: $\left\{\frac{26}{25}\right\}$

Extension Activity

The equation, $\frac{5(x+10)+300}{5}-x=70$, is an identity. Therefore, the solution set is given by $\{x\,|\,x\in R\}$, and the number puzzle will work for any real number.

2.3 Exercises

1. An equation involving more than one variable is a literal equation.

2. A literal equation, which represents a meaningful relationship among quantities, is called a formula.

3. Ohm's Law, $I = \frac{E}{R}$, is an example of a formula.

4. The formula $P^2 = kD^3$ from astronomy is an example of a literal equation.

5. The first step in solving $3a + 2b = 7x$ for b is to isolate the term $2b$.

6. The goal when solving a literal equation is to isolate the variable on one side of the equation.

7.
$$\begin{aligned} x + 4y &= 12 \\ x + 4y - 4y &= 12 - 4y \\ x &= 12 - 4y \end{aligned}$$

8.
$$\begin{aligned} x + 2y &= -10 \\ x + 2y - 2y &= -10 - 2y \\ x &= -10 - 2y \end{aligned}$$

9.
$$\begin{aligned} -5x + y &= 25 \\ -5x + y - y &= 25 - y \\ -5x &= 25 - y \\ \frac{-5x}{-5} &= \frac{25 - y}{-5} \\ x &= \frac{25 - y}{-5} \\ x &= -5 + \frac{y}{5} \end{aligned}$$

10.
$$\begin{aligned} 6x + y &= -48 \\ 6x + y - y &= -48 - y \\ 6x &= -48 - y \\ \frac{6x}{6} &= \frac{-48 - y}{6} \\ x &= -8 - \frac{y}{6} \end{aligned}$$

11.
$$\begin{aligned} 8x - 8y &= -16 \\ 8x - 8x - 8y &= -16 - 8x \\ -8y &= -16 - 8x \\ \frac{-8y}{-8} &= \frac{-16 - 8x}{-8} \\ y &= x + 2 \end{aligned}$$

12.
$$\begin{aligned} -7x - 7y &= 49 \\ -7x + 7x - 7y &= 49 + 7x \\ -7y &= 49 + 7x \\ \frac{-7y}{-7} &= \frac{49 + 7x}{-7} \\ y &= -x - 7 \end{aligned}$$

13.
$$\begin{aligned} -12x + 8y &= 36 \\ -12x + 12x + 8y &= 36 + 12x \\ 8y &= 36 + 12x \\ \frac{8y}{8} &= \frac{36 + 12x}{8} \\ y &= \frac{3}{2}x + \frac{9}{2} \end{aligned}$$

14.
$$\begin{aligned} 9x - 15y &= -27 \\ 9x - 9x - 15y &= -27 - 9x \\ -15y &= -27 - 9x \\ \frac{-15y}{-15} &= \frac{-27 - 9x}{-15} \\ y &= \frac{3}{5}x + \frac{9}{5} \end{aligned}$$

15.
$$\begin{aligned} \frac{5}{6}x - 7y &= 2 \\ \frac{5}{6}x - 7y + 7y &= 2 + 7y \\ \frac{5}{6}x &= 2 + 7y \\ \frac{6}{5}\left(\frac{5}{6}x\right) &= \frac{6}{5}(2 + 7y) \\ x &= \frac{12}{5} + \frac{42}{5}y \end{aligned}$$

16. $\frac{8}{9}x-3y=5$

$\frac{8}{9}x-3y+3y=5+3y$

$\frac{8}{9}x=5+3y$

$\frac{9}{8}\left(\frac{8}{9}x\right)=\frac{9}{8}(5+3y)$

$x=\frac{45}{8}+\frac{27}{8}y$

17. $-\frac{2}{5}x+\frac{1}{3}y=1$

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

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

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

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

18. $\frac{3}{7}x-\frac{2}{5}y=1$

$\frac{3}{7}x-\frac{3}{7}x-\frac{2}{5}y=1-\frac{3}{7}x$

$-\frac{2}{5}y=1-\frac{3}{7}x$

$-\frac{5}{2}\left(-\frac{2}{5}y\right)=-\frac{5}{2}\left(1-\frac{3}{7}x\right)$

$y=\frac{15}{14}x-\frac{5}{2}$

19. $D=RT$

$\frac{D}{R}=\frac{RT}{R}$

$\frac{D}{R}=T$

20. $I=\mathrm{Pr}t$

$\frac{I}{Pt}=\frac{Prt}{Pt}$

$\frac{I}{Pt}=r$

21. $A=lw$

$\frac{A}{w}=\frac{lw}{w}$

$\frac{A}{w}=l$

22. $A=\frac{1}{2}bh$

$2A=2\left(\frac{1}{2}bh\right)$

$2A=bh$

$\frac{2A}{b}=\frac{bh}{b}$

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

23. $V=lwh$

$\frac{V}{lw}=\frac{lwh}{lw}$

$\frac{V}{lw}=h$

24. $C=2\pi r$

$\frac{C}{2\pi}=\frac{2\pi r}{2\pi}$

$\frac{C}{2\pi}=r$

25. $P=2l+2w$

$P-2l=2l-2l+2w$

$P-2l=2w$

$\frac{P-2l}{2}=\frac{2w}{2}$

$\frac{P-2l}{2}=w$

26. $P=4s$

$\frac{P}{4}=\frac{4s}{4}$

$\frac{P}{4}=s$

27.
$$A=\frac{1}{2}h(a+b)$$
$$2A=2\left(\frac{1}{2}h(a+b)\right)$$
$$2A=h(a+b)$$
$$\frac{2A}{h}=\frac{h(a+b)}{h}$$
$$\frac{2A}{h}=a+b$$
$$\frac{2A}{h}-b=a+b-b$$
$$\frac{2A}{h}-b=a$$

28.
$$A=\frac{1}{2}h(a+b)$$
$$2A=2\left(\frac{1}{2}h(a+b)\right)$$
$$2A=h(a+b)$$
$$\frac{2A}{a+b}=\frac{h(a+b)}{a+b}$$
$$\frac{2A}{a+b}=h$$

29.
$$A=P(1+rt)$$
$$A=P+Prt$$
$$A-P=P-P+Prt$$
$$A-P=Prt$$
$$\frac{A-P}{Pt}=\frac{Prt}{Pt}$$
$$\frac{A-P}{Pt}=r$$

30.
$$A=P(1+rt)$$
$$A=P+Prt$$
$$A-P=P-P+Prt$$
$$A-P=Prt$$
$$\frac{A-P}{Pr}=\frac{Prt}{Pr}$$
$$\frac{A-P}{Pr}=t$$

31.
$$ax+x=5$$
$$(a+1)x=5$$
$$\frac{(a+1)x}{a+1}=\frac{5}{a+1}$$
$$x=\frac{5}{a+1}$$

32.
$$by+y=-3$$
$$(b+1)y=-3$$
$$\frac{(b+1)y}{b+1}=\frac{-3}{b+1}$$
$$y=\frac{-3}{b+1}$$

33.
$$S=P+Prt$$
$$S=(1+rt)P$$
$$\frac{S}{1+rt}=\frac{(1+rt)P}{1+rt}$$
$$\frac{S}{1+rt}=P$$

34.
$$B=P-Prt$$
$$B=(1-rt)P$$
$$\frac{B}{1-rt}=\frac{(1-rt)P}{1-rt}$$
$$\frac{B}{1-rt}=P$$

35.
$$S=2wh+2lw+2lh$$
$$S-2lw=2wh+2lw-2lw+2lh$$
$$S-2lw=2wh+2lh$$
$$S-2lw=(2w+2l)h$$
$$\frac{S-2lw}{2w+2l}=\frac{(2w+2l)h}{2w+2l}$$
$$\frac{S-2lw}{2w+2l}=h$$

36.
$$S=2wh+2lw+2lh$$
$$S-2wh=2wh-2wh+2lw+2lh$$
$$S-2wh=2lw+2lh$$
$$S-2wh=(2w+2h)l$$
$$\frac{S-2wh}{2w+2h}=\frac{(2w+2h)l}{2w+2h}$$
$$\frac{S-2wh}{2w+2h}=l$$

37. Answers will vary; one example is: I have \$10,000 to invest and want to earn \$1000 in interest in two years. What rate do I need?

38. Answers will vary; one example is: I have 20 feet of fence and want to enclose a rectangular area. If the width must be 5.5 feet, how long can I make the enclosure?

39.
$$C = \frac{5}{9}(F-32)$$
$$\frac{9}{5}C = \frac{9}{5}\left(\frac{5}{9}(F-32)\right)$$
$$\frac{9}{5}C = F-32$$
$$\frac{9}{5}C+32 = F-32+32$$
$$\frac{9}{5}C+32 = F$$

40.
$$F = \frac{9}{5}C+32$$
$$F = \frac{9}{5}(10)+32$$
$$F = 18+32$$
$$F = 50$$
$10^\circ C$ is equivalent to $50^\circ F$.

41.
$$F = \frac{9}{5}C+32$$
$$F-32 = \frac{9}{5}C+32-32$$
$$F-32 = \frac{9}{5}C$$
$$\frac{5}{9}(F-32) = \frac{5}{9}\left(\frac{9}{5}C\right)$$
$$\frac{5}{9}(F-32) = C$$

42.
$$C = \frac{5}{9}(F-32)$$
$$C = \frac{5}{9}((95)-32)$$
$$C = \frac{5}{9}(63)$$
$$C = 35$$
$95^\circ F$ is equivalent to $35^\circ C$.

43.

P	***l***	***w***
24 ft.	3 ft.	$w = \frac{P-2l}{2}$ $w = \frac{24-2(3)}{2}$ $w = 9$ ft.
8½ in.	3¼ in.	$w = \frac{8\frac{1}{2}-2\left(3\frac{1}{4}\right)}{2}$ $w = \frac{8\frac{1}{2}-6\frac{1}{2}}{2}$ $w = 1$ in.
6.48 cm	1.15 cm	$w = \frac{P-2l}{2}$ $w = \frac{6.48-2(1.15)}{2}$ $w = 2.09$ cm

44.

A	***h***	***b***	***a***
70 sq. ft.	7 ft.	6 ft.	$a = \frac{2A}{h}-b$ $a = \frac{2(70)}{7}-6$ $a = 14$ ft.
106¼ sq. in.	8½ in.	4¼ in.	$a = \frac{2A}{h}-b$ $a = \frac{2\left(106\frac{1}{4}\right)}{8\frac{1}{2}}-4\frac{1}{4}$ $a = 20\frac{3}{4}$ in.
116.792 sq. cm.	10.4 cm	9.2 cm	$a = \frac{2A}{h}-b$ $a = \frac{2(116.792)}{10.4}-9.2$ $a = 13.26$ cm

45. $I = Prt$

$I = (1200)(0.035)(1)$

$I = 42$

You would earn \$42 in interest.

46. $I = Prt$

$I = (2450)(0.045)(1)$

$I = 110.25$

You would earn \$110.25 in interest.

47. $I = Prt$

$(945) = (13500)(0.07)t$

$945 = 945t$

$\frac{945}{945} = \frac{945t}{945}$

$1 = t$

It would take 1 year to earn \$945 in interest.

48. $I = Prt$

$585 = (3250)(0.06)t$

$585 = 195t$

$\frac{585}{195} = \frac{195t}{195}$

$3 = t$

It would take 3 years to earn \$585 in interest.

49. $I = Prt$

$1620 = (12000)(0.0675)t$

$1620 = 810t$

$\frac{1620}{810} = \frac{810t}{810}$

$2 = t$

It would take 2 years to earn \$1,620 in interest.

50. $I = Prt$

$1218 = (5800)(0.0525)t$

$1218 = 304.5t$

$\frac{1218}{304.5} = \frac{304.5t}{304.5}$

$4 = t$

It would take 4 years to earn \$1,218 in interest.

51. $I = Prt$

$273.6 = (2280)(r)(1.5)$

$273.6 = 3420r$

$\frac{273.6}{3420} = \frac{3420r}{3420}$

$0.08 = r$

You would need to invest at a rate of 8%.

52. $I = Prt$

$294 = (5600)(r)(0.75)$

$294 = 4200r$

$\frac{294}{4200} = \frac{4200r}{4200}$

$0.07 = r$

You would need to invest at a rate of 7%.

53. $I = Prt$

$269.5 = P(0.055)(2)$

$269.5 = 0.11P$

$\frac{269.5}{0.11} = \frac{0.11P}{0.11}$

$2450 = P$

You would have to invest \$2,450.

54. $I = Prt$

$10400 = P(0.065)(5)$

$10400 = 0.325P$

$\frac{10400}{0.325} = \frac{0.325P}{0.325}$

$32000 = P$

You would have to invest \$32,000.

55. $D = rt$

$D = (620)\left(2\frac{1}{2}\right)$

$D = 1550$

The plane can travel 1,550 miles.

56. $D = rt$

$D = (225)\left(1\frac{1}{2}\right)$

$D = 337\frac{1}{2}$

The racecar can travel 337½ miles.

57. $D = rt$

$7.5 = r(0.75)$

$7.5 = 0.75r$

$\frac{7.5}{0.75} = \frac{0.75r}{0.75}$

$10 = r$

The woman is jogging at 10 miles per hour.

58. $D = rt$

$412.5 = r\left(5\frac{1}{2}\right)$

$412.5 = 5.5r$

$\frac{412.5}{5.5} = \frac{5.5r}{5.5}$

$75 = r$

Louisa drove 75 miles per hour.

59. $D = rt$

$0.8 = 4t$

$\frac{0.8}{4} = \frac{4t}{4}$

$0.2 = t$

It takes Jasmine 0.2 hours or 12 minutes.

60. $D = rt$

$11.25 = 45t$

$\frac{11.25}{45} = \frac{45t}{45}$

$0.25 = t$

It takes Harold 0.25 hours or 15 minutes.

61. Prepare We are asked to determine the details of purchasing a home theater projector on a 12 month no interest plan.

Plan We will use the sales receipt and the advertisement to answer the questions.

Process

a)

$\text{Standard APR} = \text{Prime} + 12.6\%$

$\text{Standard APR} = 7.75\% + 12.6\%$

$\text{Standard APR} = 20.35\%$

$\text{Default APR} = \text{Prime} + 16.4\%$

$\text{Default APR} = 7.75\% + 16.4\%$

$\text{Defalut APR} = 24.15\%$

Let m represent the minimum monthly payment.

$m = (1\%)(\text{Principal Balance})$

$m = (0.01)(\$1364.99)$

$m \approx \$13.65$

The minimum monthly payment would be \$13.65.

b)

$I = Prt$

$I = (\$1{,}364.99)(0.2035)(1)$

$I \approx \$277.78$

The interest on the initial balance is \$277.78. The first month's interest would be

$\$277.78 \div 12 \approx \$23.15$.

c) Helaku would owe the first month's payment, the second month's payment and the late fee, which would come to

$\$13.65 + \$13.65 + \$35 = \$62.30$.

Ponder Do our answers seem reasonable? It seems reasonable that the minimum monthly payment would be considerably less than the payment needed to pay off the principal balance in 12 months, which would be

$\$1{,}364.99 \div 12 \approx \$113.75$.

62. Prepare We are asked to determine the details of purchasing a refrigerator on a 24 month no interest plan.

Plan We will use the sales receipt and the advertisement to answer the questions.

Process

a)

$\text{Standard APR} = \text{Prime} + 13.7\%$

$\text{Standard APR} = 7.75\% + 13.7\%$

$\text{Standard APR} = 21.45\%$

$\text{Default APR} = \text{Prime} + 17.6\%$

$\text{Default APR} = 7.75\% + 17.6\%$

$\text{Defalut APR} = 25.35\%$

Let m represent the minimum monthly payment.

$m = (2\%)(\text{Principal Balance})$

$m = (0.02)(\$2560.22)$

$m \approx \$51.20$

The minimum monthly payment would be \$51.20.

c)

$$I = Prt$$
$$I = (\$2{,}560.22)(0.2145)(2)$$
$$I = \$1{,}098.33$$

The interest on the initial balance is \$1,098.33. The first month's interest would be $\$1{,}098.33 \div 12 \approx \$91.53$.

Ponder Do our answers seem reasonable? It seems reasonable that the minimum monthly payment would be considerably less than the payment needed to pay of the principal balance in 24 months, which would be $\$2{,}560.22 \div 24 \approx \$106.68$.

63. Prepare We are to find the height of a right circular cylinder after first solving the surface area formula for *h*.

Plan We will first solve the surface area formula $S = 2\pi r^2 + 2\pi rh$ for h and then substitute the given information into the new formula to find the height.

Process

$$S = 2\pi r^2 + 2\pi rh$$
$$S - 2\pi r^2 = 2\pi r^2 - 2\pi r^2 + 2\pi rh$$
$$S - 2\pi r^2 = 2\pi rh$$
$$\frac{S - 2\pi r^2}{2\pi r} = \frac{2\pi rh}{2\pi r}$$
$$\frac{S - 2\pi r^2}{2\pi r} = h$$

$$h = \frac{S - 2\pi r^2}{2\pi r}$$
$$h = \frac{48\pi - 2\pi(3)^2}{2\pi(3)}$$
$$h = \frac{48\pi - 18\pi}{6\pi}$$
$$h = \frac{30\pi}{6\pi}$$
$$h = 5$$

The height of the cylinder is 5 feet.

Ponder Does our answer seem reasonable? Yes, we can substitute 3 and 5 for the radius and height, respectively, in the surface area formula and verify that we get a surface area of 48π square feet.

64. Prepare We are to find the height of a right circular cone after first solving the volume formula for *h*.

Plan We first solve the volume formula $V = \frac{1}{3}\pi r^2 h$ for h and then substitute the given information into the new formula to find the height.

Process

$$V = \frac{1}{3}\pi r^2 h$$
$$3V = 3\left(\frac{1}{3}\pi r^2 h\right)$$
$$3V = \pi r^2 h$$
$$\frac{3V}{\pi r^2} = \frac{\pi r^2 h}{\pi r^2}$$
$$\frac{3V}{\pi r^2} = h$$

$$h = \frac{3V}{\pi r^2}$$
$$h = \frac{3(171\pi)}{\pi(6)^2}$$
$$h = \frac{513\pi}{36\pi}$$
$$h = 14.25$$

The height is 14.25 meters.

Ponder Does our answer seem reasonable? Yes, we can substitute 6 and 14.25 for the radius and height, respectively, in the volume formula and verify that we get a volume of 171π cubic meters.

65.
$$a(y+8) = 10$$
$$ay + 8a = 10$$
$$ay + 8a - 8a = 10 - 8a$$
$$ay = 10 - 8a$$
$$\frac{ay}{a} = \frac{10 - 8a}{a}$$
$$y = \frac{10 - 8a}{a}$$

66.
$$b(x-7) = 3$$
$$bx - 7b = 3$$
$$bx - 7b + 7b = 3 + 7b$$
$$bx = 3 + 7b$$
$$\frac{bx}{b} = \frac{3 + 7b}{b}$$
$$x = \frac{3 + 7b}{b}$$

67.
$$\frac{x}{2}+\frac{y}{3}=1$$
$$\frac{6}{1}\left(\frac{x}{2}+\frac{y}{3}\right)=6(1)$$
$$3x+2y=6$$
$$3x+2y-2y=6-2y$$
$$3x=6-2y$$
$$\frac{3x}{3}=\frac{6-2y}{3}$$
$$x=\frac{6-2y}{3}$$

68.
$$\frac{x}{3}+\frac{y}{5}=1$$
$$\frac{15}{1}\left(\frac{x}{3}+\frac{y}{5}\right)=15(1)$$
$$5x+3y=15$$
$$5x-5x+3y=15-5x$$
$$3y=15-5x$$
$$\frac{3y}{3}=\frac{15-5x}{3}$$
$$y=\frac{15-5x}{3}$$

69.
$$\frac{x}{a}+\frac{y}{b}=1$$
$$\frac{ab}{1}\left(\frac{x}{a}+\frac{y}{b}\right)=ab(1)$$
$$bx+ay=ab$$
$$bx-bx+ay=ab-bx$$
$$ay=ab-bx$$
$$\frac{ay}{a}=\frac{ab-bx}{a}$$
$$y=\frac{ab-bx}{a}$$

70.
$$\frac{x}{a}+\frac{y}{b}=1$$
$$\frac{ab}{1}\left(\frac{x}{a}+\frac{y}{b}\right)=ab(1)$$
$$bx+ay=ab$$
$$bx+ay-ay=ab-ay$$
$$bx=ab-ay$$
$$\frac{bx}{b}=\frac{ab-ay}{b}$$
$$x=\frac{ab-ay}{b}$$

71.
$$y=mx+b$$
$$y-b=mx+b-b$$
$$y-b=mx$$
$$\frac{y-b}{m}=\frac{mx}{m}$$
$$\frac{y-b}{m}=x$$

72.
$$ax+by=c$$
$$ax-ax+by=c-ax$$
$$by=c-ax$$
$$\frac{by}{b}=\frac{c-ax}{b}$$
$$y=\frac{c-ax}{b}$$

73.
$$\frac{y-2}{3}=\frac{x+5}{2}$$
$$\frac{6}{1}\left(\frac{y-2}{3}\right)=\frac{6}{1}\left(\frac{x+5}{2}\right)$$
$$2y-4=3x+15$$
$$2y-4+4=3x+15+4$$
$$2y=3x+19$$
$$\frac{2y}{2}=\frac{3x+19}{2}$$
$$y=\frac{3x+19}{2}$$

74.
$$\frac{y+5}{3}=\frac{x-4}{7}$$
$$\frac{21}{1}\left(\frac{y+5}{3}\right)=\frac{21}{1}\left(\frac{x-4}{7}\right)$$
$$7y+35=3x-12$$
$$7y+35+12=3x-12+12$$
$$7y+47=3x$$
$$\frac{7y+47}{3}=\frac{3x}{3}$$
$$\frac{7y+47}{3}=x$$

75. $(y-2)(x-5)=a+3$

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

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

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

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

76. $(x+3)(y+2)=a-5$

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

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

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

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

77. $D=rt$

$10=40t$

$\frac{10}{40}=\frac{40t}{40}$

$\frac{1}{4}=t$

It will take Manuel ¼ hour or 15 minutes to travel from the restaurant to the theater, therefore, he must leave the restaurant no later than 7:45 pm.

78. $D=rt$

$11=55t$

$\frac{11}{55}=\frac{55t}{55}$

$\frac{1}{5}=t$

It will take Elida 12 minutes to travel from the work to the doctor's office, therefore, she must leave work no later than 10:03 am.

79. $I=Prt$

$500=(19800)(0.0775)t$

$500=1534.5t$

$\frac{500}{1534.5}=\frac{1534.5t}{1534.5}$

$0.33\approx t$

It will be almost 4 months before Koki has her down payment.

80. $I=Prt$

$I=(45{,}000)(0.084)(3)$

$I=11{,}340$

The Carters will have enough for the down payment in three years.

Extension Activity

a) 500 seconds, or approximately 8.3 minutes
b) 4,763 seconds, or approximately 79 minutes

2.4 Exercises

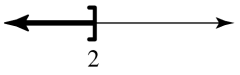
1. When we multiply or divide an inequality by a negative quantity, we must reverse the inequality symbol.

2. Answers will vary; examples include: $x > a$, $x < a$, $2x - 1 \le 30$.

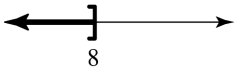
3. If the solution set to an inequality is given by the interval $[-4, \infty)$, the number -4 is a solution to the inequality.

4. If the solution set to an inequality is given by the interval $(-\infty, 2.3)$, the open parentheses at 2.3 denotes 2.3 is not a solution to the inequality.

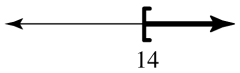
5. $(-\infty, 2]$



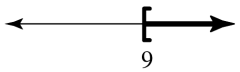
6. $(-\infty, 8]$



7. $[14, \infty)$

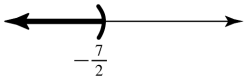


8. $[9, \infty)$

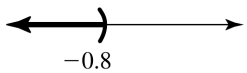


9. $\left(-\frac{4}{5}, \infty\right)$

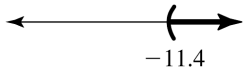
10. $\left(-\infty, -\frac{7}{2}\right)$



11. $(-\infty, -0.8)$



12. $(-11.4, \infty)$



13. $x < 4.6$

14. $x < 12.1$

15. $x > -8.5$

16. $x > -2\frac{1}{2}$

17. $x \ge \frac{21}{2}$

18. $x \ge \frac{13}{3}$

19. $x \le 11$

20. $x \le 25$

21.
$$4x \le 88$$
$$\frac{4x}{4} \le \frac{88}{4}$$
$$x \le 22$$
$$(-\infty, 22]$$

22.
$$5x \ge 105$$
$$\frac{5x}{5} \ge \frac{105}{5}$$
$$x \ge 21$$
$$[21, \infty)$$

23.
$$x + 114 > -200$$
$$x + 114 - 114 > -200 - 114$$
$$x > -314$$
$$(-314, \infty)$$

24.
$$x + 78 < 116$$
$$x + 78 - 78 < 116 - 78$$
$$x < 38$$
$$(-\infty, 38)$$

25.
$$-7x \ge 49$$
$$\frac{-7x}{-7} \le \frac{49}{-7}$$
$$x \le -7$$
$$(-\infty, -7]$$

26. $-4x \le 24$

$$\frac{-4x}{-4} \ge \frac{24}{-4}$$

$$x \ge -6$$

$$[-6, \infty)$$

27. $2x + 1 < 5$

$$2x + 1 - 1 < 5 - 1$$

$$2x < 4$$

$$\frac{2x}{2} < \frac{4}{2}$$

$$x < 2$$

$$(-\infty, 2)$$

28. $2x + 2 > 4$

$$2x + 2 - 2 > 4 - 2$$

$$2x > 2$$

$$\frac{2x}{2} > \frac{2}{2}$$

$$x > 1$$

$$(1, \infty)$$

29. $63 > 11x + 8$

$$63 - 8 > 11x + 8 - 8$$

$$55 > 11x$$

$$\frac{55}{11} > \frac{11x}{11}$$

$$5 > x$$

$$(-\infty, 5)$$

30. $34 < 13x - 5$

$$34 + 5 < 13x - 5 + 5$$

$$39 < 13x$$

$$\frac{39}{13} < \frac{13x}{13}$$

$$3 < x$$

$$(3, \infty)$$

31. $63 + 2.1x < 0$

$$63 - 63 + 2.1x < 0 - 63$$

$$2.1x < -63$$

$$\frac{2.1x}{2.1} < \frac{-63}{2.1}$$

$$x < -30$$

$$(-\infty, -30)$$

32. $36 + 2.4x < 0$

$$36 - 36 + 2.4x < 0 - 36$$

$$2.4x < -36$$

$$\frac{2.4x}{2.4} < \frac{-36}{2.4}$$

$$x < -15$$

$$(-\infty, -15)$$

33. $\frac{7}{4}x \ge 14$

$$\frac{4}{7}\left(\frac{7}{4}x\right) \ge \frac{4}{7}(14)$$

$$x \ge 8$$

$$[8, \infty)$$

34. $\frac{9}{2}x \ge 18$

$$\frac{2}{9}\left(\frac{9}{2}x\right) \ge \frac{2}{9}(18)$$

$$x \ge 4$$

$$[4, \infty)$$

35. $-x \le 11$

$$\frac{-x}{-1} \ge \frac{11}{-1}$$

$$x \ge -11$$

$$[-11, \infty)$$

36. $-x \le 13$

$$\frac{-x}{-1} \ge \frac{13}{-1}$$

$$x \ge -13$$

$$[-13, \infty)$$

37. $-\frac{2}{3}x < \frac{5}{7}$

$$-\frac{3}{2}\left(-\frac{2}{3}x\right) > -\frac{3}{2}\left(\frac{5}{7}\right)$$

$$x > -\frac{15}{14}$$

$$\left(-\frac{15}{14}, \infty\right)$$

38.
$$-\frac{3}{4}x > \frac{2}{9}$$
$$-\frac{4}{3}\left(-\frac{3}{4}x\right) < -\frac{4}{3}\left(\frac{2}{9}\right)$$
$$x < -\frac{8}{27}$$
$$\left(-\infty, -\frac{8}{27}\right)$$

39.
$$5 - x \geq -16$$
$$5 - 5 - x \geq -16 - 5$$
$$-x \geq -21$$
$$\frac{-x}{-1} \leq \frac{-21}{-1}$$
$$x \leq 21$$
$$(-\infty, 21]$$

40.
$$85 - x \leq -43$$
$$85 - 85 - x \leq -43 - 85$$
$$-x \leq -128$$
$$\frac{-x}{-1} \geq \frac{-128}{-1}$$
$$x \geq 128$$
$$[128, \infty)$$

41.
$$7x + 7 < 3 + 9x$$
$$7x - 9x + 7 < 3 + 9x - 9x$$
$$-2x + 7 < 3$$
$$-2x + 7 - 7 < 3 - 7$$
$$-2x < -4$$
$$\frac{-2x}{-2} > \frac{-4}{-2}$$
$$x > 2$$
$$(2, \infty)$$

42.
$$5x + 28 \leq 7 + 2x$$
$$5x - 2x + 28 \leq 7 + 2x - 2x$$
$$3x + 28 \leq 7$$
$$3x + 28 - 28 \leq 7 - 28$$
$$3x \leq -21$$
$$\frac{3x}{3} \leq \frac{-21}{3}$$
$$x \leq -7$$
$$(-\infty, -7]$$

43.
$$-6x + 2 \geq 2(5 - x)$$
$$-6x + 2 \geq 10 - 2x$$
$$-6x + 2x + 2 \geq 10 - 2x + 2x$$
$$-4x + 2 \geq 10$$
$$-4x + 2 - 2 \geq 10 - 2$$
$$-4x \geq 8$$
$$\frac{-4x}{-4} \leq \frac{8}{-4}$$
$$x \leq -2$$
$$(-\infty, -2]$$

44.
$$-7x + 4 > 3(4 - x)$$
$$-7x + 4 > 12 - 3x$$
$$-7x + 3x + 4 > 12 - 3x + 3x$$
$$-4x + 4 > 12$$
$$-4x + 4 - 4 > 12 - 4$$
$$-4x > 8$$
$$\frac{-4x}{-4} < \frac{8}{-4}$$
$$x < -2$$
$$(-\infty, -2)$$

45.
$$15 \leq 1 - 7x$$
$$15 - 1 \leq 1 - 1 - 7x$$
$$14 \leq -7x$$
$$\frac{14}{-7} \geq \frac{-7x}{-7}$$
$$-2 \geq x$$
$$(-\infty, -2]$$

46.
$$12 \geq 2 - 5x$$
$$12 - 2 \geq 2 - 2 - 5x$$
$$10 \geq -5x$$
$$\frac{10}{-5} \leq \frac{-5x}{-5}$$
$$-2 \leq x$$
$$[-2, \infty)$$

47.
$$\begin{aligned} x &> -3x+5 \\ x+3x &> -3x+3x+5 \\ 4x &> 5 \\ \frac{4x}{4} &> \frac{5}{4} \\ x &> \frac{5}{4} \\ &\left(\frac{5}{4},\infty\right) \end{aligned}$$

48.
$$\begin{aligned} x &< -5x+3 \\ x+5x &< -5x+5x+3 \\ 6x &< 3 \\ \frac{6x}{6} &< \frac{3}{6} \\ x &< \frac{1}{2} \\ &\left(-\infty,\frac{1}{2}\right) \end{aligned}$$

49.
$$\begin{aligned} 0.3x+1.4 &\geq -0.4x \\ 0.3x+0.4x+1.4 &\geq -0.4x+0.4x \\ 0.7x+1.4 &\geq 0 \\ 0.7x+1.4-1.4 &\geq 0-1.4 \\ 0.7x &\geq -1.4 \\ \frac{0.7x}{0.7} &\geq \frac{-1.4}{0.7} \\ x &\geq -2 \\ &[-2,\infty) \end{aligned}$$

50.
$$\begin{aligned} 0.5x+8.1 &> -0.4x \\ 0.5x+0.4x+8.1 &> -0.4x+0.4x \\ 0.9x+8.1 &> 0 \\ 0.9x+8.1-8.1 &> 0-8.1 \\ 0.9x &> -8.1 \\ \frac{0.9x}{0.9} &> \frac{-8.1}{0.9} \\ x &> -9 \\ &(-9,\infty) \end{aligned}$$

51.
$$\begin{aligned} 10 &< -3(x-2)+6x \\ 10 &< -3x+6+6x \\ 10 &< 3x+6 \\ 10-6 &< 3x+6-6 \\ 4 &< 3x \\ \frac{4}{3} &< \frac{3x}{3} \\ \frac{4}{3} &< x \\ &\left(\frac{4}{3},\infty\right) \end{aligned}$$

52.
$$\begin{aligned} 8 &\geq -6(x-5)+10x \\ 8 &\geq -6x+30+10x \\ 8 &\geq 4x+30 \\ 8-30 &\geq 4x+30-30 \\ -22 &\geq 4x \\ \frac{-22}{4} &\geq \frac{4x}{4} \\ -\frac{11}{2} &\geq x \\ &\left(-\infty,-\frac{11}{2}\right] \end{aligned}$$

53.
$$\begin{aligned} \frac{x}{2}-\frac{x}{3} &\leq \frac{7}{6} \\ \frac{6}{1}\left(\frac{x}{2}-\frac{x}{3}\right) &\leq \frac{6}{1}\left(\frac{7}{6}\right) \\ 3x-2x &\leq 7 \\ x &\leq 7 \\ &(-\infty,7] \end{aligned}$$

54.
$$\begin{aligned} \frac{x}{2}-\frac{x}{5} &> \frac{9}{10} \\ \frac{10}{1}\left(\frac{x}{2}-\frac{x}{5}\right) &> \frac{10}{1}\left(\frac{9}{10}\right) \\ 5x-2x &> 9 \\ 3x &> 9 \\ \frac{3x}{3} &> \frac{9}{3} \\ x &> 3 \\ &(3,\infty) \end{aligned}$$

55. $-2(x+5) < 3(2x-7)$

$-2x-10 < 6x-21$

$-2x-6x-10 < 6x-6x-21$

$-8x-10 < -21$

$-8x-10+10 < -21+10$

$-8x < -11$

$\frac{-8x}{-8} > \frac{-11}{-8}$

$x > \frac{11}{8}$

$\left(\frac{11}{8}, \infty\right)$

56. $-3(x+4) \le 6(3x-5)$

$-3x-12 \le 18x-30$

$-3x-18x-12 \le 18x-18x-30$

$-21x-12 \le -30$

$-21x-12+12 \le -30+12$

$-21x \le -18$

$\frac{-21x}{-21} \ge \frac{-18}{-21}$

$x \ge \frac{6}{7}$

$\left[\frac{6}{7}, \infty\right)$

57. $7(x+2)+3(2x-1) > 0$

$7x+14+6x-3 > 0$

$13x+11 > 0$

$13x+11-11 > 0-11$

$13x > -11$

$\frac{13x}{13} > \frac{-11}{13}$

$x > -\frac{11}{13}$

$\left(-\frac{11}{13}, \infty\right)$

58. $5(x-1)+2(2x+5) < 0$

$5x-5+4x+10 < 0$

$9x+5 < 0$

$9x+5-5 < 0-5$

$9x < -5$

$\frac{9x}{9} < \frac{-5}{9}$

$x < -\frac{5}{9}$

$\left(-\infty, -\frac{5}{9}\right)$

59. $8x+4 \le 13+8x$

$8x-8x+4 \le 13+8x-8x$

$4 \le 13$

$(-\infty, \infty)$

60. $5x+13 \le 18+5x$

$5x-5x+13 \le 18+5x-5x$

$13 \le 18$

$(-\infty, \infty)$

61. $3(2x-8) > 6x$

$6x-24 > 6x$

$6x-6x-24 > 6x-6x$

$-24 > 0$

$\varnothing$

62. $5(2x-1) > 10x$

$10x-5 > 10x$

$10x-10x-5 > 10x-10x$

$-5 > 0$

$\varnothing$

63. $-6h < 2(4-3h)$

$-6h < 8-6h$

$-6h+6h < 8-6h+6h$

$0 < 8$

$(-\infty, \infty)$

64. $-8k > 4(7-2k)$

$-8k > 28-8k$

$-8k+8k > 28-8k+8k$

$0 > 28$

$\varnothing$

65. $2(4m-2)+m<11+9m$
$8m-4+m<11+9m$
$9m-4<11+9m$
$9m-9m-4<11+9m-9m$
$-4<11$
$(-\infty,\infty)$

66. $3p+8<5(2p+1)-7p$
$3p+8<10p+5-7p$
$3p+8<3p+5$
$3p-3p+8<3p+5-3p$
$8<5$
$\varnothing$

67. $1.2x+3\geq 0.6(2x+5)$
$1.2x+3\geq 1.2x+3$
$1.2x-1.2x+3\geq 1.2x-1.2x+3$
$3\geq 3$
$(-\infty,\infty)$

68. $0.4(6x+5)\geq 2.4x+2$
$2.4x+2\geq 2.4x+2$
$2.4x-2.4x+2\geq 2.4x-2.4x+2$
$2\geq 2$
$(-\infty,\infty)$

69. a) $6<2x$; answers will vary
Six is less than twice a number.

b) $2x-6$ **;** answers will vary
six less than twice a number

70. Answers will vary; one example is: There is always a parenthesis instead of a bracket for $\pm\infty$ because ∞ is a symbol and not a number. Only numbers are included in solution sets.

71. Answers will vary; one example is: Sandra needs to take a cab from the airport. She can spend at most \$20. If one company charges a flat rate of \$9.75 and an additional \$1.50 per mile, and she lives 4.3 miles away, can she afford to take the cab home?

72. Answers will vary; one example is: If Sandra goes to her friend's house, which is 22 miles from the airport, she will need to withdraw at least how much money from the ATM (remember that she already has \$20)?

73. Let x represent the number.
$\frac{3}{4}+5x>x-3$
$\frac{3}{4}+5x-x>x-x-3$
$\frac{3}{4}+4x>-3$
$\frac{3}{4}-\frac{3}{4}+4x>-3-\frac{3}{4}$
$4x>-\frac{15}{4}$
$\frac{1}{4}(4x)>\frac{1}{4}\left(-\frac{15}{4}\right)$
$x>-\frac{15}{16}$
$\left(-\frac{15}{16},\infty\right)$

74. Let x represent the number.
$3x-\frac{2}{5}\leq x+2$
$3x-x-\frac{2}{5}\leq x-x+2$
$2x-\frac{2}{5}\leq 2$
$2x-\frac{2}{5}+\frac{2}{5}\leq 2+\frac{2}{5}$
$2x\leq\frac{12}{5}$
$\frac{1}{2}(2x)\leq\frac{1}{2}\left(\frac{12}{5}\right)$
$x\leq\frac{6}{5}$
$\left(-\infty,\frac{6}{5}\right]$

75. Let x represent Priscilla's score on the third game.
$\frac{115+88+x}{3}\geq 110$
$\frac{203+x}{3}\geq 110$
$\frac{3}{1}\left(\frac{203+x}{3}\right)\geq 3(110)$
$203+x\geq 330$
$203-203+x\geq 330-203$
$x\geq 127$
She must score 127 points or higher on her third game.

76. Let x represent Joaquin's score on the third game.

$$\frac{175+139+x}{3} \geq 150$$
$$\frac{314+x}{3} \geq 150$$
$$\frac{3}{1}\left(\frac{314+x}{3}\right) \geq 3(150)$$
$$314+x \geq 450$$
$$314-314+x \geq 450-314$$
$$x \geq 136$$

He must score 136 points or higher on his third game.

77. Prepare We are asked to determine what Hector must score on his final exam in order to make a B in his math course.

Plan To average the scores we must add them together and divide by 5. This average must be greater than or equal to 80 in order to earn a B.

Process Let x represent Hector's score on the final exam.

$$\frac{77+83+x+70+x}{5} \geq 80$$
$$\frac{230+2x}{5} \geq 80$$
$$\frac{5}{1}\left(\frac{230+2x}{5}\right) \geq 5(80)$$
$$230+2x \geq 400$$
$$230-230+2x \geq 400-230$$
$$2x \geq 170$$
$$\frac{2x}{2} \geq \frac{170}{2}$$
$$x \geq 85$$

Hector must score 85% to 100% on the final exam in order to earn at least a B.

Ponder Does our answer seem reasonable? We can verify our answer by averaging the grades.

78. Prepare We are asked to determine what Isabelle must score on his final exam in order to make at least a 70 in her chemistry course.

Plan To average the scores we must add them together and divide by 5. This average must be greater than or equal to 70.

Process Let x represent Isabelle's score on the final exam.

$$\frac{76+x+61+65+x}{5} \geq 70$$
$$\frac{202+2x}{5} \geq 70$$
$$\frac{5}{1}\left(\frac{202+2x}{5}\right) \geq 5(70)$$
$$202+2x \geq 350$$
$$202-202+2x \geq 350-202$$
$$2x \geq 148$$
$$\frac{2x}{2} \geq \frac{148}{2}$$
$$x \geq 74$$

Isabelle must score 74% to 100% on the final exam in order to earn at least a 70% for the course.

Ponder Does our answer seem reasonable? We can verify our answer by averaging the grades.

79. Prepare We are to determine which meal plans Candelle can afford.

Plan We must set up an inequality using the given information. Candelle's expenses cannot exceed \$13,800 for the year.

Process Let x be the amount that Candelle can spend on a meal plan for one semester.

$$2(2{,}600)+2(2{,}300)+2(1{,}200)+2x \leq 13{,}800$$
$$12{,}200+2x \leq 13{,}800$$
$$12{,}200-12{,}200+2x \leq 13{,}800-12{,}200$$
$$2x \leq 1{,}600$$
$$\frac{2x}{2} \leq \frac{1{,}600}{2}$$
$$x \leq 800$$

Candelle must spend no more than \$800 per semester on a meal plan. Therefore, Candelle can afford plans A or B.

Ponder Does our answer seem reasonable? Yes, We can verify our answer by adding up Candelle's expenses using \$800 for a meal plan.

80. Prepare We are to determine which meal plans Ricardo can afford.

Plan We must set up an inequality using the given information. Ricardo's expenses cannot exceed \$12,000 for the year.

Process Let x be the amount that Ricardo can spend on a meal plan for one semester.

$$\begin{aligned}2(2{,}350)+2(2{,}275)+2(650)+2x &\le 12{,}000\\ 10{,}550+2x &\le 12{,}000\\ 10{,}550-10{,}550+2x &\le 12{,}000-10{,}550\\ 2x &\le 1{,}450\\ \frac{2x}{2} &\le \frac{1{,}450}{2}\\ x &\le 725\end{aligned}$$

Ricardo must spend no more than \$725 per semester on a meal plan. Therefore, Ricardo can afford plan A only.

Ponder Does our answer seem reasonable? Yes, We can verify our answer by adding up Ricardo's expenses using \$725 for a meal plan.

81.
$$\begin{aligned}\frac{3x-1}{9}+\frac{3x}{2} &\le \frac{7}{6}\\ \frac{18}{1}\left(\frac{3x-1}{9}+\frac{3x}{2}\right) &\le \frac{18}{1}\left(\frac{7}{6}\right)\\ 6x-2+27x &\le 21\\ 33x-2 &\le 21\\ 33x-2+2 &\le 21+2\\ 33x &\le 23\\ \frac{33x}{33} &\le \frac{23}{33}\\ x &\le \frac{23}{33}\\ \left(-\infty,\frac{23}{33}\right]\end{aligned}$$

82.
$$\begin{aligned}\frac{2x-3}{4}+\frac{3x}{5} &\ge \frac{5}{2}\\ \frac{20}{1}\left(\frac{2x-3}{4}+\frac{3x}{5}\right) &\ge \frac{20}{1}\left(\frac{5}{2}\right)\\ 10x-15+12x &\ge 50\\ 22x-15 &\ge 50\\ 22x-15+15 &\ge 50+15\\ 22x &\ge 65\\ \frac{22x}{22} &\ge \frac{65}{22}\\ x &\ge \frac{65}{22}\\ \left[\frac{65}{22},\infty\right)\end{aligned}$$

83.
$$\begin{aligned}\frac{7}{8}x+\frac{11}{8}x &\le 6.5-x\\ \frac{18}{8}x &\le 6.5-x\\ 2.25x &\le 6.5-x\\ 2.25x+x &\le 6.5-x+x\\ 3.25x &\le 6.5\\ \frac{3.25x}{3.25} &\le \frac{6.5}{3.25}\\ x &\le 2\\ (-\infty,2]\end{aligned}$$

84.
$$\begin{aligned}\frac{11}{4}x+x &< 2.25-0.75x\\ \frac{15}{4}x &< 2.25-0.75x\\ 3.75x+0.75x &< 2.25-0.75x+0.75x\\ 4.5x &< 2.25\\ \frac{4.5x}{4.5} &< \frac{2.25}{4.5}\\ x &< \frac{1}{2}\\ \left(-\infty,\frac{1}{2}\right)\end{aligned}$$

85.
$$\begin{aligned}4(3x-2)-3(7x-4) &> -14\\ 12x-8-21x+12 &> -14\\ -9x+4 &> -14\\ -9x+4-4 &> -14-4\\ -9x &> -18\\ \frac{-9x}{-9} &< \frac{-18}{-9}\\ x &< 2\\ (-\infty,2)\end{aligned}$$

86.
$$\begin{aligned}3(2x+5)-5(3x-1) &\le -7\\ 6x+15-15x+5 &\le -7\\ -9x+20 &\le -7\\ -9x+20-20 &\le -7-20\\ -9x &\le -27\\ \frac{-9x}{-9} &\ge \frac{-27}{-9}\\ x &\ge 3\\ [3,\infty)\end{aligned}$$

87.
$$\begin{aligned} -15 &\le 11x - 7(-2x+5) \\ -15 &\le 11x + 14x - 35 \\ -15 &\le 25x - 35 \\ -15 + 35 &\le 25x - 35 + 35 \\ 20 &\le 25x \\ \frac{20}{25} &\le \frac{25x}{25} \\ \frac{4}{5} &\le x \end{aligned}$$
$$\left[\frac{4}{5}, \infty\right)$$

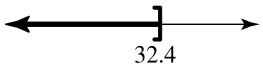
88.
$$\begin{aligned} -9 &\le 5x - 3(-7x-4) \\ -9 &\le 5x + 21x + 12 \\ -9 &\le 26x + 12 \\ -9 - 12 &\le 26x + 12 - 12 \\ -21 &\le 26x \\ \frac{-21}{26} &\le \frac{26x}{26} \\ -\frac{21}{26} &\le x \end{aligned}$$
$$\left[-\frac{21}{26}, \infty\right)$$

89.
$$\begin{aligned} -5(2x+4) &< 16x - (5 - 4x) \\ -10x - 20 &< 16x - 5 + 4x \\ -10x - 20x - 20 &< 20x - 20x - 5 \\ -30x - 20 &< -5 \\ -30x - 20 + 20 &< -5 + 20 \\ -30x &< 15 \\ \frac{-30x}{-30} &> \frac{15}{-30} \\ x &> -\frac{1}{2} \end{aligned}$$
$$\left(-\frac{1}{2}, \infty\right)$$

90.
$$\begin{aligned} 3x - 2(7 - 3x) &> -4(6x+1) \\ 3x - 14 + 6x &> -24x - 4 \\ 9x - 14 &> -24x - 4 \\ 9x + 24x - 14 &> -24x + 24x - 4 \\ 33x - 14 &> -4 \\ 33x - 14 + 14 &> -4 + 14 \\ 33x &> 10 \\ \frac{33x}{33} &> \frac{10}{33} \\ x &> \frac{10}{33} \end{aligned}$$
$$\left(\frac{10}{33}, \infty\right)$$

Extension Activity

Answers will vary; one example is: The linear inequality is $20x \le 648$, where x represents the number of students. The solution is $x \le 32.4$. The graph of the solution is:



Some of the solutions on the graph do not make sense. For example, we cannot have 32.4 students, so the graph should have stopped at 32. Also, we cannot have a negative number of students, so the graph should have begun at 0.

MEMO

TO: The Registrar

FR: Students in Beginning Algebra, Section 103 In the General Education Building, there are 20 classrooms. We counted 648 total chairs in the building. This gives an approximate class size of 32 students per class per hour. However, not all classrooms have 32 chairs. Therefore, it is imperative to carefully assign classes to the appropriately sized rooms.

2.5 Exercises

1. A compound inequality may be connected by either the word and or or.

2. A double inequality is simply a compound inequality with the connective and.

3. The closed interval $[-3,7]$ as a solution set tells us that both -3 and 7 are solutions to the original inequality.

4. The open interval $(5,23)$ as a solution set tells us that both 5 and 23 are not solutions to the original inequality.

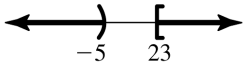
5. The goal when solving a double inequality is to isolate the variable in the center.

6. When solving a compound inequality, if we multiply or divide by a negative quantity, we must reverse the inequality symbol.

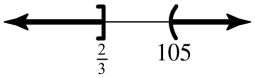
7. In the interval $\left[-\frac{1}{2},15\right)$, the number 15 is not a solution to the inequality, but the number $-\frac{1}{2}$ is a solution.

8. In the interval $\left(-100,\frac{23}{10}\right]$, the number -100 is not a solution to the inequality, but the number $\frac{23}{10}$ is.

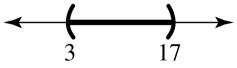
9. $(-\infty,-5)\cup[23,\infty)$



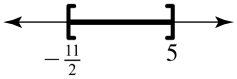
10. $\left(-\infty,\frac{2}{3}\right]\cup(105,\infty)$



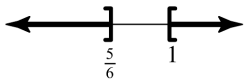
11. $(3,17)$



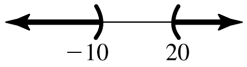
12. $\left[-\frac{11}{2},5\right]$



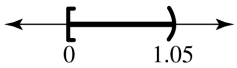
13. $\left(-\infty,\frac{5}{6}\right]\cup[1,\infty)$



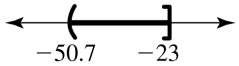
14. $(-\infty,-10)\cup(20,\infty)$



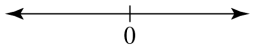
15. $[0,1.05)$



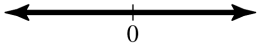
16. $(-50.7,-23]$



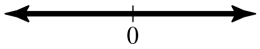
17. $\{\ \}$



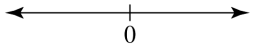
18. $(-\infty,\infty)$



19. $(-\infty,\infty)$



20. $\{\ \}$



21. $-2.3 \le x \le 11.57$

22. $33.5 \le x \le 101$

23. $-\frac{2}{3} < x < \frac{25}{4}$

24. $-\frac{1}{5} < x < \frac{12}{5}$

25. $0 \le x < 5$

26. $17 \le x < 51$

27. $-2 < x \le 75$

28. $-9 < x \le 43$

29. $x \le -2$ or $x > -1$

30. $x < 15$ *or* $x \ge 36$

31. $x < 8$ *or* $x > 12$

32. $x \le -4$ *or* $x \ge 6$

33. $x \le -2.2$ *or* $x \ge 5.8$

34. $x < 13.1$ *or* $x > 18.6$

35. $-\frac{12}{5} < x < 0$ *or* $x \ge 3$

36. $3.5 < x < 16$ *or* $x > 25$

37. $x > 12.5$ *or* $0.25x < 2.5$

$$\frac{0.25x}{0.25} < \frac{2.5}{0.25}$$

$$x < 10$$

$$(-\infty, 10) \cup (12.5, \infty)$$

38. $x < 9.57$ *or* $0.36x > 7.2$

$$\frac{0.36x}{0.36} > \frac{7.2}{0.36}$$

$$x > 20$$

$$(-\infty, 9.57) \cup (20, \infty)$$

39. $x \le 5.06$ *and* $10x > 21$

$$\frac{10x}{10} > \frac{21}{10}$$

$$x > 2.1$$

$$(2.1, 5.06]$$

40. $19x \le 25$ *and* $100x > -325$

$$\frac{19x}{19} \le \frac{25}{19} \quad \textit{and} \quad \frac{100x}{100} > \frac{-325}{100}$$

$$x \le \frac{25}{19} \quad \textit{and} \quad x > -3.25$$

$$\left(-3.25, \frac{25}{19}\right]$$

41. $-6x < -36$ *and* $\frac{2}{3}x < 16$

$$\frac{-6x}{-6} > \frac{-36}{-6} \quad \textit{and} \quad \frac{3}{2}\left(\frac{2}{3}x\right) < \frac{3}{2}(16)$$

$$x > 6 \quad \textit{and} \quad x < 24$$

$$(6, 24)$$

42. $-\frac{1}{5}x \ge 2$ and $-2x \le 13$

$$-\frac{5}{1}\left(-\frac{1}{5}x\right) \le -5(2) \quad \text{and} \quad \frac{-2x}{-2} \ge \frac{13}{-2}$$

$$x \le -10 \quad \text{and} \quad x \ge -6.5$$

$$\varnothing$$

43. $3x - 6 \le 2$ *or* $2x - 1 < 0$

$$3x \le 8 \quad \textit{or} \quad 2x < 1$$

$$\frac{3x}{3} \le \frac{8}{3} \quad \textit{or} \quad \frac{2x}{2} < \frac{1}{2}$$

$$x \le \frac{8}{3} \quad \textit{or} \quad x < \frac{1}{2}$$

$$\left(-\infty, \frac{8}{3}\right]$$

44. $3x - 4 \ge 0$ *or* $8x - 48 > -1$

$$3x \ge 4 \quad \textit{or} \quad 8x > 47$$

$$\frac{3x}{3} \ge \frac{4}{3} \quad \textit{or} \quad \frac{8x}{8} > \frac{47}{8}$$

$$x \ge \frac{4}{3} \quad \textit{or} \quad x > \frac{47}{8}$$

$$\left[\frac{4}{3}, \infty\right)$$

45. $17 - 6x \ge 65$ *or* $45x + 4 < 14$

$$-6x \ge 48 \quad \textit{or} \quad 45x < 10$$

$$\frac{-6x}{-6} \le \frac{48}{-6} \quad \textit{or} \quad \frac{45x}{45} < \frac{10}{45}$$

$$x \le -8 \quad \textit{or} \quad x < \frac{2}{9}$$

$$\left(-\infty, \frac{2}{9}\right)$$

46. $5-16x<-27 \quad or \quad 21x+6\geq 16$

$-16x<-32 \quad or \quad 21x\geq 10$

$\frac{-16x}{-16}>\frac{-32}{-16} \quad or \quad \frac{21x}{21}\geq\frac{10}{21}$

$x>2 \quad or \quad x\geq\frac{10}{21}$

$\left[\frac{10}{21},\infty\right)$

47. $-7x+2>5 \quad or \quad -8x\leq -32$

$-7x>3 \quad or \quad \frac{-8x}{-8}\geq\frac{-32}{-8}$

$\frac{-7x}{-7}<\frac{3}{-7} \quad or \quad x\geq 4$

$x<-\frac{3}{7}$

$\left(-\infty,-\frac{3}{7}\right)\cup[4,\infty)$

48. $-5x\geq 11 \quad or \quad -3x+5<3$

$\frac{-5x}{-5}\leq\frac{11}{-5} \quad or \quad -3x<-2$

$x\leq-\frac{11}{5} \quad or \quad \frac{-3x}{-3}>\frac{-2}{-3}$

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

$\left(-\infty,-\frac{11}{5}\right]\cup\left(\frac{2}{3},\infty\right)$

49. $x+3<-7 \quad or \quad 2x-1\geq 9$

$x<-10 \quad or \quad 2x\geq 10$

$\frac{2x}{2}\geq\frac{10}{2}$

$x\geq 5$

$(-\infty,-10)\cup[5,\infty)$

50. $3x+1\leq -8 \quad or \quad x+5<175$

$3x\leq -9 \quad or \quad x<170$

$\frac{3x}{3}\leq\frac{-9}{3}$

$x\leq -3$

$(-\infty,170)$

51. $-(x+45)>3x+41 \quad and \quad 6(x-5)<42$

$-x-45>3x+41 \quad and \quad 6x-30<42$

$-4x>86 \quad and \quad 6x<72$

$\frac{-4x}{-4}<\frac{86}{-4} \quad and \quad \frac{6x}{6}<\frac{72}{6}$

$x<-21.5 \quad and \quad x<12$

$(-\infty,-21.5)$

52. $-10(x+5)\leq 15 \quad and \quad 2(x-12)\geq 4$

$-10x-50\leq 15 \quad and \quad 2x-24\geq 4$

$-10x\leq 65 \quad and \quad 2x\geq 28$

$\frac{-10x}{-10}\geq\frac{65}{-10} \quad and \quad \frac{2x}{2}\geq\frac{28}{2}$

$x\geq -6.5 \quad and \quad x\geq 14$

$[14,\infty)$

53. $5x+6\leq 2(x-7) \quad or \quad -10x-3<3(6-x)$

$5x+6\leq 2x-14 \quad or \quad -10x-3<18-3x$

$3x\leq -20 \quad or \quad -7x<21$

$\frac{3x}{3}\leq\frac{-20}{3} \quad or \quad \frac{-7x}{-7}>\frac{21}{-7}$

$x\leq-\frac{20}{3} \quad or \quad x>-3$

$\left(-\infty,-\frac{20}{3}\right]\cup(-3,\infty)$

54. $-4(x+2)>6x+1 \quad or \quad 20x-4>4(x+3)$

$-4x-8>6x+1 \quad or \quad 20x-4>4x+12$

$-10x>9 \quad or \quad 16x>16$

$\frac{-10x}{-10}<\frac{9}{-10} \quad or \quad \frac{16x}{16}>\frac{16}{16}$

$x<-\frac{9}{10} \quad or \quad x>1$

$\left(-\infty,-\frac{9}{10}\right)\cup(1,\infty)$

55. $24<x+6<32$

$24-6<x+6-6<32-6$

$18<x<26$

$(18,26)$

56. $17\leq x+3\leq 45$

$17-3\leq x+3-3\leq 45-3$

$14\leq x\leq 42$

$[14,42]$

57. $-15 \le 3x \le 24$

$$\frac{-15}{3} \le \frac{3x}{3} \le \frac{24}{3}$$

$$-5 \le x \le 8$$

$$[-5,8]$$

58. $-24 < 6x < 12$

$$\frac{-24}{6} < \frac{6x}{6} < \frac{12}{6}$$

$$-4 < x < 2$$

$$(-4,2)$$

59. $-235 < 5 - 2x \le -115$

$$-235 - 5 < 5 - 5 - 2x \le -115 - 5$$

$$-240 < -2x \le -120$$

$$\frac{-240}{-2} > \frac{-2x}{-2} \ge \frac{-120}{-2}$$

$$60 \le x < 120$$

$$[60,120)$$

60. $-135 < 6 - 3x \le -84$

$$-135 - 6 < 6 - 6 - 3x \le -84 - 6$$

$$-141 < -3x \le -90$$

$$\frac{-141}{-3} > \frac{-3x}{-3} \ge \frac{-90}{-3}$$

$$30 \le x < 47$$

$$[30,47)$$

61. $\frac{1}{3} < \frac{x}{4} \le \frac{2}{3}$

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

$$\frac{4}{3} < x \le \frac{8}{3}$$

$$\left(\frac{4}{3}, \frac{8}{3}\right]$$

62. $\frac{2}{5} < \frac{x}{3} \le \frac{4}{5}$

$$\frac{3}{1}\left(\frac{2}{5}\right) < \frac{3}{1}\left(\frac{x}{3}\right) \le \frac{3}{1}\left(\frac{4}{5}\right)$$

$$\frac{6}{5} < x \le \frac{12}{5}$$

$$\left(\frac{6}{5}, \frac{12}{5}\right]$$

63. $0 \le \frac{x-3}{4} \le 4$

$$4(0) \le \frac{4}{1}\left(\frac{x-3}{4}\right) \le 4(4)$$

$$0 \le x - 3 \le 16$$

$$0 + 3 \le x - 3 + 3 \le 16 + 3$$

$$3 \le x \le 19$$

$$[3,19]$$

64. $0 < \frac{x-5}{3} < 7$

$$3(0) < \frac{3}{1}\left(\frac{x-5}{3}\right) < 3(7)$$

$$0 < x - 5 < 21$$

$$0 + 5 < x - 5 + 5 < 21 + 5$$

$$5 < x < 26$$

$$(5,26)$$

65. $-14 < -11 - x \le -3$

$$-14 + 11 < -11 + 11 - x \le -3 + 11$$

$$-3 < -x \le 8$$

$$\frac{-3}{-1} > \frac{-x}{-1} \ge \frac{8}{-1}$$

$$-8 \le x < 3$$

$$[-8,3)$$

66. $-35 < -25 - x \le -7$

$$-35 + 25 < -25 + 25 - x \le -7 + 25$$

$$-10 < -x \le 18$$

$$\frac{-10}{-1} > \frac{-x}{-1} \ge \frac{18}{-1}$$

$$-18 \le x < 10$$

$$[-18,10)$$

67. $35.1 < 0.3x < 124.2$

$$\frac{35.1}{0.3} < \frac{0.3x}{0.3} < \frac{124.2}{0.3}$$

$$117 < x < 414$$

$$(117,414)$$

68. $145.5 < 0.5x < 205.5$

$$\frac{145.5}{0.5} < \frac{0.5x}{0.5} < \frac{205.5}{0.5}$$

$$291 < x < 411$$

$$(291,411)$$

69. $x<17$ *and* $x>-18$. $-18<x<17$. Answers will vary; one example is: I prefer the second form because it is easier to visualize that x is between -18 and 17 because it is physically written between the two numbers.

70. *Or* refers to the union of inequality solutions; *and* refers to the intersection.

71. $\frac{2}{3}x-4\le 12$ *or* $\frac{1}{5}x+10>15$

$\frac{2}{3}x\le 16$ *or* $\frac{1}{5}x>5$

$\frac{3}{2}\left(\frac{2}{3}x\right)\le\frac{3}{2}(16)$ *or* $\frac{5}{1}\left(\frac{1}{5}x\right)>5(5)$

$x\le 24$ *or* $x>25$

$(-\infty,24]\cup(25,\infty)$

72. $\frac{1}{10}x+6<-9$ *or* $\frac{2}{5}x-7\ge 2$

$\frac{1}{10}x<-15$ *or* $\frac{2}{5}x\ge 9$

$\frac{10}{1}\left(\frac{1}{10}x\right)<10(-15)$ *or* $\frac{5}{2}\left(\frac{2}{5}x\right)\ge\frac{5}{2}(9)$

$x<-150$ *or* $x\ge\frac{45}{2}$

$(-\infty,-150)\cup\left[\frac{45}{2},\infty\right)$

73. $\frac{5}{9}(-69-32)\le C\le\frac{5}{9}(117-32)$

$\frac{5}{9}(-101)\le C\le\frac{5}{9}(85)$

$\frac{-505}{9}\le C\le\frac{425}{9}$

This is approximately the double inequality $-56^\circ\le C\le 47\left|^\circ\right|$.

74. $\frac{5}{9}(-58-32)\le C\le\frac{5}{9}(120-32)$

$\frac{5}{9}(-90)\le C\le\frac{5}{9}(88)$

$-50\le C\le\frac{440}{9}$

This is approximately the double inequality $-50^\circ\le C\le 49^\circ$.

75. a) $6{,}000\le 55x+4{,}625\le 7{,}980$

b) $6{,}000\le 55x+4{,}625\le 7{,}980$

$6{,}000-4{,}625\le 55x+4{,}625-4{,}625\le 7{,}980-4{,}625$

$1{,}375\le 55x\le 3{,}355$

$\frac{1{,}375}{55}\le\frac{55x}{55}\le\frac{3{,}355}{55}$

$25\le x\le 61$

The Hudsons can afford between 25 and 61 hours of labor.

76. a) $500\le 40x+340\le 600$

b) $500\le 40x+340\le 600$

$500-340\le 40x+340-340\le 600-340$

$160\le 40x\le 260$

$\frac{160}{40}\le\frac{40x}{40}\le\frac{260}{40}$

$4\le x\le 6.5$

Wilma can afford between 4 and 6.5 hours of labor.

77. **Prepare** Felix wishes to determine the September sales his department needs in order to beat the record low and meet the high for the quarter.

Plan Write a double inequality with the record low as the lowest value, the record high as the greatest value, and the expression that represents the average sales for the third quarter of Felix's department in the middle.

Process Let x represent the sales for September.

$34{,}000<\frac{38{,}790+56{,}235+x}{3}<75{,}000$

$34{,}000<\frac{95{,}025+x}{3}<75{,}000$

$3(34{,}000)<\frac{3}{1}\left(\frac{95{,}025+x}{3}\right)<3(75{,}000)$

$102{,}000<95{,}025+x<225{,}000$

$102{,}000-95{,}025<95{,}025-95{,}025+x<225{,}000-95{,}025$

$6{,}975<x<129{,}975$

The July sales should be between \$6,775 and \$129,975.

Ponder Does our answer make sense? Yes. We can easily compute the average for the three months to see that the conditions are satisfied.

78. Prepare Aretha wishes to determine the score she needs in her third game to reach her low or reach her high average.

Plan Write a double inequality with the record low as the lowest value, the record high as the greatest value, and the expression that represents the average score in the middle.

Process Let x represent the score for the third game.

$$92 < \frac{85+150+x}{3} < 160$$

$$92 < \frac{235+x}{3} < 160$$

$$3(92) < \frac{3}{1}\left(\frac{235+x}{3}\right) < 3(160)$$

$$276 < 235 + x < 480$$

$$276 - 235 < 235 - 235 + x < 480 - 235$$

$$41 < x < 245$$

The score for the third game should be between 41 and 245.

Ponder Does our answer make sense? Yes. We can easily compute the average for the three games to see that the conditions are satisfied.

79.

$$\frac{x}{3}+\frac{x}{4} > \frac{x}{6}+1 \quad or \quad \frac{x}{5}-\frac{x}{2} < 1$$

$$\frac{12}{1}\left(\frac{x}{3}+\frac{x}{4}\right) > \frac{12}{1}\left(\frac{x}{6}+1\right) \quad or \quad \frac{10}{1}\left(\frac{x}{5}-\frac{x}{2}\right) < 10(1)$$

$$4x+3x > 2x+12 \quad or \quad 2x-5x < 10$$

$$7x > 2x+12 \quad or \quad -3x < 10$$

$$7x-2x > 2x-2x+12 \quad or \quad \frac{-3x}{-3} > \frac{10}{-3}$$

$$5x > 12 \quad or \quad x > -\frac{10}{3}$$

$$\frac{5x}{5} > \frac{12}{5}$$

$$x > \frac{12}{5}$$

$$\left(-\frac{10}{3}, \infty\right)$$

80.

$$\frac{x}{2}-\frac{x}{5} \le 2 \quad or \quad \frac{x}{6}+\frac{x}{3} < \frac{3x}{2}+1$$

$$\frac{10}{1}\left(\frac{x}{2}-\frac{x}{5}\right) \le 10(2) \quad or \quad \frac{6}{1}\left(\frac{x}{6}+\frac{x}{3}\right) < \frac{6}{1}\left(\frac{3x}{2}+1\right)$$

$$5x-2x \le 20 \quad or \quad x+2x < 9x+6$$

$$3x \le 20 \quad or \quad 3x < 9x+6$$

$$\frac{3x}{3} \le \frac{20}{3} \quad or \quad 3x-9x < 9x-9x+6$$

$$x \le \frac{20}{3} \quad or \quad -6x < 6$$

$$\frac{-6x}{-6} > \frac{6}{-6}$$

$$x > -1$$

$$(-\infty, \infty)$$

81.

$$\begin{array}{rcl} -4x-15>5+x & \text{and} & 2(x+3)>2(3-2x) \\ -4x-x-15>5+x-x & \text{and} & 2x+6>6-4x \\ -5x-15>5 & \text{and} & 2x+4x+6>6-4x+4x \\ -5x-15+15>5+15 & \text{and} & 6x+6>6 \\ -5x>20 & \text{and} & 6x+6-6>6-6 \\ \dfrac{-5x}{-5}<\dfrac{20}{-5} & \text{and} & 6x>0 \\ x<-4 & \text{and} & \dfrac{6x}{6}>\dfrac{0}{6} \\ & & x>0 \\ & \{\ \} & \end{array}$$

82.

$$\begin{array}{rcl} -(x-3)>2(x+1)+1 & \text{and} & 8(x-4)>1 \\ -x+3>2x+2+1 & \text{and} & 8x-32>1 \\ -x+3>2x+3 & \text{and} & 8x-32+32>1+32 \\ -x-2x+3>2x-2x+3 & \text{and} & 8x>33 \\ -3x+3>3 & \text{and} & \dfrac{8x}{8}>\dfrac{33}{8} \\ -3x+3-3>3-3 & \text{and} & x>\dfrac{33}{8} \\ -3x>0 & & \\ \dfrac{-3x}{-3}<\dfrac{0}{3} & & \\ x<0 & & \\ & \{\ \} & \end{array}$$

83.

$$\begin{array}{rcl} 2(x+7)+1<15 & \text{or} & -4(x-6)<-3 \\ 2x+14+1<15 & \text{or} & -4x+24<-3 \\ 2x+15<15 & \text{or} & -4x+24-24<-3-24 \\ 2x+15-15<15-15 & \text{or} & -4x<-27 \\ 2x<0 & \text{or} & \dfrac{-4x}{-4}>\dfrac{-27}{-4} \\ \dfrac{2x}{2}<\dfrac{0}{2} & \text{or} & x>\dfrac{27}{4} \\ x<0 & & \end{array}$$

$$(-\infty,0)\cup\left(\frac{27}{4},\infty\right)$$

84. $7(x-7)+9 \ge -40$ *or* $-5(2x+20) \ge 5$

$7x-49+9 \ge -40$ *or* $-10x-100 \ge 5$

$7x-40 \ge -40$ *or* $-10x-100+100 \ge 5+100$

$7x-40+40 \ge -40+40$ *or* $-10x \ge 105$

$7x \ge 0$ *or* $\frac{-10x}{-10} \le \frac{105}{-10}$

$\frac{7x}{7} \ge \frac{0}{7}$ *or* $x \le -\frac{21}{2}$

$x \ge 0$

$\left(-\infty, -\frac{21}{2}\right] \cup [0, \infty)$

85. $-\frac{2}{3}x+\frac{1}{4} > \frac{1}{2}$ *or* $15x+10 \le 32$

$\frac{12}{1}\left(-\frac{2}{3}x+\frac{1}{4}\right) > \frac{12}{1}\left(\frac{1}{2}\right)$ *or* $15x+10-10 \le 32-10$

$-8x+3 > 6$ *or* $15x \le 22$

$-8x+3-3 > 6-3$ *or* $\frac{15x}{15} \le \frac{22}{15}$

$-8x > 3$ *or* $x \le \frac{22}{15}$

$\frac{-8x}{-8} < \frac{3}{-8}$

$x < -\frac{3}{8}$

$\left(-\infty, \frac{22}{15}\right]$

86. $\frac{4}{5}x-\frac{1}{3} < \frac{1}{15}$ *or* $7-3x < -14$

$\frac{15}{1}\left(\frac{4}{5}x-\frac{1}{3}\right) < \frac{15}{1}\left(\frac{1}{15}\right)$ *or* $7-7-3x < -14-7$

$12x-5 < 1$ *or* $-3x < -21$

$12x-5+5 < 1+5$ *or* $\frac{-3x}{-3} > \frac{-21}{-3}$

$12x < 6$ *or* $x > 7$

$\frac{12x}{12} < \frac{6}{12}$

$x < \frac{1}{2}$

$\left(-\infty, \frac{1}{2}\right) \cup (7, \infty)$

87.
$$\frac{29}{2} \le \frac{15x-6}{2} < 21$$
$$\frac{2}{1}\left(\frac{29}{2}\right) \le \frac{2}{1}\left(\frac{15x-6}{2}\right) < 2(21)$$
$$29 \le 15x-6 < 42$$
$$29+6 \le 15x-6+6 < 42+6$$
$$35 \le 15x < 48$$
$$\frac{35}{15} \le \frac{15x}{15} < \frac{48}{15}$$
$$\frac{7}{3} \le x < \frac{16}{5}$$
$$\left[\frac{7}{3}, \frac{16}{5}\right)$$

88.
$$-2 < \frac{-15x-14}{2} \le 17$$
$$2(-2) < \frac{2}{1}\left(\frac{-15x-14}{2}\right) \le 2(17)$$
$$-4 < -15x-14 \le 34$$
$$-4+14 < -15x-14+14 \le 34+14$$
$$10 < -15x \le 48$$
$$\frac{10}{-15} > \frac{-15x}{-15} \ge \frac{48}{-15}$$
$$-\frac{16}{5} \le x < -\frac{2}{3}$$
$$\left[-\frac{16}{5}, \frac{2}{3}\right)$$

89.
$$\frac{3}{2}x < -15 \quad \textit{and} \quad 7x+13 \ge -15$$
$$\frac{2}{3}\left(\frac{3}{2}x\right) < \frac{2}{3}(-15) \quad \textit{and} \quad 7x+13-13 \ge -15-13$$
$$x < -10 \quad \textit{and} \quad 7x \ge -28$$
$$\frac{7x}{7} \ge \frac{-28}{7}$$
$$x \ge -4$$
$$\{\ \}$$

90.
$$-35+2x > 1 \quad \textit{and} \quad -\frac{2}{5}x > -\frac{33}{5}$$
$$-35+35+2x > 1+35 \quad \textit{and} \quad -\frac{5}{2}\left(-\frac{2}{5}x\right) < -\frac{5}{2}\left(-\frac{33}{5}\right)$$
$$2x > 36 \quad \textit{and} \quad x < \frac{33}{2}$$
$$\frac{2x}{2} > \frac{36}{2}$$
$$x > 18$$
$$\{\ \}$$

Extension Activity

Answers will vary; one example is: A used Toyota Corolla for \$9,274, plus 6.25% sales tax, plus \$180 registration fee. The total sales price is \$10,033.63. For 100% financing for 36 months at 7.5%, the monthly payment is \$312 and for 60 months at 6.8%, the monthly payment is \$198. Let x represent the number of hours you work each month. The, assuming an hourly wage of \$10 per hour, the double inequality is $198 \le 10x \le 312$. Therefore, you would have to work at least 19.8 hours per month to make the 60-month car payment and 31.2 hours per month to make the 36-month car payment. To determine if buying the car is a wise decision is an individual choice and should be based on such factors as how many hours you work and go to school and your monthly budget. Don't forget to include gas, insurance, and maintenance.

2.6 Exercises

1. When solving an absolute value equation, the first thing we should do is isolate the absolute value on the left-hand side. Then, check to see if the constant on the right-hand side is strictly positive.

2. The absolute value of x is equal to the real number a if and only if $x = a$ or $x = -a$.

3. If the constant on the right-hand side is zero, and absolute value equation may have one solution.

4. An absolute value inequality involving "less than" may have zero real numbers as its solution, if the constant on the right-hand side is negative.

5. An absolute value inequality involving "greater than" may have infinite real numbers as its solution, if the constant on the right-hand side is negative.

6. An absolute value equation may have zero solutions, if the constant on the right-hand side is negative.

7. An absolute value equation may have two solutions, if the constant on the right-hand side is positive.

8. An absolute value inequality involving "less than" may be written as a double inequality or as a compound inequality involving the connective and.

9.
$$|x| = 23$$
$$x = -23 \quad or \quad x = 23$$
$$\{-23, 23\}$$

10.
$$|x| = 45$$
$$x = -45 \quad or \quad x = 45$$
$$\{-45, 45\}$$

11.
$$|x+1| = 109$$
$$x+1 = -109 \quad or \quad x+1 = 109$$
$$x = -110 \quad or \quad x = 108$$
$$\{-110, 108\}$$

12.
$$|x+2| = 56$$
$$x+2 = -56 \quad or \quad x+2 = 56$$
$$x = -58 \quad or \quad x = 54$$
$$\{-58, 54\}$$

13.
$$|5x| = 55$$
$$5x = -55 \quad or \quad 5x = 55$$
$$x = -11 \quad or \quad x = 11$$
$$\{-11, 11\}$$

14.
$$|7x| = 49$$
$$7x = -49 \quad or \quad 7x = 49$$
$$x = -7 \quad or \quad x = 7$$
$$\{-7, 7\}$$

15.
$$|-8x| = 64$$
$$-8x = -64 \quad or \quad -8x = 64$$
$$x = 8 \quad or \quad x = -8$$
$$\{-8, 8\}$$

16.
$$|-25x| = 225$$
$$-25x = -225 \quad or \quad -25x = 225$$
$$x = 9 \quad or \quad x = -9$$
$$\{-9, 9\}$$

17.
$$\left|\frac{x}{2}\right| = \frac{3}{4}$$
$$\frac{x}{2} = -\frac{3}{4} \quad or \quad \frac{x}{2} = \frac{3}{4}$$
$$\frac{2}{1}\left(\frac{x}{2}\right) = \frac{2}{1}\left(-\frac{3}{4}\right) \quad or \quad \frac{2}{1}\left(\frac{x}{2}\right) = \frac{2}{1}\left(\frac{3}{4}\right)$$
$$x = -\frac{3}{2} \quad or \quad x = \frac{3}{2}$$
$$\left\{-\frac{3}{2}, \frac{3}{2}\right\}$$

18.
$$\left|\frac{x}{6}\right| = \frac{5}{12}$$
$$\frac{x}{6} = -\frac{5}{12} \quad or \quad \frac{x}{6} = \frac{5}{12}$$
$$\frac{6}{1}\left(\frac{x}{6}\right) = \frac{6}{1}\left(-\frac{5}{12}\right) \quad or \quad \frac{6}{1}\left(\frac{x}{6}\right) = \frac{6}{1}\left(\frac{5}{12}\right)$$
$$x = -\frac{5}{2} \quad or \quad x = \frac{5}{2}$$
$$\left\{-\frac{5}{2}, \frac{5}{2}\right\}$$

19. $\left|-\frac{2}{3}x\right| = \frac{4}{5}$

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

20. $\left|-\frac{3}{4}x\right| = \frac{5}{6}$

$$-\frac{3}{4}x = -\frac{5}{6} \quad or \quad -\frac{3}{4}x = \frac{5}{6}$$
$$-\frac{4}{3}\left(-\frac{3}{4}x\right) = -\frac{4}{3}\left(-\frac{5}{6}\right) \quad or \quad -\frac{4}{3}\left(-\frac{3}{4}x\right) = -\frac{4}{3}\left(\frac{5}{6}\right)$$
$$x = \frac{10}{9} \quad or \quad x = -\frac{10}{9}$$
$$\left\{-\frac{10}{9}, \frac{10}{9}\right\}$$

21. $\left|\frac{7-x}{3}\right| = 110$

$$\frac{7-x}{3} = -110 \quad or \quad \frac{7-x}{3} = 110$$
$$\frac{3}{1}\left(\frac{7-x}{3}\right) = 3(-110) \quad or \quad \frac{3}{1}\left(\frac{7-x}{3}\right) = 3(110)$$
$$7-x = -330 \quad or \quad 7-x = 330$$
$$-x = -337 \quad or \quad -x = 323$$
$$\frac{-x}{-1} = \frac{-337}{-1} \quad or \quad \frac{-x}{-1} = \frac{323}{-1}$$
$$x = 337 \quad or \quad x = -323$$
$$\{-323, 337\}$$

22. $\left|\frac{4-x}{2}\right| = 235$

$$\frac{4-x}{2} = -235 \quad or \quad \frac{4-x}{2} = 235$$
$$\frac{2}{1}\left(\frac{4-x}{2}\right) = 2(-235) \quad or \quad \frac{2}{1}\left(\frac{4-x}{2}\right) = 2(235)$$
$$4-x = -470 \quad or \quad 4-x = 470$$
$$-x = -474 \quad or \quad -x = 466$$
$$\frac{-x}{-1} = \frac{-474}{-1} \quad or \quad \frac{-x}{-1} = \frac{466}{-1}$$
$$x = 474 \quad or \quad x = -466$$
$$\{-466, 474\}$$

23. $|17-3x| = 12$

$$17-3x = -12 \quad or \quad 17-3x = 12$$
$$-3x = -29 \quad or \quad -3x = -5$$
$$\frac{-3x}{-3} = \frac{-29}{-3} \quad or \quad \frac{-3x}{-3} = \frac{-5}{-3}$$
$$x = \frac{29}{3} \quad or \quad x = \frac{5}{3}$$
$$\left\{\frac{5}{3}, \frac{29}{3}\right\}$$

24. $|15-10x| = 38$

$$15-10x = -38 \quad or \quad 15-10x = 38$$
$$-10x = -53 \quad or \quad -10x = 23$$
$$\frac{-10x}{-10} = \frac{-53}{-10} \quad or \quad \frac{-10x}{-10} = \frac{23}{-10}$$
$$x = \frac{53}{10} \quad or \quad x = -\frac{23}{10}$$
$$\left\{-\frac{23}{10}, \frac{53}{10}\right\}$$

25. $|3x-2| = 6$

$$3x-2 = -6 \quad or \quad 3x-2 = 6$$
$$3x = -4 \quad or \quad 3x = 8$$
$$\frac{3x}{3} = \frac{-4}{3} \quad or \quad \frac{3x}{3} = \frac{8}{3}$$
$$x = -\frac{4}{3} \quad or \quad x = \frac{8}{3}$$
$$\left\{-\frac{4}{3}, \frac{8}{3}\right\}$$

26. $|4x-3|=7$

$4x-3=-7 \quad or \quad 4x-3=7$

$4x=-4 \quad or \quad 4x=10$

$\frac{4x}{4}=\frac{-4}{4} \quad or \quad \frac{4x}{4}=\frac{10}{4}$

$x=-1 \quad or \quad x=\frac{5}{2}$

$\left\{-1,\frac{5}{2}\right\}$

27. $|5x-3|+11=23$

$|5x-3|=12$

$5x-3=-12 \quad or \quad 5x-3=12$

$5x=-9 \quad or \quad 5x=15$

$\frac{5x}{5}=\frac{-9}{5} \quad or \quad \frac{5x}{5}=\frac{15}{5}$

$x=-\frac{9}{5} \quad or \quad x=3$

$\left\{-\frac{9}{5},3\right\}$

28. $|6x-13|-4=19$

$|6x-13|=23$

$6x-13=-23 \quad or \quad 6x-13=23$

$6x=-10 \quad or \quad 6x=36$

$\frac{6x}{6}=\frac{-10}{6} \quad or \quad \frac{6x}{6}=\frac{36}{6}$

$x=-\frac{5}{3} \quad or \quad x=6$

$\left\{-\frac{5}{3},6\right\}$

29. $\left|\frac{1}{2}x-1\right|=3$

$\frac{1}{2}x-1=-3 \quad or \quad \frac{1}{2}x-1=3$

$\frac{1}{2}x=-2 \quad or \quad \frac{1}{2}x=4$

$\frac{2}{1}\left(\frac{1}{2}x\right)=2(-2) \quad or \quad \frac{2}{1}\left(\frac{1}{2}x\right)=2(4)$

$x=-4 \quad or \quad x=8$

$\{-4,8\}$

30. $\left|\frac{1}{3}x-2\right|=5$

$\frac{1}{3}x-2=-5 \quad or \quad \frac{1}{3}x-2=5$

$\frac{1}{3}x=-3 \quad or \quad \frac{1}{3}x=7$

$\frac{3}{1}\left(\frac{1}{3}x\right)=3(-3) \quad or \quad \frac{3}{1}\left(\frac{1}{3}x\right)=3(7)$

$x=-9 \quad or \quad x=21$

$\{-9,21\}$

31. $|4x+2|-12=-12$

$|4x+2|=0$

$4x+2=0$

$4x=-2$

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

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

$\left\{-\frac{1}{2}\right\}$

32. $|3x+24|-9=-9$

$|3x+24|=0$

$3x+24=0$

$3x=-24$

$\frac{3x}{3}=\frac{-24}{3}$

$x=-8$

$\{-8\}$

33. $|6-5x|+8=10$

$|6-5x|=2$

$6-5x=-2 \quad or \quad 6-5x=2$

$-5x=-8 \quad or \quad -5x=-4$

$\frac{-5x}{-5}=\frac{-8}{-5} \quad or \quad \frac{-5x}{-5}=\frac{-4}{-5}$

$x=\frac{8}{5} \quad or \quad x=\frac{4}{5}$

$\left\{\frac{4}{5},\frac{8}{5}\right\}$

34. $|5-7x|+6=13$

$|5-7x|=7$

$5-7x=-7 \quad or \quad 5-7x=7$

$-7x=-12 \quad or \quad -7x=2$

$\frac{-7x}{-7}=\frac{-12}{-7} \quad or \quad \frac{-7x}{-7}=\frac{2}{-7}$

$x=\frac{12}{7} \quad or \quad x=-\frac{2}{7}$

$\left\{-\frac{2}{7},\frac{12}{7}\right\}$

35. $\left|\frac{1}{2}-x\right|+22=12$

$\left|\frac{1}{2}-x\right|=-10$

$\{\ \}$

36. $\left|\frac{1}{5}-x\right|+32=25$

$\left|\frac{1}{5}-x\right|=-7$

$\{\ \}$

37. $\left|\frac{3}{4}x+\frac{1}{4}\right|+6=6$

$\left|\frac{3}{4}x+\frac{1}{4}\right|=0$

$\frac{3}{4}x+\frac{1}{4}=0$

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

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

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

$\left\{-\frac{1}{3}\right\}$

38. $\left|\frac{5}{3}x+\frac{1}{3}\right|+8=8$

$\left|\frac{5}{3}x+\frac{1}{3}\right|=0$

$\frac{5}{3}x+\frac{1}{3}=0$

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

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

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

$\left\{-\frac{1}{5}\right\}$

39. $|0.2x+3|-4.2=0$

$|0.2x+3|=4.2$

$0.2x+3=-4.2 \quad or \quad 0.2x+3=4.2$

$0.2x=-7.2 \quad or \quad 0.2x=1.2$

$\frac{0.2x}{0.2}=\frac{-7.2}{0.2} \quad or \quad \frac{0.2x}{0.2}=\frac{1.2}{0.2}$

$x=-36 \quad or \quad x=6$

$\{-36,6\}$

40. $|0.2x+5|-2.8=0$

$|0.2x+5|=2.8$

$0.2x+5=-2.8 \quad or \quad 0.2x+5=2.8$

$0.2x=-7.8 \quad or \quad 0.2x=-2.2$

$\frac{0.2x}{0.2}=\frac{-7.8}{0.2} \quad or \quad \frac{0.2x}{0.2}=\frac{-2.2}{0.2}$

$x=-39 \quad or \quad x=-11$

$\{-39,-11\}$

41. $6+|2x+1|=2$

$|2x+1|=-4$

$\{\ \}$

42. $8+|3x+4|=4$

$|3x+4|=-4$

$\{\ \}$

43. $|x-6|=|5-3x|$

$x-6=5-3x \quad or \quad x-6=-(5-3x)$

$4x=11 \quad or \quad x-6=-5+3x$

$x=\frac{11}{4} \quad or \quad -2x=1$

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

$\left\{-\frac{1}{2},\frac{11}{4}\right\}$

44. $|x-4|=|12-5x|$

$x-4=12-5x \quad or \quad x-4=-(12-5x)$

$6x=16 \quad or \quad x-4=-12+5x$

$x=\frac{16}{6} \quad or \quad -4x=-8$

$x=\frac{8}{3} \quad or \quad x=\frac{-8}{-4}$

$x=2$

$\left\{2,\frac{8}{3}\right\}$

45. $|-3x-14|=|9+11x|$

$-3x-14=9+11x \quad or \quad -3x-14=-(9+11x)$

$-14x=23 \quad or \quad -3x-14=-9-11x$

$x=-\frac{23}{14} \quad or \quad 8x=5$

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

$\left\{-\frac{23}{14},\frac{5}{8}\right\}$

46. $|-4x-35|=|17+2x|$

$-4x-35=17+2x \quad or \quad -4x-35=-(17+2x)$

$-6x=52 \quad or \quad -4x-35=-17-2x$

$x=\frac{52}{-6} \quad or \quad -2x=18$

$x=-\frac{26}{3} \quad or \quad x=-9$

$\left\{-9,-\frac{26}{3}\right\}$

47. $|x+3|=|x-15|$

$x+3=x-15 \quad or \quad x+3=-(x-15)$

$0=-18 \quad or \quad x+3=-x+15$

$or \quad 2x=12$

$x=6$

$\{6\}$

48. $|-2x-1|=|13-2x|$

$-2x-1=13-2x \quad or \quad -2x-1=-(13-2x)$

$-1=13 \quad or \quad -2x-1=-13+2x$

$-4x=-12$

$x=3$

$\{3\}$

49. $|3x+5|=|7+3x|$

$3x+5=7+3x \quad or \quad 3x+5=-(7+3x)$

$5=7 \quad or \quad 3x+5=-7-3x$

$6x=-12$

$x=-2$

$\{-2\}$

50. $|x+4|=|13+x|$

$x+4=13+x \quad or \quad x+4=-(13+x)$

$4=13 \quad or \quad x+4=-13-x$

$2x=-17$

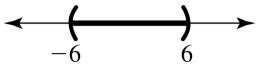
$x=-\frac{17}{2}$

$\left\{-\frac{17}{2}\right\}$

51. $|x|<6$

$-6<x<6$

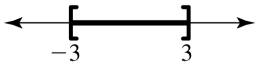
$(-6,6)$



52. $|x|\le 3$

$-3\le x\le 3$

$[-3,3]$



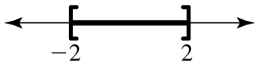
53. $|6x| \le 12$

$-12 \le 6x \le 12$

$\frac{-12}{6} \le \frac{6x}{6} \le \frac{12}{6}$

$-2 \le x \le 2$

$[-2, 2]$



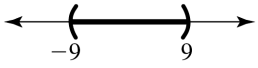
54. $|5x| < 45$

$-45 < 5x < 45$

$\frac{-45}{5} < \frac{5x}{5} < \frac{45}{5}$

$-9 < x < 9$

$(-9, 9)$



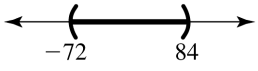
55. $|x - 6| < 78$

$-78 < x - 6 < 78$

$-78 + 6 < x - 6 + 6 < 78 + 6$

$-72 < x < 84$

$(-72, 84)$



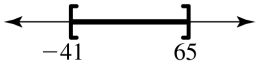
56. $|x - 12| \le 53$

$-53 \le x - 12 \le 53$

$-53 + 12 \le x - 12 + 12 \le 53 + 12$

$-41 \le x \le 65$

$[-41, 65]$



57. $|12x + 5| \le 65$

$-65 \le 12x + 5 \le 65$

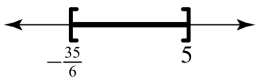
$-65 - 5 \le 12x + 5 - 5 \le 65 - 5$

$-70 \le 12x \le 60$

$\frac{-70}{12} \le \frac{12x}{12} \le \frac{60}{12}$

$-\frac{35}{6} \le x \le 5$

$\left[-\frac{35}{6}, 5\right]$



58. $|32x + 2| < 66$

$-66 < 32x + 2 < 66$

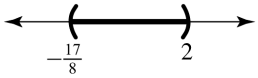
$-66 - 2 < 32x + 2 - 2 < 66 - 2$

$-68 < 32x < 64$

$\frac{-68}{32} < \frac{32x}{32} < \frac{64}{32}$

$-\frac{17}{8} < x < 2$

$\left(-\frac{17}{8}, 2\right)$



59. $|17 - 2x| < 19$

$-19 < 17 - 2x < 19$

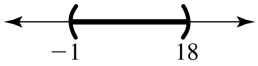
$-19 - 17 < 17 - 17 - 2x < 19 - 17$

$-36 < -2x < 2$

$\frac{-36}{-2} > \frac{-2x}{-2} > \frac{2}{-2}$

$-1 < x < 18$

$(-1, 18)$



60. $|13 - 4x| \le 29$

$-29 \le 13 - 4x \le 29$

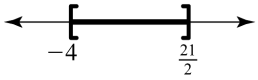
$-29 - 13 \le 13 - 13 - 4x \le 29 - 13$

$-42 \le -4x \le 16$

$\frac{-42}{-4} \ge \frac{-4x}{-4} \ge \frac{16}{-4}$

$-4 \le x \le \frac{21}{2}$

$\left[-4, \frac{21}{2}\right]$



61. $\left|\frac{x - 8}{5}\right| \le 6$

$-6 \le \frac{x - 8}{5} \le 6$

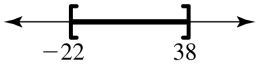
$5(-6) \le \frac{5}{1}\left(\frac{x - 8}{5}\right) \le 5(6)$

$-30 \le x - 8 \le 30$

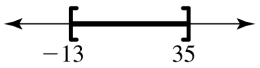
$-30 + 8 \le x - 8 + 8 \le 30 + 8$

$-22 \le x \le 38$

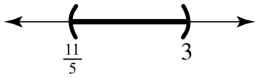
$[-22, 38]$



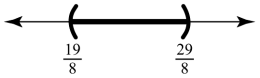
62.
$$\left|\frac{x-11}{6}\right| \le 4$$
$$-4 \le \frac{x-11}{6} \le 4$$
$$6(-4) \le \frac{6}{1}\left(\frac{x-11}{6}\right) \le 6(4)$$
$$-24 \le x-11 \le 24$$
$$-24+11 \le x-11+11 \le 24+11$$
$$-13 \le x \le 35$$
$$[-13,35]$$



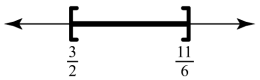
63.
$$|5x-13|+16<18$$
$$|5x-13|+16-16<18-16$$
$$|5x-13|<2$$
$$-2<5x-13<2$$
$$-2+13<5x-13+13<2+13$$
$$11<5x<15$$
$$\frac{11}{5}<\frac{5x}{5}<\frac{15}{5}$$
$$\frac{11}{5}<x<3$$
$$\left(\frac{11}{5},3\right)$$



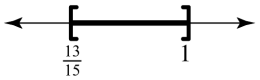
64.
$$|8x-24|+2<7$$
$$|8x-24|+2-2<7-2$$
$$|8x-24|<5$$
$$-5<8x-24<5$$
$$-5+24<8x-24+24<5+24$$
$$19<8x<29$$
$$\frac{19}{8}<\frac{8x}{8}<\frac{29}{8}$$
$$\frac{19}{8}<x<\frac{29}{8}$$
$$\left(\frac{19}{8},\frac{29}{8}\right)$$



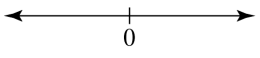
65.
$$\left|\frac{2x}{5}-\frac{2}{3}\right| \le \frac{1}{15}$$
$$-\frac{1}{15} \le \frac{2x}{5}-\frac{2}{3} \le \frac{1}{15}$$
$$\frac{15}{1}\left(-\frac{1}{15}\right) \le \frac{15}{1}\left(\frac{2x}{5}-\frac{2}{3}\right) \le \frac{15}{1}\left(\frac{1}{15}\right)$$
$$-1 \le 6x-10 \le 1$$
$$-1+10 \le 6x-10+10 \le 1+10$$
$$9 \le 6x \le 11$$
$$\frac{9}{6} \le \frac{6x}{6} \le \frac{11}{6}$$
$$\frac{3}{2} \le x \le \frac{11}{6}$$
$$\left[\frac{3}{2},\frac{11}{6}\right]$$



66.
$$\left|\frac{3x}{7}-\frac{2}{5}\right| \le \frac{1}{35}$$
$$-\frac{1}{35} \le \frac{3x}{7}-\frac{2}{5} \le \frac{1}{35}$$
$$\frac{35}{1}\left(-\frac{1}{35}\right) \le \frac{35}{1}\left(\frac{3x}{7}-\frac{2}{5}\right) \le \frac{35}{1}\left(\frac{1}{35}\right)$$
$$-1 \le 15x-14 \le 1$$
$$-1+14 \le 15x-14+14 \le 1+14$$
$$13 \le 15x \le 15$$
$$\frac{13}{15} \le \frac{15x}{15} \le \frac{15}{15}$$
$$\frac{13}{15} \le x \le 1$$
$$\left[\frac{13}{15},1\right]$$



67.
$$|12x+5|+27<17$$
$$|12x+5|+27-27<17-27$$
$$|12x+5|<-10$$
$$\{\ \}$$

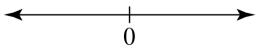


68. $|9x+33|+50<45$

$|9x+33|+50-50<45-50$

$|9x+33|<-5$

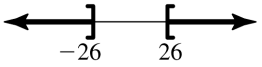
$\{\ \}$



69. $|x|\geq 26$

$x\leq -26 \quad or \quad x\geq 26$

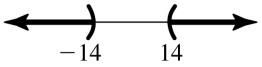
$(-\infty,-26]\cup[26,\infty)$



70. $|x|>14$

$x<-14 \quad or \quad x>14$

$(-\infty,-14)\cup(14,\infty)$



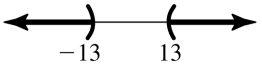
71. $|10x|>130$

$10x<-130 \quad or \quad 10x>130$

$\frac{10x}{10}<\frac{-130}{10} \quad or \quad \frac{10x}{10}>\frac{130}{10}$

$x<-13 \quad or \quad x>13$

$(-\infty,-13)\cup(13,\infty)$



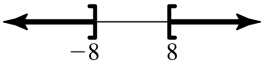
72. $|9x|\geq 72$

$9x\leq -72 \quad or \quad 9x\geq 72$

$\frac{9x}{9}\leq\frac{-72}{9} \quad or \quad \frac{9x}{9}\geq\frac{72}{9}$

$x\leq -8 \quad or \quad x\geq 8$

$(-\infty,-8]\cup[8,\infty)$

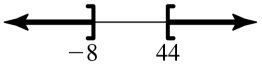


73. $|x-18|\geq 26$

$x-18\leq -26 \quad or \quad x-18\geq 26$

$x\leq -8 \quad or \quad x\geq 44$

$(-\infty,-8]\cup[44,\infty)$

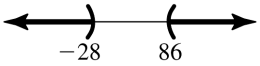


74. $|x-29|>57$

$x-29<-57 \quad or \quad x-29>57$

$x<-28 \quad or \quad x>86$

$(-\infty,-28)\cup(86,\infty)$



75. $|8x+5|>69$

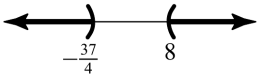
$8x+5<-69 \quad or \quad 8x+5>69$

$8x<-74 \quad or \quad 8x>64$

$\frac{8x}{8}<\frac{-74}{8} \quad or \quad \frac{8x}{8}>\frac{64}{8}$

$x<-\frac{37}{4} \quad or \quad x>8$

$\left(-\infty,-\frac{37}{4}\right)\cup(8,\infty)$



76. $|3x+12|\geq 75$

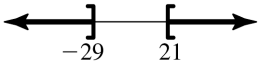
$3x+12\leq -75 \quad or \quad 3x+12\geq 75$

$3x\leq -87 \quad or \quad 3x\geq 63$

$\frac{3x}{3}\leq\frac{-87}{3} \quad or \quad \frac{3x}{3}\geq\frac{63}{3}$

$x\leq -29 \quad or \quad x\geq 21$

$(-\infty,-29]\cup[21,\infty)$



77. $|16-4x|\geq 28$

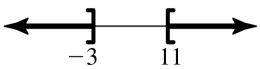
$16-4x\leq -28 \quad or \quad 16-4x\geq 28$

$-4x\leq -44 \quad or \quad -4x\geq 12$

$\frac{-4x}{-4}\geq\frac{-44}{-4} \quad or \quad \frac{-4x}{-4}\leq\frac{12}{-4}$

$x\geq 11 \quad or \quad x\leq -3$

$(-\infty,-3]\cup[11,\infty)$



78. $|7-11x|>51$

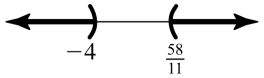
$7-11x<-51 \quad or \quad 7-11x>51$

$-11x<-58 \quad or \quad -11x>44$

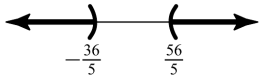
$\frac{-11x}{-11}>\frac{-58}{-11} \quad or \quad \frac{-11x}{-11}<\frac{44}{-11}$

$x>\frac{58}{11} \quad or \quad x<-4$

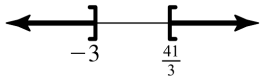
$(-\infty,-4)\cup\left(\frac{58}{11},\infty\right)$



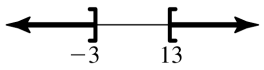
79.
$$|5x-10|-12>34$$
$$|5x-10|>46$$
$$5x-10<-46 \quad or \quad 5x-10>46$$
$$5x<-36 \quad or \quad 5x>56$$
$$\frac{5x}{5}<\frac{-36}{5} \quad or \quad \frac{5x}{5}>\frac{56}{5}$$
$$x<-\frac{36}{5} \quad or \quad x>\frac{56}{5}$$
$$\left(-\infty,-\frac{36}{5}\right)\cup\left(\frac{56}{5},\infty\right)$$



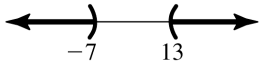
80.
$$|6x-32|-45\geq 5$$
$$|6x-32|\geq 50$$
$$6x-32\leq -50 \quad or \quad 6x-32\geq 50$$
$$6x\leq -18 \quad or \quad 6x\geq 82$$
$$\frac{6x}{6}\leq\frac{-18}{6} \quad or \quad \frac{6x}{6}\geq\frac{82}{6}$$
$$x\leq -3 \quad or \quad x\geq\frac{41}{3}$$
$$(-\infty,-3]\cup\left[\frac{41}{3},\infty\right)$$



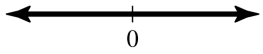
81.
$$\left|\frac{x-5}{4}\right|+4\geq 6$$
$$\left|\frac{x-5}{4}\right|\geq 2$$
$$\frac{x-5}{4}\leq -2 \quad or \quad \frac{x-5}{4}\geq 2$$
$$\frac{4}{1}\left(\frac{x-5}{4}\right)\leq 4(-2) \quad or \quad \frac{4}{1}\left(\frac{x-5}{4}\right)\geq 4(2)$$
$$x-5\leq -8 \quad or \quad x-5\geq 8$$
$$x\leq -3 \quad or \quad x\geq 13$$
$$(-\infty,-3]\cup[13,\infty)$$



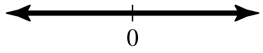
82.
$$\left|\frac{x-3}{2}\right|+9>14$$
$$\left|\frac{x-3}{2}\right|>5$$
$$\frac{x-3}{2}<-5 \quad or \quad \frac{x-3}{2}>5$$
$$\frac{2}{1}\left(\frac{x-3}{2}\right)<2(-5) \quad or \quad \frac{2}{1}\left(\frac{x-3}{2}\right)>2(5)$$
$$x-3<-10 \quad or \quad x-3>10$$
$$x<-7 \quad or \quad x>13$$
$$(-\infty,-7)\cup(13,\infty)$$



83.
$$\left|\frac{5x}{3}+1\right|+24\geq 18$$
$$\left|\frac{5x}{3}+1\right|\geq -6$$
$$(-\infty,\infty)$$



84.
$$\left|\frac{7x}{5}+2\right|+6\geq 4$$
$$\left|\frac{7x}{5}+2\right|\geq -2$$
$$(-\infty,\infty)$$



85. a) $\{\ \}$ The absolute value of any number is always greater than or equal to zero and cannot be a negative number. Thus the solution set is the empty set.

b) $\{\ \}$ The absolute value of any number is always greater than or equal to zero, thus the solution set is the empty set.

c) $(-\infty,\infty)$ The absolute value of any number is always greater than a negative number, thus the solutions set is the set of all real numbers.

86. The solution to $|x|>1$ is $(-\infty,-1)\cup(1,\infty)$ because only numbers greater than one or less than negative one make the statement true. The solution to $|x|<1$ is $(-1,1)$ because only numbers between negative one and one (but not including them) make the statement true.

87.
$$|x-16|>72$$
$$x-16<-72 \quad or \quad x-16>72$$
$$x<-56 \quad or \quad x>88$$
$$(-\infty,-56)\cup(88,\infty)$$

88.
$$|2x+16|+3=17$$
$$|2x+16|=14$$
$$2x+16=-14 \quad or \quad 2x+16=14$$
$$2x=-30 \quad or \quad 2x=-2$$
$$\frac{2x}{2}=\frac{-30}{2} \quad or \quad \frac{2x}{2}=\frac{-2}{2}$$
$$x=-15 \quad or \quad x=-1$$
$$\{-15,-1\}$$

89.
$$|100x|\le 400$$
$$-400\le 100x\le 400$$
$$\frac{-400}{100}\le\frac{100x}{100}\le\frac{400}{100}$$
$$-4\le x\le 4$$
$$[-4,4]$$

90.
$$|x+35|<7$$
$$-7<x+35<7$$
$$-7-35<x+35-35<7-35$$
$$-42<x<-28$$
$$(-42,-28)$$

91.
$$\left|\frac{7-3x}{5}\right|-3=-1$$
$$\left|\frac{7-3x}{5}\right|=2$$
$$\frac{7-3x}{5}=-2 \quad or \quad \frac{7-3x}{5}=2$$
$$\frac{5}{1}\left(\frac{7-3x}{5}\right)=5(-2) \quad or \quad \frac{5}{1}\left(\frac{7-3x}{5}\right)=5(2)$$
$$7-3x=-10 \quad or \quad 7-3x=10$$
$$-3x=-17 \quad or \quad -3x=3$$
$$\frac{-3x}{-3}=\frac{-17}{-3} \quad or \quad \frac{-3x}{-3}=\frac{3}{-3}$$
$$x=\frac{17}{3} \quad or \quad x=-1$$
$$\left\{-1,\frac{17}{3}\right\}$$

92.
$$\left|\frac{x}{8}+1\right|\ge 3$$
$$\frac{x}{8}+1\le -3 \quad or \quad \frac{x}{8}+1\ge 3$$
$$\frac{8}{1}\left(\frac{x}{8}+1\right)\le 8(-3) \quad or \quad \frac{8}{1}\left(\frac{x}{8}+1\right)\ge 8(3)$$
$$x+8\le -24 \quad or \quad x+8\ge 24$$
$$x\le -32 \quad or \quad x\ge 16$$
$$(-\infty,-32]\cup[16,\infty)$$

93.
$$|6-4x|=|4x-7|$$
$$6-4x=4x-7 \quad or \quad 6-4x=-(4x-7)$$
$$-8x=-13 \quad or \quad 6-4x=-4x+7$$
$$\frac{-8x}{-8}=\frac{-13}{-8} \quad or \quad 6=7$$
$$x=\frac{13}{8}$$
$$\left\{\frac{13}{8}\right\}$$

94.
$$|5-13x|+3<21$$
$$|5-13x|<18$$
$$-18<5-13x<18$$
$$-23<-13x<13$$
$$\frac{-23}{-13}>\frac{-13x}{-13}>\frac{13}{-13}$$
$$-1<x<\frac{23}{13}$$
$$\left(-1,\frac{23}{13}\right)$$

95.
$$\left|-2x+\frac{4}{5}\right|<14$$
$$-14<-2x+\frac{4}{5}<14$$
$$5(-14)<\frac{5}{1}\left(-2x+\frac{4}{5}\right)<5(14)$$
$$-70<-10x+4<70$$
$$-74<-10x<66$$
$$\frac{-74}{-10}>\frac{-10x}{-10}>\frac{66}{-10}$$
$$-\frac{33}{5}<x<\frac{37}{5}$$
$$\left(-\frac{33}{5},\frac{37}{5}\right)$$

96.
$$\left|\frac{x-11}{3}\right| \le \frac{1}{2}$$
$$-\frac{1}{2} \le \frac{x-11}{3} \le \frac{1}{2}$$
$$\frac{6}{1}\left(-\frac{1}{2}\right) \le \frac{6}{1}\left(\frac{x-11}{3}\right) \le \frac{6}{1}\left(\frac{1}{2}\right)$$
$$-3 \le 2x-22 \le 3$$
$$19 \le 2x \le 25$$
$$\frac{19}{2} \le \frac{2x}{2} \le \frac{25}{2}$$
$$\frac{19}{2} \le x \le \frac{25}{2}$$
$$\left[\frac{19}{2}, \frac{25}{2}\right]$$

97.
$$|-18x+1|+6=4$$
$$|-18x+1|=-2$$
$$\{\ \}$$

98.
$$|-5x|=-12$$
$$\{\ \}$$

99.
$$6+|x-18| \ge 13$$
$$|x-18| \ge 7$$
$$x-18 \le -7 \quad or \quad x-18 \ge 7$$
$$x \le 11 \quad or \quad x \ge 25$$
$$(-\infty, 11] \cup [25, \infty)$$

100.
$$\left|\frac{1}{2}+x\right|+40=50$$
$$\left|\frac{1}{2}+x\right|=10$$
$$\frac{1}{2}+x=-10 \quad or \quad \frac{1}{2}+x=10$$
$$x=-\frac{21}{2} \quad or \quad x=\frac{19}{2}$$
$$\left\{-\frac{21}{2}, \frac{19}{2}\right\}$$

101.
$$\left|\frac{2-4x}{3}\right|+19>15$$
$$\left|\frac{2-4x}{3}\right|>-4$$
$$(-\infty, \infty)$$

102.
$$|5-7x|=|7x-3|$$
$$5-7x=7x-3 \quad or \quad 5-7x=-(7x-3)$$
$$-7x=7x-8 \quad or \quad 5-7x=-7x+3$$
$$-14x=-8 \quad or \quad 5=3$$
$$\frac{-14x}{-14}=\frac{-8}{-14}$$
$$x=\frac{4}{7}$$
$$\left\{\frac{4}{7}\right\}$$

Extension Activity

Student 1

1.
$$|5-3x|=17$$
$$5-3x=-17 \quad or \quad 5-3x=17$$
$$-3x=-22 \quad or \quad -3x=12$$
$$\frac{-3x}{-3}=\frac{-22}{-3} \quad or \quad \frac{-3x}{-3}=\frac{12}{-3}$$
$$x=\frac{22}{3} \quad or \quad x=-4$$
$$\left\{-4, \frac{22}{3}\right\}$$

2.
$$|5-3x|+20=17$$
$$|5-3x|=-3$$
$$\varnothing$$

Student 2

1.
$$|5-3x|<17$$
$$-17<5-3x<17$$
$$-22<-3x<12$$
$$\frac{-22}{-3}>\frac{-3x}{-3}>\frac{12}{-3}$$
$$-4<x<\frac{22}{3}$$
$$\left(-4, \frac{22}{3}\right)$$

2.
$$|5-3x|+20<17$$
$$|5-3x|<-3$$
$$\varnothing$$

Student 3

1. $|5-3x| \geq 17$

$5-3x \leq -17 \quad or \quad 5-3x \geq 17$

$-3x \leq -22 \quad or \quad -3x \geq 12$

$\frac{-3x}{-3} \geq \frac{-22}{-3} \quad or \quad \frac{-3x}{-3} \leq \frac{12}{-3}$

$x \geq \frac{22}{3} \quad or \quad x \leq -4$

$(-\infty, -4] \cup \left[\frac{22}{3}, \infty\right)$

2. $|5-3x| + 20 \geq 17$

$|5-3x| \geq -3$

$(-\infty, \infty)$

2.7 Exercises

1. If we are kayaking upstream, against the current, we would be decreasing the rate of the kayak in still water by the current's rate.

2. If we are kayaking downstream, with the current, we would be increasing the rate of the kayak in still water by the current's rate.

3. When setting up an equation for a mixture problem involving pure acid, the percentage of acid would be 100%.

4. If a situation calls for 100% fruit juice to be mixed with a 20% fruit juice solution, the range of percentages the final mix can cover would be between 100% and 20%.

5. When setting up a mixture problem involving 100% boric acid, 35% boric acid, and 50% boric acid, the two percentages we are mixing together would be 35% and 100%.

6. When solving a mixture problem involving 20% alcohol, 50% alcohol and 70% alcohol, the 50% alcohol would have to be the strength of the final desired mixture.

7. **Prepare** We are to determine how long it will take Johanna to catch Katherine.

Plan We will set up a chart to organize the information given in the problem. We will then use this information to write and solve a linear equation with one variable.

Process Let t represent the amount of time it takes Johanna to catch Katherine.

	Rate • Time = Distance		
Katherine	4mph	$t+1.5$ (in hours)	$D_1 = 4(t+1.5)$ (in miles)
Johanna	16mph	t (in hours)	$D_2 = 16t$ (in miles)

$$\begin{aligned} D_1 &= D_2 \\ 4(t+1.5) &= 16t \\ 4t+6 &= 16t \\ 6 &= 12t \\ \frac{1}{2} &= t \end{aligned}$$

It will take Johanna ½ hour to catch Katherine.

Ponder Does our answer seem reasonable? Yes. We can check to see if they traveled the same distance.

8. **Prepare** We are to determine how long it will take Joshua to get to the IHOP.

Plan We will set up a chart to organize the information given in the problem. We will then use this information to write and solve a linear equation with one variable.

Process Let t represent the amount of time it takes Joshua to get to the IHOP.

	Rate • Time = Distance		
Joshua	10mph	t (in hours)	$D_1 = 10t$ (in miles)
Nigel	8mph	$t+0.5$ (in hours)	$D_2 = 8(t+0.5)$ (in miles)

$$\begin{aligned} D_1 + D_2 &= 13 \\ 10t + 8(t+0.5) &= 13 \\ 18t + 4 &= 13 \\ 18t &= 9 \\ t &= \frac{1}{2} \end{aligned}$$

It will take Joshua ½ hour to get to the IHOP.

Ponder Does our answer seem reasonable? Yes. We can check to see if their total distance traveled is 13 miles.

9. **Prepare** We are to determine how long it will take the military jet to overtake the subsonic airplane.

Plan We will set up a chart to organize the information given in the problem. We will then use this information to write and solve a linear equation with one variable.

Process Let t represent the amount of time it takes the military jet to overtake the subsonic airplane.

	Rate • Time = Distance		
Military Jet	1,476mph	t (in hours)	$D_1 = 1{,}476t$ (in miles)
Subsonic Airplane	492mph	$t+4$ (in hours)	$D_2 = 492(t+4)$ (in miles)

$$\begin{aligned} D_1 &= D_2 \\ 1,476t &= 492(t+4) \\ 1,476t &= 492t + 1,968 \\ 984t &= 1,968 \\ t &= 2 \end{aligned}$$

It will take the military jet 2 hours to overtake the subsonic airplane.

Ponder Does our answer seem reasonable? Yes. We can check to see if they traveled the same distance.

10. Prepare We are to determine how long it will take for the two aircraft to be 3,900 miles apart.

Plan We will set up a chart to organize the information given in the problem. We will then use this information to write and solve a linear equation with one variable.

Process Let t represent the amount of time the subsonic airplane is in flight.

	Rate •	Time =	Distance
Concorde	1,450mph	$t+2$ (in hours)	$D_1 = 1,450(t+2)$ (in miles)
Subsonic Airplane	450mph	t (in hours)	$D_2 = 450t$ (in miles)

$$\begin{aligned} D_1 - D_2 &= 3,900 \\ 1,450(t+2) - 450t &= 3,900 \\ 1,450t + 2,900 - 450t &= 3,900 \\ 1,000t &= 1,000 \\ t &= 1 \end{aligned}$$

It will take 1 hour for the two planes to be 3,900 miles apart.

Ponder Does our answer seem reasonable? Yes. We can compute the distance traveled by each plane in one hour and then determine the difference of their distances.

11. Prepare We are to determine how long it will take for the O'Connells and the Smiths to be 5 miles apart.

Plan We will set up a chart to organize the information given in the problem. We will then use this information to write and solve a linear equation with one variable.

Process Let t represent the amount of time the O'Connells drive after the stop at the railroad crossing.

	Rate •	Time =	Distance
O'Connells	75mph	t (in hours)	$D_1 = 75t$ (in miles)
Smiths	65mph	$t+0.25$ (in hours)	$D_2 = 65(t+0.25)$ (in miles)

$$\begin{aligned} D_2 - D_1 &= 5 \\ 65(t+0.25) - 75t &= 5 \\ -10t + 16.25 &= 5 \\ -10t &= -11.25 \\ t &= 1.125 \end{aligned}$$

It will take the O'Connells 1.125 or $1\frac{1}{8}$ hours to be within talking distance of the Smiths.

Ponder Does our answer seem reasonable? Yes. We can check to see if their difference between their distances is 5 miles.

12. Prepare We are to determine how long it will take for the two groups to be out of walkie-talkie range.

Plan We will set up a chart to organize the information given in the problem. We will then use this information to write and solve a linear equation with one variable.

Process Let t represent the amount of time the Black Bears have been hiking.

	Rate •	Time =	Distance
Black Bears	8mph	t (in hours)	$D_1 = 8t$ (in miles)
Wildcats	4mph	$t+0.5$ (in hours)	$D_2 = 4(t+0.5)$ (in miles)

$$\begin{aligned} D_1 + D_2 &= 5 \\ 8t + 4(t+0.5) &= 5 \\ 12t + 2 &= 5 \\ 12t &= 3 \\ t &= \frac{1}{4} \end{aligned}$$

The two groups will be out of walkie-talkie range in ¼ hour or 15 minutes.

Ponder Does our answer seem reasonable? Yes. We can check to see if the total distance between them is 5 miles.

13. Prepare We are to determine the speed of the blimp in still air.

Plan We will set up a chart to organize the information given in the problem. We will then use this information to write and solve a linear equation with one variable.

Process Let r represent the speed of the blimp in still air.

	Rate •	Time	= Distance
Tailwind	$r+15$ mph	6 hours	$D_1=(r+15)6$ (in miles)
Headwind	$r-5$ mph	10 hours	$D_2=(r-5)10$ (in miles)

$$\begin{aligned} D_1+D_2&=600\\ (r+15)6+(r-5)10&=600\\ 6r+90+10r-50&=600\\ 16r+40&=600\\ 16r&=560\\ r&=35 \end{aligned}$$

The speed of the blimp in still air is 35 miles per hour.

Ponder Does our answer seem reasonable? Yes. It seems reasonable that a blimp could travel 35 miles per hour in still air.

14. Prepare We are to determine the speed of the plane in still air.

Plan We will set up a chart to organize the information given in the problem. We will then use this information to write and solve a linear equation with one variable.

Process Let r represent the speed of the plane in still air.

	Rate •	Time	= Distance
Tailwind	$r+20$ mph	$\frac{4}{5}$ hour	$D_1=(r+20)\frac{4}{5}$ (in miles)
No Wind	r mph	$1\frac{1}{2}$ hours	$D_2=r\left(\frac{3}{2}\right)$ (in miles)

$$\begin{aligned} D_1+D_2&=200\\ (r+20)\frac{4}{5}+r\left(\frac{3}{2}\right)&=200\\ \frac{4}{5}r+16+\frac{3}{2}r&=200\\ \frac{4}{5}r+\frac{3}{2}r&=184\\ 8r+15r&=1{,}840\\ 23r&=1{,}840\\ r&=80 \end{aligned}$$

The speed of the plane in still air is 80 miles per hour.

Ponder Does our answer seem reasonable? Yes. It is reasonable that the plane can travel 80 miles per hour in no wind.

15. Prepare We are to determine how much Aneesa invested in each of the two simple interest accounts.

Plan We will set up a chart to organize the information given in the problem. We will then use this information to write and solve a linear equation with one variable.

Process Let p represent the amount invested at 2% interest.

	$P\bullet r\bullet t=I$			
3% Investment	$p+3{,}000$	0.03	1	$I_1=0.03(p+3{,}000)$
2% Investment	p	0.02	1	$I_2=0.02p$

$$\begin{aligned} I_1+I_2&=690\\ 0.03(p+3{,}000)+0.02p&=690\\ 0.03p+90+0.02p&=690\\ 0.05p&=600\\ p&=12{,}000 \end{aligned}$$

Aneesa invested \$12,000 at 2% interest and \$15,000 at 3% interest.

Ponder Does our answer seem reasonable? Yes. The interest earned at 3% is $0.03(15{,}000) = \$450$, and the interest earned at 2% is $0.02(12{,}000) = \$240$. The sum of the interest from the two investments is $\$450 + \$240 = \$690$.

16. Prepare We are to determine how much the Lees invested at each of the two simple interest rates.

Plan We will set up a chart to organize the information given in the problem. We will then use this information to write and solve a linear equation with one variable.

Process Let p represent the amount invested at 3% interest.

$P \bullet r \bullet t = I$				
3% Investment	p	0.03	1	$I_1 = 0.03p$
4% Investment	$2p + 30{,}000$	0.04	1	$I_2 = 0.04(2p + 30{,}000)$

$$\begin{aligned} I_1 + I_2 &= 5{,}600 \\ 0.03p + 0.04(2p + 30{,}000) &= 5{,}600 \\ 0.03p + 0.08p + 1{,}200 &= 5{,}600 \\ 0.11p &= 4{,}400 \\ p &= 40{,}000 \end{aligned}$$

The Lees invested \$40,000 at 3% interest and \$110,000 at 4% interest.

Ponder Does our answer seem reasonable? Yes. The interest earned at 3% is $0.03(15{,}000) = \$450$, and the interest earned at 2% is $0.02(12{,}000) = \$240$. The sum of the interest from the two investments is $\$450 + \$240 = \$690$.

17. Prepare We are to determine how much the honor society invested at 8% interest.

Plan We will set up a chart to organize the information given in the problem. We will then use this information to write and solve a linear equation with one variable.

Process Let p represent the amount invested at 7% interest.

$P \bullet r \bullet t = I$				
7% Investment	p	0.07	1	$I_1 = 0.07p$
8% Investment	$500 - p$	0.08	1	$I_2 = 0.08(500 - p)$

$$\begin{aligned} I_1 + I_2 &= 38 \\ 0.07p + 0.08(500 - p) &= 38 \\ 0.07p + 40 - 0.08p &= 38 \\ -0.01p &= -2 \\ p &= 200 \end{aligned}$$

The honor society invested \$300 at 8% interest.

Ponder Does our answer seem reasonable? Yes. The interest earned at 7% is $0.07(200) = \$14$, and the interest earned at 8% is $0.08(300) = \$24$. The sum of the interest from the two investments is $\$14 + \$24 = \$38$.

18. Prepare We are to determine how much the math honor society invested at 9% interest.

Plan We will set up a chart to organize the information given in the problem. We will then use this information to write and solve a linear equation with one variable.

Process Let p represent the amount invested at 9% interest.

$P \bullet r \bullet t = I$				
9% Investment	p	0.09	1	$I_1 = 0.09p$
8% Investment	$800 - p$	0.08	1	$I_2 = 0.08(800 - p)$

$$\begin{aligned} I_1 + I_2 &= 70.40 \\ 0.09p + 0.08(800 - p) &= 70.40 \\ 0.09p + 64 - 0.08p &= 70.40 \\ 0.01p &= 6.40 \\ p &= 640 \end{aligned}$$

The honor society invested \$640 at 9% interest.

Ponder Does our answer seem reasonable? Yes. The interest earned at 9% is $0.09(640) = \$57.60$, and the interest earned at 8% is $0.08(160) = \$12.80$. The sum of the interest from the two investments is $\$57.60 + \$12.80 = \$70.40$.

19. Prepare We are to determine how much Professor Cadena invested at each of two simple interest rates.

Plan We will set up a chart to organize the information given in the problem. We will then use this information to write and solve a linear equation with one variable.

Process Let p represent the amount invested at 7% interest.

$P \bullet r \bullet t = I$				
7% Investment	p	0.07	1	$I_1 = 0.07p$
8% Investment	$p + 6{,}000$	0.08	1	$I_2 = 0.08(p + 6{,}000)$

$$\begin{aligned} I_1 + I_2 &= 780 \\ 0.07p + 0.08(p + 6{,}000) &= 780 \\ 0.07p + 0.08p + 480 &= 780 \\ 0.15p &= 300 \\ p &= 2{,}000 \end{aligned}$$

Professor Cadena invested \$2,000 at 7% interest and \$8,000 at 8% interest.

Ponder Does our answer seem reasonable? Yes. The interest earned at 7% is $0.07(2{,}000) = \$140$, and the interest earned at 8% is $0.08(8{,}000) = \$640$. The sum of the interest from the two investments is $\$140 + \$640 = \$780$.

20. Prepare We are to determine how much the Investment Club invested in each bond.

Plan We will set up a chart to organize the information given in the problem. We will then use this information to write and solve a linear equation with one variable.

Process Let p represent the amount invested at 3% interest.

$P \bullet r \bullet t = I$				
3% Investment	p	0.03	1	$I_1 = 0.03p$
5.5% Investment	$p + 1{,}500$	0.055	1	$I_2 = 0.055(p + 1{,}500)$

$$\begin{aligned} I_1 + I_2 &= 125 \\ 0.03p + 0.055(p + 1{,}500) &= 125 \\ 0.03p + 0.055p + 82.5 &= 125 \\ 0.085p &= 42.5 \\ p &= 500 \end{aligned}$$

The Investment Club invested \$500 at 3% interest and \$2,000 at 5.5% interest.

Ponder Does our answer seem reasonable? Yes. The interest earned at 3% is $0.03(500) = \$15$, and the interest earned at 5.5% is $0.055(2{,}000) = \$110$. The sum of the interest from the two investments is $\$15 + \$110 = \$125$.

21. Prepare We are to determine how much Tiffany invested at each of two simple interest rates.

Plan We will set up a chart to organize the information given in the problem. We will then use this information to write and solve a linear equation with one variable.

Process Let p represent the amount invested at 5.5% interest.

$P \bullet r \bullet t = I$				
5.5% Investment	p	0.055	1	$I_1 = 0.055p$
7.7% Investment	$p + 2{,}500$	0.077	1	$I_2 = 0.077(p + 2{,}500)$

$$\begin{aligned} I_1 + 275 &= I_2 \\ 0.055p + 275 &= 0.077(p + 2{,}500) \\ 0.055p + 275 &= 0.077p + 192.5 \\ -0.022p &= -82.5 \\ p &= 3{,}750 \end{aligned}$$

The honor society invested \$3,750 at 5.5% interest and \$6,250 at 7.7% interest.

Ponder Does our answer seem reasonable? Yes. The interest earned at 5.5% is $0.055(3{,}750) = \$206.25$, and the interest earned at 7.7% is $0.077(6{,}250) = \$481.25$. The difference between the interest from the two investments is $\$481.25 - \$206.25 = \$275$.

22. Prepare We are to determine how Chandler invested at each of two simple interest rates.

Plan We will set up a chart to organize the information given in the problem. We will then use this information to write and solve a linear equation with one variable.

Process Let p represent the amount invested at 4.75% interest.

$P \bullet r \bullet t = I$				
4.75% Investment	p	0.0475	1	$I_1 = 0.0475p$
6% Investment	$2p$	0.06	1	$I_2 = 0.06(2p)$

$$\begin{aligned} I_1 + 72.5 &= I_2 \\ 0.0475p + 72.5 &= 0.06(2p) \\ 0.0475p + 72.5 &= 0.12p \\ -0.0725p &= -72.5 \\ p &= 1{,}000 \end{aligned}$$

The honor society invested \$1,000 at 4.75% interest and \$2,000 at 6% interest.

Ponder Does our answer seem reasonable? Yes. The interest earned at 4.75% is $0.0475(1{,}000) = \$47.50$, and the interest earned at 6% is $0.06(2{,}000) = \$120$. The difference between the interest from the two investments is $\$120 + \$47.50 = \$72.50$.

23. Prepare We want to determine how much 100% pineapple juice Olaf should mix with 50 cups of 10% pineapple juice liquid to make a punch containing 20% pineapple juice.

Plan We will set up a chart to organize the information given in the problem. We will then use this information to write and solve a linear equation with one variable.

Process Let x represent the number of cups of 100% pineapple juice needed for the mixture.

	100% Pineapple Juice	10% Pineapple Juice	20% Pineapple Juice
# of cups	x	50	$x+50$
% pineapple juice	1	0.10	0.20

$$\begin{aligned} x + 0.10(50) &= 0.20(x+50) \\ x + 5 &= 0.20x + 10 \\ 0.80x &= 5 \\ x &= 6.25 \end{aligned}$$

Olaf will need 6.25 cups of 100% pineapple juice.

Ponder Does our answer seem reasonable? Yes. There are $6.25(100\%) = 6.25$ cups of pineapple juice in the first container and $50(10\%) = 5$ cups of pineapple juice in the second container. Therefore, there are $6.25 + 5 = 11.25$ cups of pineapple juice in the two containers combined. In the final mixture, there are $(6.25 + 50)(20\%) = 11.25$ cups of pineapple juice. Since this is equal to the amount we obtained from both containers, our answer is correct.

24. Prepare We want to determine how much 30% fruit punch liquid Delilah should mix with 30 cups of 100% fruit punch liquid to make a 70% fruit punch drink.

Plan We will set up a chart to organize the information given in the problem. We will then use this information to write and solve a linear equation with one variable.

Process Let x represent the number of cups of 30% fruit punch liquid needed for the mixture.

	30% Fruit Punch	100% Fruit Punch	70% Fruit Punch
# of cups	x	30	$x+30$
% fruit punch	0.30	1	0.70

$$\begin{aligned} 0.30x + 30 &= 0.70(x+30) \\ 0.30x + 30 &= 0.70x + 21 \\ -0.40x &= -9 \\ x &= 22.5 \end{aligned}$$

Delilah will need 22.5 cups of 30% fruit punch.

Ponder Does our answer seem reasonable? Yes. There are $22.5(30\%) = 6.75$ cups of fruit punch in the first container and $30(100\%) = 30$ cups of fruit punch in the second container. Therefore, there are $6.75 + 30 = 36.75$ cups of fruit punch in the two containers combined. In the final mixture, there are $(22.5 + 30)(70\%) = 36.75$ cups of fruit punch. Since this is equal to the amount we obtained from both containers, our answer is correct.

25. Prepare We want to determine how much 60% acid solution the chemist should mix with some 100% acid solution to make an 80% acid solution.

Plan We will set up a chart to organize the information given in the problem. We will then use this information to write and solve a linear equation with one variable.

Process Let x represent the number of liters of 60% acid solution needed for the mixture.

	60% Acid Solution	100% Acid Solution	80% Acid Solution
# of liters	x	$6.3-x$	6.3
% acid	0.60	1	0.80

$$\begin{aligned} 0.60x+1(6.3-x) &= 6.3(0.80) \\ 0.60x+6.3-x &= 5.04 \\ -0.40x &= -1.26 \\ x &= 3.15 \end{aligned}$$

The chemist will need 3.15 liters of 60% acid solution.

Ponder Does our answer seem reasonable? Yes. There are $3.15(60\%)=1.89$ liters of acid in the first container and $(6.3-3.15)(100\%)=3.15$ liters of acid in the second container. Therefore, there are $3.15+1.89=5.04$ liters of acid in the two containers combined. In the final mixture, there are $6.3(80\%)=5.04$ liters of acid. Since this is equal to the amount we obtained from both containers, our answer is correct.

26. Prepare We want to determine how much 100% alcohol solution the pharmacist should mix with some 20% alcohol solution to make a 45% alcohol solution.

Plan We will set up a chart to organize the information given in the problem. We will then use this information to write and solve a linear equation with one variable.

Process Let x represent the number of gallons of 100% alcohol solution needed for the mixture.

	100% Alcohol Solution	20% Alcohol Solution	45% Alcohol Solution
# of gallons	x	$20.2-x$	20.2
% alcohol	1	0.20	0.45

$$\begin{aligned} x+0.20(20.2-x) &= 20.2(0.45) \\ x+4.04-0.20x &= 9.09 \\ 0.80x &= 5.05 \\ x &= 6.3125 \end{aligned}$$

The pharmacist will need 6.3125 gallons of 100% alcohol solution.

Ponder Does our answer seem reasonable? Yes. There are $6.3125(100\%)=6.3125$ gallons of alcohol in the first container and $(20.2-6.3125)(20\%)=2.7775$ gallons of alcohol in the second container. Therefore, there are $6.3125+2.7775=9.09$ gallons of alcohol in the two containers combined. In the final mixture, there are $20.2(45\%)=9.09$ gallons of alcohol. Since this is equal to the amount we obtained from both containers, our answer is correct.

27. Prepare We want to determine how much 40% salt solution Josie should mix with some 70% salt solution to make a 50% salt solution.

Plan We will set up a chart to organize the information given in the problem. We will then use this information to write and solve a linear equation with one variable.

Process Let x represent the number of gallons of 40% salt solution needed for the mixture.

	40% Salt Solution	70% Salt Solution	50% Salt Solution
# of gallons	x	$12-x$	12
% salt	0.40	0.70	0.50

$$\begin{aligned} 0.40x+0.70(12-x) &= 0.50(12) \\ 0.40x+8.4-0.7x &= 6 \\ -0.3x &= -2.4 \\ x &= 8 \end{aligned}$$

Josie will need 8 gallons of 40% salt solution.

Ponder Does our answer seem reasonable? Yes. There are $8(40\%)=3.2$ gallons of salt in the first container and $(12-8)(70\%)=2.8$ gallons of salt in the second container. Therefore, there are $3.2+2.8=6$ gallons of salt in the two containers combined. In the final mixture, there are $12(50\%)=6$ gallons of salt. Since this is equal to the amount we obtained from both containers, our answer is correct.

28. Prepare We want to determine how much 50% butterfat solution Aimee should mix with some 20% butterfat solution to make a 27% butterfat solution.

Plan We will set up a chart to organize the information given in the problem. We will then use this information to write and solve a linear equation with one variable.

Process Let x represent the number of ounces of 50% butterfat solution needed for the mixture.

	50% Butterfat Solution	20% Butterfat Solution	27% Butterfat Solution
# of ounces	x	$3.6-x$	3.6
% butterfat	0.50	0.20	0.27

$$\begin{aligned} 0.50x+0.20(3.6-x) &= 3.6(0.27) \\ 0.50x+0.72-0.20x &= 0.972 \\ 0.30x &= 0.252 \\ x &= 0.84 \end{aligned}$$

Aimee will need 0.84 ounce of 50% butterfat solution.

Ponder Does our answer seem reasonable? Yes. There is $0.84(50\%)=0.42$ ounce of butterfat in the first container and $(3.6-0.84)(20\%)=0.552$ ounce of butterfat in the second container. Therefore, there is $0.42+0.552=0.972$ ounce of butterfat in the two containers combined. In the final mixture, there is $3.6(27\%)=0.972$ ounce of butterfat. Since this is equal to the amount we obtained from both containers, our answer is correct.

29. Prepare We want to determine the number of pounds of cashews the Athletic Club will be able to purchase at \$12 per pound to mix with peanuts that cost \$4 per pound in order to make a mixture that costs \$6 per pound.

Plan We will set up a chart to organize the information given in the problem. We will then use this information to write and solve a linear equation with one variable.

Process Let x represent the number of pounds of cashews the club will be able to purchase.

	Cashews	Peanuts	Mixture
# of pounds	x	3	$x+3$
price per pound	\$12	\$4	\$6

$$12x+3(4)=6(x+3)$$
$$12x+12=6x+18$$
$$6x=6$$
$$x=1$$

The Athletic Club will be able to purchase 1 pound of cashews.

Ponder Does our answer seem reasonable? Yes. The total cost of the cashews is $1(\$12)=\$12$ and the total cost of the peanuts is $3(\$4)=\$12$. Therefore, the total cost for the nuts is $\$12+\$12=\$24$. The cost of the mix is $(1+3)(\$6)=\$24$. Since the cost for the mix is the same as the total cost of the nuts, our answer is correct.

30. Prepare We want to determine the number of pounds of pecans the Booster Club will be able to purchase at \$6 per pound to mix with walnuts that cost \$9 per pound in order to make a mixture that costs \$7 per pound.

Plan We will set up a chart to organize the information given in the problem. We will then use this information to write and solve a linear equation with one variable.

Process Let x represent the number of pounds of pecans the club will be able to purchase.

	Pecans	Walnuts	Mixture
# of pounds	x	5	$x+5$
price per pound	\$6	\$9	\$7

$$6x+5(9)=7(x+5)$$
$$6x+45=7x+35$$
$$-x=-10$$
$$x=10$$

The Booster Club will be able to purchase 10 pounds of pecans.

Ponder Does our answer seem reasonable? Yes. The total cost of the pecans is $10(\$6)=\$60$ and the total cost of the walnuts is $5(\$9)=\$45$. Therefore, the total cost for the nuts is $\$60+\$45=\$105$. The cost of the mix is $(10+5)(\$7)=\$105$. Since the cost for the mix is the same as the total cost of the nuts, our answer is correct.

31. Prepare We want to determine the number of quarts of creamy peanut butter that Mrs. Humphries need to purchase to mix with some 20% smooth peanut butter to make 2 quarts of 50% smooth peanut butter.

Plan We will set up a chart to organize the information given in the problem. We will then use this information to write and solve a linear equation with one variable.

Process Let x represent the number of quarts of creamy peanut butter that Mrs. Humphries will need to purchase.

	100% Smooth Peanut Butter	20% Smooth Peanut Butter	50% Smooth Peanut Butter
# of quarts	x	$2-x$	2
% smooth	1	0.20	0.50

$$x + 0.20(2 - x) = 2(0.50)$$
$$x + 0.40 - 0.20x = 1$$
$$0.80x = 0.60$$
$$x = 0.75$$

Mrs. Humphries must purchase 0.75 quarts of creamy peanut butter.

Ponder Does our answer seem reasonable? Yes. There is $0.75(100\%) = 0.75$ quart of creamy peanut butter in the first container and $(2 - 0.75)(20\%) = .25$ quart of smooth peanut butter in the second container. Therefore, there is $0.75 + 0.25 = 1$ quart of smooth peanut butter in the two containers combined. In the final mixture, there is $2(50\%) = 1$ quart of smooth peanut butter. Since this is equal to the amount we obtained from both containers, our answer is correct.

32. Prepare We want to determine the number of quarts of the peanut-butter-and-jelly swirl that Mrs. Quesada needs to purchase to mix with some pure jelly to make $4\frac{1}{2}$ quarts of 50% peanut-butter-and-jelly-mix.

Plan We will set up a chart to organize the information given in the problem. We will then use this information to write and solve a linear equation with one variable.

Process Let x represent the number of quarts of the peanut-butter-and-jelly swirl that Mrs. Quesada must purchase.

	25% Jelly Swirl	100% Jelly	50% Jelly Mix
# of quarts	x	$4\frac{1}{2} - x$	$4\frac{1}{2}$
% jelly	0.25	1	0.50

$$0.25x + 1\left(4\frac{1}{2} - x\right) = 0.50\left(4\frac{1}{2}\right)$$
$$0.25x + 4.5 - x = 2.25$$
$$-0.75x = -2.25$$
$$x = 3$$

Mrs. Quesada must purchase 3 quarts of the peanut-butter-and-jelly swirl.

Ponder Does our answer seem reasonable? Yes. There is $3(25\%) = .75$ quart of jelly in the first container and $\left(4\frac{1}{2} - 3\right)(100\%) = 1.5$ quart of jelly in the second container. Therefore, there is $0.75 + 1.5 = 2.25$ quarts of jelly in the two containers combined. In the final mixture, there is $4\frac{1}{2}(50\%) = 2.25$ quarts of jelly. Since this is equal to the amount we obtained from both containers, our answer is correct.

Extension Activity

Prepare We want to determine the number of boxes of Glass Magic that should be mixed with one box of Cascade to obtain a mixture that contains 12% phosphorous.

Plan We will set up a chart to organize the information given in the problem. We will then use this information to write and solve a linear equation with one variable. We must note that 1 box of Cascade is 75 ounces and 1 box of Glass Magic is 16 ounces.

Process Let x represent the number of ounces of Glass Magic needed for the mixture.

	21.6% Phosphorous	6.4% Phosphorous	12% Phosphorous
# of ounces	x	75	$x + 75$
% phosphorous	0.216	0.064	0.12

$$0.216x + 0.064(75) = 0.12(x + 75)$$
$$0.216x + 4.8 = 0.12x + 9$$
$$0.096x = 4.2$$
$$x = 43.75$$

To determine the number of 16 ounce boxes of Glass Magic that need to be mixed with one 75 ounce box of Cascade, we simply divide 43.75 by 16; $43.75 \div 16 = 2.734375$. Therefore, we should mix 3 boxes of Glass Magic with 1 box of Cascade to get at least a 12% phosphorous mix.

Ponder Does our answer seem reasonable? Yes. Even though 3 boxes is actually more than we need, the problem states that we need at least a 12% mixture. The extra amount of glass magic will give us a little more than 12% phosphorous.

Chapter 2 Review Problem Set

1. Yes, because the exponent on x is positive one.

2. No, because the highest power of x is two.

3. No, because there are two variables.

4. No, because the power of x in the first term is negative one.

5.
$$5x+1=12$$
$$5\left(\frac{11}{5}\right)+1=12$$
$$11+1=12$$
$$12=12$$
Yes, $\frac{11}{5}$ is a solution.

6.
$$-14=3x-2$$
$$-14=3(-3)-2$$
$$-14=-9-2$$
$$-14=-11$$
No, -3 is not a solution.

7.
$$4a-2-a=5a+10$$
$$4(-4)-2-(-4)=5(-4)+10$$
$$-16-2+4=-20+10$$
$$-14=-10$$
No, -4 is not a solution.

8.
$$-2(y-4)-(3y-1)=-2+(2y-1)$$
$$-2\left(\left(\frac{12}{7}\right)-4\right)-\left(3\left(\frac{12}{7}\right)-1\right)=-2+\left(2\left(\frac{12}{7}\right)-1\right)$$
$$-2\left(-\frac{16}{7}\right)-\left(\frac{36}{7}-1\right)=-2+\left(\frac{24}{7}-1\right)$$
$$\frac{32}{7}-\left(\frac{29}{7}\right)=-2+\left(\frac{17}{7}\right)$$
$$\frac{3}{7}=\frac{3}{7}$$
Yes, $\frac{12}{7}$ is a solution.

9.
$$x+15=-10$$
$$x+15-15=-10-15$$
$$x=-25$$
Solution Set: $\{-25\}$

10.
$$2.5-x=3.5$$
$$2.5-2.5-x=3.5-2.5$$
$$-x=1$$
$$\frac{-x}{-1}=\frac{1}{-1}$$
$$x=-1$$
Solution Set: $\{-1\}$

11.
$$x+\frac{2}{3}=-\frac{4}{5}$$
$$x+\frac{2}{3}-\frac{2}{3}=-\frac{4}{5}-\frac{2}{3}$$
$$x=-\frac{22}{15}$$
Solution Set: $\left\{-\frac{22}{15}\right\}$

12.
$$-5x=2\frac{1}{2}$$
$$-5x=\frac{5}{2}$$
$$-\frac{1}{5}(-5x)=-\frac{1}{5}\left(\frac{5}{2}\right)$$
$$x=-\frac{1}{2}$$
Solution Set: $\left\{-\frac{1}{2}\right\}$

13.
$$\frac{x}{10}=-15$$
$$\frac{10}{1}\left(\frac{x}{10}\right)=10(-15)$$
$$x=-150$$
Solution Set: $\{-150\}$

14.
$$\frac{1}{2}=\frac{2}{3}y$$
$$\frac{3}{2}\left(\frac{1}{2}\right)=\frac{3}{2}\left(\frac{2}{3}y\right)$$
$$\frac{3}{4}=y$$
Solution Set: $\left\{\frac{3}{4}\right\}$

15. $3c-12=18$

$3c-12+12=18+12$

$3c=30$

$\frac{3c}{3}=\frac{30}{3}$

$c=10$

Solution Set: $\{10\}$

16. $45=12-11w$

$45-12=12-12-11w$

$33=-11w$

$\frac{33}{-11}=\frac{-11w}{-11}$

$-3=w$

Solution Set: $\{-3\}$

17. $\frac{2}{3}x-8=0$

$\frac{2}{3}x-8+8=0+8$

$\frac{2}{3}x=8$

$\frac{3}{2}\left(\frac{2}{3}x\right)=\frac{3}{2}(8)$

$x=12$

Solution Set: $\{12\}$

18. $12x+5=5$

$12x+5-5=5-5$

$12x=0$

$\frac{12x}{12}=\frac{0}{12}$

$x=0$

Solution Set: $\{0\}$

19. $12=8m-10m$

$12=-2m$

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

$-6=m$

Solution Set: $\{-6\}$

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

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

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

$\frac{4}{1}\left(\frac{x}{4}\right)=4(-7)$

$x=-28$

Solution Set: $\{-28\}$

21. $-10x+\frac{1}{6}=-\frac{2}{3}$

$-10x+\frac{1}{6}-\frac{1}{6}=-\frac{2}{3}-\frac{1}{6}$

$-10x=-\frac{5}{6}$

$-\frac{1}{10}(-10x)=-\frac{1}{10}\left(-\frac{5}{6}\right)$

$x=\frac{1}{12}$

Solution Set: $\left\{\frac{1}{12}\right\}$

22. $-x+0.25+0.5x=-4$

$-0.5x+0.25=-4$

$-0.5x+0.25-0.25=-4-0.25$

$-0.5x=-4.25$

$\frac{-0.5x}{-0.5}=\frac{-4.25}{-0.5}$

$x=8.5$

Solution Set: $\{8.5\}$

23. $4a-3+2a=8a-3-a$

$6a-3=7a-3$

$6a-7a-3=7a-7a-3$

$-a-3=-3$

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

$-a=0$

$\frac{-a}{-1}=\frac{0}{-1}$

$a=0$

Solution Set: $\{0\}$

24. $6x-4-3x=3x+10+4x$

$3x-4=7x+10$

$3x-7x-4=7x-7x+10$

$-4x-4=10$

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

$-4x=14$

$\frac{-4x}{-4}=\frac{14}{-4}$

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

Solution Set: $\left\{-\frac{7}{2}\right\}$

25. Let x represent the unknown number.

$\frac{1}{4}x=0.12$

$0.25x=0.12$

$\frac{0.25x}{0.25}=\frac{0.12}{0.25}$

$x=0.48$

The number is 0.48.

26. Let x represent the unknown number.

$x+250=84$

$x+250-250=84-250$

$x=-166$

The number is -166.

27. Let x represent the length of the first side of the triangle.

$x+x+2+x-2=24$

$3x=24$

$\frac{3x}{3}=\frac{24}{3}$

$x=8$

The length of the first side is 8 inches, the second side is 10 inches, and the third side is 6 inches.

28. Prepare We are to determine the difference between the body shop price and the retail price of the front-end grill.

Plan We can set up and solve a linear equation in one variable.

Process Let x represent the difference between the body shop price and the retail price of the front-end grill.

$x=(\text{body shop price})-(\text{retail price})$

$x=799+799(0.20)-799$

$x=159.8$

The difference in price is \$159.80.

Ponder Does our answer seem reasonable? Yes. A simple check of arithmetic will validate the result.

29. $4(3x+1)=40$

$12x+4=40$

$12x+4-4=40-4$

$12x=36$

$\frac{12x}{12}=\frac{36}{12}$

$x=3$

Solution Set: $\{3\}$

30. $16=8(n-10)$

$16=8n-80$

$16+80=8n-80+80$

$96=8n$

$\frac{96}{8}=\frac{8n}{8}$

$12=n$

Solution Set: $\{12\}$

31. $26=7x-(2x+9)$

$26=7x-2x-9$

$26=5x-9$

$26+9=5x-9+9$

$35=5x$

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

$7=x$

Solution Set: $\{7\}$

32. $18x-2(6x+1)=-10$

$18x-12x-2=-10$

$6x-2=-10$

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

$6x=-8$

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

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

Solution Set: $\left\{-\frac{4}{3}\right\}$

34. $5+2(3a-1)=-3a-15$

$5+6a-2=-3a-15$

$6a+3=-3a-15$

$6a+3a+3=-3a+3a-15$

$9a+3=-15$

$9a+3-3=-15-3$

$9a=-18$

$\frac{9a}{9}=\frac{-18}{9}$

$a=-2$

Solution Set: $\{-2\}$

35. $-2(x-4)-(3x-1)=-2+(2x-1)$

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

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

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

$-7x+9=-3$

$-7x+9-9=-3-9$

$-7x=-12$

$\frac{-7x}{-7}=\frac{-12}{-7}$

$x=\frac{12}{7}$

Solution Set: $\left\{\frac{12}{7}\right\}$

36. $4m-2\{3+2m-[5-(m+1)]\}=-24$

$4m-2\{3+2m-[5-m-1]\}=-24$

$4m-2\{3+2m-[-m+4]\}=-24$

$4m-2\{3+2m+m-4\}=-24$

$4m-2\{3m-1\}=-24$

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

$-2m+2=-24$

$-2m+2-2=-24-2$

$-2m=-26$

$\frac{-2m}{-2}=\frac{-26}{-2}$

$m=13$

Solution Set: $\{13\}$

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

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

$12x+8=36x-15$

$12x-36x+8=36x-36x-15$

$-24x+8=-15$

$-24x+8-8=-15-8$

$-24x=-23$

$\frac{-24x}{-24}=\frac{-23}{-24}$

$x=\frac{23}{24}$

Solution Set: $\left\{\frac{23}{24}\right\}$

38. $\frac{x-4}{2}=\frac{3x-10}{5}$

$\frac{10}{1}\left(\frac{x-4}{2}\right)=\frac{10}{1}\left(\frac{3x-10}{5}\right)$

$5x-20=6x-20$

$5x-6x-20=6x-6x-20$

$-x-20=-20$

$-x-20+20=-20+20$

$-x=0$

$\frac{-x}{-1}=\frac{0}{-1}$

$x=0$

Solution Set: $\{0\}$

39.
$$\frac{x}{2}+\frac{x-3}{4}=\frac{10}{3}$$
$$\frac{12}{1}\left(\frac{x}{2}+\frac{x-3}{4}\right)=\frac{12}{1}\left(\frac{10}{3}\right)$$
$$6x+3x-9=40$$
$$9x-9=40$$
$$9x-9+9=40+9$$
$$9x=49$$
$$\frac{9x}{9}=\frac{49}{9}$$
$$x=\frac{49}{9}$$
Solution Set: $\left\{\frac{49}{9}\right\}$

40.
$$1.2x-0.66=0.3x+1.14$$
$$1.2x-0.3x-0.66=0.3x-0.3x+1.14$$
$$0.9x-0.66=1.14$$
$$0.9x-0.66+0.66=1.14+0.66$$
$$0.9x=1.80$$
$$\frac{0.9x}{0.9}=\frac{1.80}{0.9}$$
$$x=2$$
Solution Set: $\{2\}$

41.
$$\frac{2}{3}x-0.3=\frac{1}{15}x+\frac{9}{30}$$
$$\frac{30}{1}\left(\frac{2}{3}x-0.3\right)=\frac{30}{1}\left(\frac{1}{15}x+\frac{9}{30}\right)$$
$$20x-9=2x+9$$
$$20x-2x-9=2x-2x+9$$
$$18x-9=9$$
$$18x-9+9=9+9$$
$$18x=18$$
$$\frac{18x}{18}=\frac{18}{18}$$
$$x=1$$
Solution Set: $\{1\}$

42.
$$8+4w=9w-5w+2$$
$$8+4w=4w+2$$
$$8+4w-4w=4w-4w+2$$
$$8=2$$
The equation is inconsistent.
Solution Set: $\{\ \}$ or $\varnothing$

43.
$$20+4(3v-5)=12v$$
$$20+12v-20=12v$$
$$12v=12v$$
$$12v-12v=12v-12v$$
$$0=0$$
The equation is an identity.
Solution Set: $\{v \mid v \in R\}$

44.
$$2.2(4x+6)-0.8x=4(3.3+2x)$$
$$8.8x+13.2-0.8x=13.2+8x$$
$$8x+13.2=13.2+8x$$
$$8x-8x+13.2=13.2+8x-8x$$
$$13.2=13.2$$
The equations is an identity.
Solution Set: $\{x \mid x \in R\}$

45.
$$\frac{3}{7}+x=x+\frac{7}{3}$$
$$\frac{3}{7}x-x=x-x+\frac{7}{3}$$
$$\frac{3}{7}=\frac{7}{3}$$
The equation is inconsistent.
Solution Set: $\{\ \}$ or $\varnothing$

46. Let x represent the unknown number.
$$\frac{3}{4}x=32+\frac{1}{8}x$$
$$\frac{8}{1}\left(\frac{3}{4}x\right)=\frac{8}{1}\left(32+\frac{1}{8}x\right)$$
$$6x=256+x$$
$$6x-x=256+x-x$$
$$5x=256$$
$$\frac{5x}{5}=\frac{256}{5}$$
$$x=\frac{256}{5}$$

The number is $\frac{256}{5}$.

47. Let x represent the original price of the car battery.

$$\begin{aligned} x - 0.20x &= 68.50 \\ 0.80x &= 68.50 \\ \frac{0.80x}{0.80} &= \frac{68.50}{0.80} \\ x &= 85.625 \end{aligned}$$

The original price of the car battery was \$85.63.

48. **Prepare** We must solve the linear equation for x to determine how many miles a customer would have to travel with each company for the cost of his rides to be equal.

Plan Solve the linear equation for x by using the Strategy for Solving Linear Equations.

Process

$$\begin{aligned} 2.50 + 0.75x &= 3.70 + 0.90(x - 2) \\ 2.50 + 0.75x &= 3.70 + 0.90x - 1.8 \\ 2.50 + 0.75x &= 0.90x + 1.9 \\ 2.50 + 0.75x - 0.90x &= 0.90x - 0.90x + 1.9 \\ 2.50 - 0.15x &= 1.9 \\ 2.50 - 2.50 - 0.15x &= 1.9 - 2.50 \\ -0.15x &= -0.6 \\ x &= 4 \end{aligned}$$

Therefore, a customer would have to travel 4 miles for the cost of his rides to be equal.

Ponder Does our answer seem reasonable? We can check our answer. The cost of travel with the first cab is $\$2.50 + 0\$.75(4) = \$5.50$. The cost of travel with the second cab is $\$3.70 + \$0.90(4 - 2) = \$5.50$. Because the cost is the same for both cabs, the answer is correct.

49. **Prepare** We must find the measures of two unknown supplementary angles.

Plan We will write and solve a linear equation in one variable using the given information.

Process Let x represent the first angle.

$$\begin{aligned} x + \frac{2}{3}x + 5 &= 180 \\ \frac{5}{3}x + 5 - 5 &= 180 - 5 \\ \frac{5}{3}x &= 175 \\ \frac{3}{5}\left(\frac{5}{3}x\right) &= \frac{3}{5}(175) \\ x &= 105 \end{aligned}$$

The first angle is 105°, and the second angle is $\frac{2}{3}(105) + 5 = 75^\circ$.

Ponder Does our answer seem reasonable? Yes. Because the sum of the angles is 180°, the result is reasonable.

50. **Prepare** We are to find the three lengths that the board must be cut into.

Plan We will set up and solve a linear equation in one variable.

Process Let x represent the length of the first piece.

$$\begin{aligned} x + \frac{1}{2}x + 1 + x - 3 &= 32 \\ \frac{5}{2}x &= 34 \\ \frac{2}{5}\left(\frac{5}{2}x\right) &= \frac{2}{5}(34) \\ x &= 13.6 \end{aligned}$$

The length of the first board is 13.6 feet, the length of the second board is 7.8 feet, and the length of the third board is 10.6 feet.

Ponder Does our answer seem reasonable? Yes. Because the lengths of the three pieces add up to 32, our answer is reasonable.

51.

$$\begin{aligned} 8x - 5y &= 2 \\ 8x - 5y + 5y &= 2 + 5y \\ 8x &= 5y + 2 \\ \frac{8x}{8} &= \frac{5y + 2}{8} \\ x &= \frac{5y + 2}{8} \end{aligned}$$

52.
$$-\frac{1}{2}x+\frac{2}{3}y=5$$
$$\frac{6}{1}\left(-\frac{1}{2}x+\frac{2}{3}y\right)=6(5)$$
$$-3x+4y=30$$
$$-3x+3x+4y=30+3x$$
$$4y=30+3x$$
$$\frac{4y}{4}=\frac{3x+30}{4}$$
$$y=\frac{3x+30}{4}$$

53.
$$D=RT$$
$$\frac{D}{T}=\frac{RT}{T}$$
$$R=\frac{D}{T}$$

54.
$$P=2l+2w$$
$$P-2w=2l+2w-2w$$
$$P-2w=2l$$
$$\frac{P-2w}{2}=\frac{2l}{2}$$
$$l=\frac{P-2w}{2}$$

55.
$$A=\frac{1}{2}h(a+b)$$
$$2A=2\left(\frac{1}{2}h(a+b)\right)$$
$$2A=h(a+b)$$
$$\frac{2A}{h}=\frac{h(a+b)}{h}$$
$$\frac{2A}{h}=a+b$$
$$\frac{2A}{h}-a=a-a+b$$
$$b=\frac{2A}{h}-a$$

56.
$$cx+x=0$$
$$(c+1)x=0$$
$$\frac{(c+1)x}{c+1}=\frac{0}{c+1}$$
$$x=0$$

57.
$$\frac{x}{2}+\frac{y}{3}=1$$
$$\frac{6}{1}\left(\frac{x}{2}+\frac{y}{3}\right)=6(1)$$
$$3x+2y=6$$
$$3x-3x+2y=6-3x$$
$$2y=6-3x$$
$$\frac{2y}{2}=\frac{6-3x}{2}$$
$$y=\frac{6-3x}{2}$$

58.
$$F=kx$$
$$120=k(8)$$
$$\frac{120}{8}=\frac{8k}{8}$$
$$k=15$$

59.
$$C=\frac{5}{9}(F-32)$$
$$C=\frac{5}{9}((-40)-32)$$
$$C=-40^\circ$$

60.
$$F=\frac{9}{5}C+32$$
$$F=\frac{9}{5}(20)+32$$
$$C=36+32$$
$$C=68$$

61.
$$I=Prt$$
$$1{,}543.50=(6{,}300)(r)\left(3\frac{1}{2}\right)$$
$$1{,}543.50=22{,}050r$$
$$\frac{1{,}543.50}{22{,}050}=\frac{22{,}050r}{22{,}050}$$
$$r=0.07$$
The interest rate is 7%.

62.
$$I=Prt$$
$$1{,}237.50=(7{,}500)(0.055)t$$
$$1{,}237.50=412.5t$$
$$\frac{1{,}237.50}{412.5}=\frac{412.5t}{412.5}$$
$$t=3$$
It will take 3 years.

63. $D = RT$

$D = (40)\left(3\frac{1}{4}\right)$

$D = 130$

The blimp can travel 130 miles.

64. $D = RT$

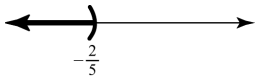
$42 = R(0.75)$

$\frac{42}{0.75} = \frac{0.75R}{0.75}$

$R = 56$

Erin drove at a rate of 56 miles per hour.

65. $\left(-\infty, -\frac{2}{5}\right)$



66. $x \geq 3.5$

67. $x - 92 < 12$

$x - 92 + 92 < 12 + 92$

$x < 104$

$(-\infty, 104)$

68. $-3x > 8$

$\frac{-3x}{-3} < \frac{8}{-3}$

$x < -\frac{8}{3}$

$\left(-\infty, -\frac{8}{3}\right)$

69. $6x \geq -24$

$\frac{6x}{6} \geq \frac{-24}{6}$

$x \geq -4$

$[-4, \infty)$

70. $12 - x \leq 5$

$12 - 12 - x \leq 5 - 12$

$-x \leq -7$

$\frac{-x}{-1} \geq \frac{-7}{-1}$

$x \geq 7$

$[7, \infty)$

71. $x > -4x + 20$

$x + 4x > -4x + 4x + 20$

$5x > 20$

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

$x > 4$

$(4, \infty)$

72. $-5x - 2 < 3(x + 2)$

$-5x - 2 < 3x + 6$

$-5x - 3x - 2 < 3x - 3x + 6$

$-8x < 8$

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

$x > -1$

$(-1, \infty)$

73. $0 \leq -2(x - 3) + 6x$

$0 \leq -2x + 6 + 6x$

$0 \leq 4x + 6$

$0 - 4x \leq 4x - 4x + 6$

$-4x \leq 6$

$\frac{-4x}{-4} \geq \frac{6}{-4}$

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

$\left[-\frac{3}{2}, \infty\right)$

74. $0.8x + 9.1 < 0.1x$

$0.8x - 0.1x + 9.1 < 0.1x - 0.1x$

$0.7x + 9.1 < 0$

$0.7x + 9.1 - 9.1 < 0 - 9.1$

$0.7x < -9.1$

$\frac{0.7x}{0.7} < \frac{-9.1}{0.7}$

$x < -13$

$(-\infty, -13)$

75.
$$\frac{x}{3}-\frac{x}{2}\ge\frac{5}{6}$$
$$\frac{6}{1}\left(\frac{x}{3}-\frac{x}{2}\right)\ge\frac{6}{1}\left(\frac{5}{6}\right)$$
$$2x-3x\ge 5$$
$$-x\ge 5$$
$$\frac{-x}{-1}\le\frac{5}{-1}$$
$$x\le -5$$
$$(-\infty,-5]$$

76.
$$\frac{x-3}{5}+\frac{x}{4}>3$$
$$\frac{20}{1}\left(\frac{x-3}{5}+\frac{x}{4}\right)>20(3)$$
$$4x-12+5x>60$$
$$9x-12>60$$
$$9x-12+12>60+12$$
$$9x>72$$
$$\frac{9x}{9}>\frac{72}{9}$$
$$x>8$$
$$(8,\infty)$$

77.
$$7p+27\ge 15+7p$$
$$7p-7p+27\ge 15+7p-7p$$
$$27\ge 15$$
$$(-\infty,\infty)$$

78.
$$-24t<8(5-3t)$$
$$-24t<40-24t$$
$$-24t+24t<40-24y+24t$$
$$0<40$$
$$(-\infty,\infty)$$

79.
$$8(6-x)+10x\le 2x+6$$
$$48-8x+10x\le 2x+6$$
$$48+2x\le 2x+6$$
$$48+2x-2x\le 2x-2x+6$$
$$48\le 6$$
$\{\ \}$ or $\varnothing$

80.
$$3.2x-5<6x-(2.8x+5)$$
$$3.2x-5<6x-2.8x-5$$
$$3.2x-5<3.2x-5$$
$$3.2x-3.2x-5<3.2x-3.2x-5$$
$$-5<-5$$
$\{\ \}$ or $\varnothing$

81. Let x represent the unknown number.

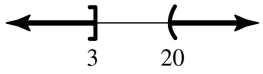
$$4x-\frac{2}{3}<x+1$$
$$4x-x-\frac{2}{3}<x-x+1$$
$$3x-\frac{2}{3}<1$$
$$3x-\frac{2}{3}+\frac{2}{3}<1+\frac{2}{3}$$
$$3x<\frac{5}{3}$$
$$\frac{1}{3}(3x)<\frac{1}{3}\left(\frac{5}{3}\right)$$
$$x<\frac{5}{9}$$
$$\left(-\infty,\frac{5}{9}\right)$$

82. Let x represent the score Danita needs in her third game to average at least 110.

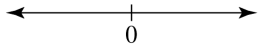
$$\frac{120+96+x}{3}\ge 110$$
$$\frac{216+x}{3}\ge 110$$
$$\frac{3}{1}\left(\frac{216+x}{3}\right)\ge 3(110)$$
$$216+x\ge 330$$
$$216-216+x\ge 330-216$$
$$x\ge 114$$
$$[114,\infty)$$

Danita needs to score at least 114.

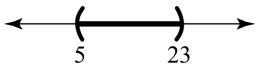
83. $(-\infty,-3]\cup(20,\infty)$



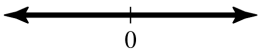
84. $\{\ \}$



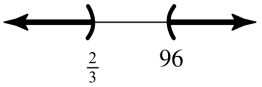
85. $(5,23)$



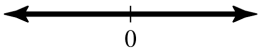
86. $(-\infty,\infty)$



87. $\left(-\infty,\frac{2}{3}\right)\cup(96,\infty)$



88. $(-\infty,\infty)$



89. $x \ge -2$ and $x < 11.5$

90. $x > -\frac{1}{4}$ and $x < \frac{10}{3}$

91. $x \ge 0$ and $x < 10$

92. $x > -5$ and $x \le 25$

93. $x \le -5$ or $x > -2$

94. $2\frac{1}{2} < x < 12$ or $x > 30$

95. $x > 13.5$ or $0.55x < 2.5$

$x > 13.5$ or $\frac{0.55x}{0.55} < \frac{2.5}{0.55}$

$x < 4.54$

$(-\infty, 4.54)\cup(13.5,\infty)$

96. $5x \le 32$ and $80x > -450$

$\frac{5x}{5} \le \frac{32}{5}$ and $\frac{80x}{80} > \frac{-450}{80}$

$x \le \frac{32}{5}$ and $x > -\frac{45}{8}$

$\left(-\frac{45}{8}, \frac{32}{5}\right]$

97. $-3x < -18$ and $\frac{2}{3}x < 16$

$\frac{-3x}{-3} > \frac{-18}{-3}$ and $\frac{3}{2}\left(\frac{2}{3}x\right) < \frac{3}{2}(16)$

$x > 6$ and $x < 24$

$(6,24)$

98. $-(x+20) > 2x+15$ and $3(x+2) < -10$

$-x-20 > 2x+15$ and $3x+6 < -10$

$-3x > 35$ and $3x < -16$

$\frac{-3x}{-3} < \frac{35}{-3}$ and $\frac{3x}{3} < \frac{-16}{3}$

$x < -\frac{35}{3}$ and $x < -\frac{16}{3}$

$\left(-\infty, -\frac{35}{3}\right)$

99. $\frac{x}{3} - \frac{x}{4} \le 5$ or $\frac{x}{6} + \frac{x}{3} > \frac{3x}{2}$

$\frac{12}{1}\left(\frac{x}{3} - \frac{x}{4}\right) \le 12(5)$ or $\frac{6}{1}\left(\frac{x}{6} + \frac{x}{3}\right) > \frac{6}{1}\left(\frac{3x}{2}\right)$

$4x - 3x \le 60$ or $x + 2x > 9x$

$x \le 60$ or $-6x > 0$

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

$x < 0$

$(-\infty, 60]$

100. $2(x+3)+5 < 10$ and $7(x-2)+5 > -9$

$2x+6+5 < 10$ and $7x-14+5 > -9$

$2x < -1$ and $7x > 0$

$\frac{2x}{2} < \frac{-1}{2}$ and $\frac{7x}{7} > \frac{0}{7}$

$x < -\frac{1}{2}$ and $x > 0$

$\{\ \}$

101. $0 < 2x+8 < 36$

$0-8 < 2x+8-8 < 36-8$

$-8 < 2x < 28$

$\frac{-8}{2} < \frac{2x}{2} < \frac{28}{2}$

$-4 < x < 14$

$(-4,14)$

102.
$$-10 < 3 - 2x \le 14$$
$$-10 - 3 < 3 - 3 - 2x \le 14 - 3$$
$$-13 < -2x \le 11$$
$$\frac{-13}{-2} > \frac{-2x}{-2} \ge \frac{11}{-2}$$
$$-\frac{11}{2} \le x < \frac{13}{2}$$
$$\left[-\frac{11}{2}, \frac{13}{2}\right)$$

103.
$$-5 \ge -18 - x > -20$$
$$-5 + 18 \ge -18 + 18 - x > -20 + 18$$
$$13 \ge -x > -2$$
$$\frac{13}{-1} \le \frac{-x}{-1} < \frac{-2}{-1}$$
$$-13 \le x < 2$$
$$[-13, 2)$$

104.
$$-10 \le \frac{-12x + 5}{2} \le 25$$
$$2(-10) \le \frac{2}{1}\left(\frac{-12x + 5}{2}\right) \le 2(25)$$
$$-20 \le -12x + 5 \le 50$$
$$-20 - 5 \le -12x + 5 - 5 \le 50 - 5$$
$$-25 \le -12x \le 45$$
$$\frac{-25}{-12} \ge \frac{-12x}{-12} \ge \frac{45}{-12}$$
$$-\frac{15}{4} \le x \le \frac{25}{12}$$
$$\left[-\frac{15}{4}, \frac{25}{12}\right]$$

105.
$$|x| = 16$$
$$x = -16 \quad \text{or} \quad x = 16$$
$$\{-16, 16\}$$

106.
$$|x + 4| = -96$$
$$\{\ \}$$

107.
$$|-5x| = 75$$
$$-5x = -75 \quad \text{or} \quad -5x = 75$$
$$\frac{-5x}{-5} = \frac{-75}{-5} \quad \text{or} \quad \frac{-5x}{-5} = \frac{75}{-5}$$
$$x = 15 \quad \text{or} \quad -15$$
$$\{-15, 15\}$$

108.
$$|4 - 2x| - 18 = -6$$
$$|4 - 2x| = 12$$
$$4 - 2x = -12 \quad \text{or} \quad 4 - 2x = 12$$
$$-2x = -16 \quad \text{or} \quad -2x = 8$$
$$\frac{-2x}{-2} = \frac{-16}{-2} \quad \text{or} \quad \frac{-2x}{-2} = \frac{8}{-2}$$
$$x = 8 \quad \text{or} \quad x = -4$$
$$\{-4, 8\}$$

109.
$$|4 - x| = 25$$
$$4 - x = -25 \quad \text{or} \quad 4 - x = 25$$
$$-x = -29 \quad \text{or} \quad -x = 21$$
$$\frac{-x}{-1} = \frac{-29}{-1} \quad \text{or} \quad \frac{-x}{-1} = \frac{21}{-1}$$
$$x = 29 \quad \text{or} \quad x = -21$$
$$\{-21, 29\}$$

110.
$$\left|\frac{a}{2}\right| = \frac{7}{8}$$
$$\frac{a}{2} = -\frac{7}{8} \quad \text{or} \quad \frac{a}{2} = \frac{7}{8}$$
$$\frac{2}{1}\left(\frac{a}{2}\right) = \frac{2}{1}\left(-\frac{7}{8}\right) \quad \text{or} \quad \frac{2}{1}\left(\frac{a}{2}\right) = \frac{2}{1}\left(\frac{7}{8}\right)$$
$$a = -\frac{7}{4} \quad \text{or} \quad a = \frac{7}{4}$$
$$\left\{-\frac{7}{4}, \frac{7}{4}\right\}$$

111.
$$|5x - 1| - 6 = -6$$
$$|5x - 1| = 0$$
$$5x - 1 = 0$$
$$5x = 1$$
$$\frac{5x}{5} = \frac{1}{5}$$
$$x = \frac{1}{5}$$
$$\left\{\frac{1}{5}\right\}$$

112.
$$\left|\frac{1 - y}{3}\right| + 40 = 22$$
$$\left|\frac{1 - y}{3}\right| = -18$$
$$\{\ \}$$

113. $|x-2|=|4-2x|$

$x-2=-(4-2x)$ or $x-2=4-2x$

$x-2=-4+2x$ or $3x=6$

$-x=-2$ or $\frac{3x}{3}=\frac{6}{3}$

$\frac{-x}{-1}=\frac{-2}{-1}$ or $x=2$

$x=2$

$\{2\}$

114. $|-3x-10|=|9+2x|$

$-3x-10=-(9+2x)$ or $-3x-10=9+2x$

$-3x-10=-9-2x$ or $-5x=19$

$-x=1$ or $\frac{-5x}{-5}=\frac{19}{-5}$

$\frac{-x}{-1}=\frac{1}{-1}$ or $x=-\frac{19}{5}$

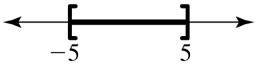
$x=-1$

$\left\{-\frac{19}{5},-1\right\}$

115. $|x|\le 5$

$-5\le x\le 5$

$[-5,5]$



116. $|16-2x|<18$

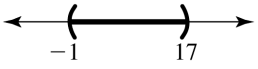
$-18<16-2x<18$

$-34<-2x<2$

$\frac{-34}{-2}>\frac{-2x}{-2}>\frac{2}{-2}$

$-1<x<17$

$(-1,17)$



117. $\left|\frac{x-12}{4}\right|\le 10$

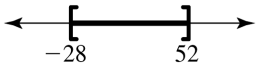
$-10\le\frac{x-12}{4}\le 10$

$4(-10)\le\frac{4}{1}\left(\frac{x-12}{4}\right)\le 4(10)$

$-40\le x-12\le 40$

$-28\le x\le 52$

$[-28,52]$



118. $|2x-4|+6<18$

$|2x-4|<12$

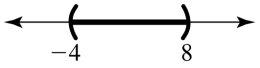
$-12<2x-4<12$

$-8<2x<16$

$\frac{-8}{2}<\frac{2x}{2}<\frac{16}{2}$

$-4<x<8$

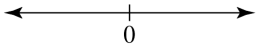
$(-4,8)$



119. $|8x+3|+15<12$

$|8x+3|<-3$

$\{\ \}$



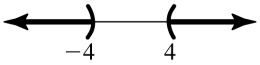
120. $|2x|>8$

$2x<-8$ or $2x>8$

$\frac{2x}{2}<\frac{-8}{2}$ or $\frac{2x}{2}>\frac{8}{2}$

$x<-4$ or $x>4$

$(-\infty,-4)\cup(4,\infty)$



121. $|4x+16|-10\ge 34$

$|4x+16|\ge 44$

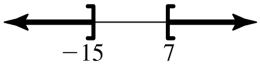
$4x+16\le -44$ or $4x+16\ge 44$

$4x\le -60$ or $4x\ge 28$

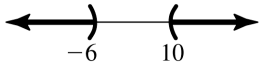
$\frac{4x}{4}\le\frac{-60}{4}$ or $\frac{4x}{4}\ge\frac{28}{4}$

$x\le -15$ or $x\ge 7$

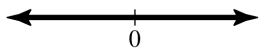
$(-\infty,-15]\cup[7,\infty)$



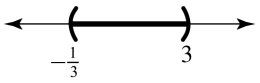
122.
$$\left|\frac{x-2}{4}\right|+6>8$$
$$\left|\frac{x-2}{4}\right|>2$$
$$\frac{x-2}{4}<-2 \quad \text{or} \quad \frac{x-2}{4}>2$$
$$\frac{4}{1}\left(\frac{x-2}{4}\right)<4(-2) \quad \text{or} \quad \frac{4}{1}\left(\frac{x-2}{4}\right)>4(2)$$
$$x-2<-8 \quad \text{or} \quad x-2>8$$
$$x<-6 \quad \text{or} \quad x>10$$
$$(-\infty,-6)\cup(10,\infty)$$



123.
$$\left|\frac{2x}{3}+5\right|+8\geq 4$$
$$\left|\frac{2x}{3}+5\right|\geq -4$$
$$(-\infty,\infty)$$



124.
$$12-|3x-4|>7$$
$$-|3x-4|>-5$$
$$-1(-|3x-4|)<-1(-5)$$
$$|3x-4|<5$$
$$-5<3x-4<5$$
$$-1<3x<9$$
$$\frac{-1}{3}<\frac{3x}{3}<\frac{9}{3}$$
$$-\frac{1}{3}<x<3$$
$$\left(-\frac{1}{3},3\right)$$



125. **Prepare** We are to determine the speed of the helicopter in still air.

Plan We will set up a chart to organize the information given in the problem. We will then use this information to write and solve a linear equation with one variable.

Process Let r represent the speed of the helicopter in still air.

	Rate •	Time	= Distance
headwind	$r-15$ mph	2 (in hours)	$D_1=2(r-15)$ (in miles)
tailwind	$r+5$ mph	$1\frac{1}{2}$ (in hours)	$D_2=1.5(r+5)$ (in miles)

$$D_1+D_2=240$$
$$2(r-15)+1.5(r+5)=240$$
$$2r-30+1.5r+7.5=240$$
$$3.5r-22.5=240$$
$$3.5r=262.5$$
$$r=75$$

The helicopter can travel 75 miles per hour in still air.

Ponder Does our answer seem reasonable? Yes. We can check to see that the total distance traveled at this speed is 240 miles.

126. **Prepare** We want to determine how many milliliters of the mixture the curator makes from 150 ml of a 3% acid solution and some 100% acid solution.

Plan We will set up a chart to organize the information given in the problem. We will then use this information to write and solve a linear equation with one variable.

Process Let x represent the number of milliliters in the final mixture.

	40% Acid Solution	3% Acid Solution	100% Acid Solution
# of milliliters	x	150	$x-150$
% acid	0.40	0.03	1

$$\begin{aligned} 0.03(150)+x-150&=0.40x\\ 4.5+x-150&=0.40x\\ 0.60x&=145.5\\ x&=242.5 \end{aligned}$$

The curator makes 242.5 milliliters of the 40% acid solution.

Ponder Does our answer seem reasonable? Yes. There are $150(3\%)=4.5$ milliliters of acid in the first container and $(242.5-150)(100\%)=92.5$ milliliters of acid in the second container. Therefore, there are $4.5+92.5=97$ milliliters of acid in the two containers combined. In the final mixture, there are $242.5(40\%)=97$ milliliters of acid. Since this is equal to the amount we obtained from both containers, our answer is correct.

127. Prepare We want to determine the number of pounds of cashews and peanuts that Sayem purchased.

Plan We will set up a chart to organize the information given in the problem. We will then use this information to write and solve a linear equation with one variable.

Process Let x represent the number of pounds of cashews that Sayem purchased.

	Cashews	Peanuts	Mixture
# of pounds	x	$x+2$	$2x+2$
price per pound	\$7.50	\$2.50	\$4.50

$$\begin{aligned} 7.5x+2.5(x+2)&=4.5(2x+2)\\ 7.5x+2.5x+5&=9x+9\\ x&=4 \end{aligned}$$

Sayem purchased 4 pounds of cashews and 6 pounds of peanuts.

Ponder Does our answer seem reasonable? Yes. The total cost of the cashews is $4(\$7.50)=\$30$ and the total cost of the peanuts is $6(\$2.50)=\$15$. Therefore, the total cost for the nuts is $\$30+\$15=\$45$. The cost of the mix is $(2(4)+2)(\$4.50)=\$45$. Since the cost for the mix is the same as the total cost of the nuts, our answer is correct.

128. Prepare We are to determine how much Shannon invested at each of two simple interest rates.

Plan We will set up a chart to organize the information given in the problem. We will then use this information to write and solve a linear equation with one variable.

Process Let p represent the amount invested at 8% interest.

	$P\bullet r\bullet t=I$			
8% Investment	p	0.08	1	$I_1=0.08p$
9% Investment	$8,000-p$	0.09	1	$I_2=0.09(8,000-p)$

$$\begin{aligned} I_1 + I_2 &= 690 \\ 0.08p + 0.09(8{,}000 - p) &= 690 \\ 0.08p + 720 - 0.09p &= 690 \\ -0.01p &= -30 \\ p &= 3{,}000 \end{aligned}$$

Shannon invested \$3,000 at 8% interest and \$5,000 at 9% interest.

Ponder Does our answer seem reasonable? Yes. The interest earned at 8% is $0.08(3{,}000) = \$240$, and the interest earned at 9% is $0.09(5{,}000) = \$450$. The sum of the interest from the two investments is $\$240 + \$450 = \$690$.

CHAPTER 2 TEST

1. c, e, j

2. e

3. h

4. a, f, g, i

5. b, d

6.
$$\begin{aligned} -3(x+4)+7 &= 5x+11 \\ -3x-12+7 &= 5x+11 \\ -3x-5 &= 5x+11 \\ -3x-5x-5 &= 5x-5x+11 \\ -8x-5 &= 11 \\ -8x-5+5 &= 11+5 \\ -8x &= 16 \\ \frac{-8x}{-8} &= \frac{16}{-8} \\ x &= -2 \end{aligned}$$
$$\{-2\}$$

7.
$$\begin{aligned} \frac{3}{2}t+\frac{1}{5} &= -\frac{2}{5} \\ 10\left(\frac{3}{2}t+\frac{1}{5}\right) &= 10\left(-\frac{2}{5}\right) \\ 15t+2 &= -4 \\ 15t+2-2 &= -4-2 \\ 15t &= -6 \\ \frac{15t}{15} &= \frac{-6}{15} \\ t &= -\frac{2}{5} \end{aligned}$$
$$\left\{-\frac{2}{5}\right\}$$

8.
$$\begin{aligned} \frac{x-2}{3}-\frac{x+5}{2} &= \frac{1}{6} \\ 6\left(\frac{x-2}{3}-\frac{x+5}{2}\right) &= 6\left(\frac{1}{6}\right) \\ 2x-4-3x-15 &= 1 \\ -x-19 &= 1 \\ -x-19+19 &= 1+19 \\ -x &= 20 \\ \frac{-x}{-1} &= \frac{20}{-1} \\ x &= -20 \end{aligned}$$
$$\{-20\}$$

9.
$$|3x+5| = 26$$

$3x+5 = 26$ or $3x+5 = -26$

$3x+5-5 = 26-5$ $\qquad$ $3x+5-5 = -26-5$

$3x = 21$ $\qquad$ $3x = -31$

$\frac{3x}{3} = \frac{21}{3}$ $\qquad$ $\frac{3x}{3} = \frac{-31}{3}$

$x = 7$ $\qquad$ $x = -\frac{31}{3}$

$$\left\{-\frac{31}{3}, 7\right\}$$

10.
$$\left|6-\frac{1}{2}x\right|+8 = 0$$
$$\left|6-\frac{1}{2}x\right|+8-8 = 0-8$$
$$\left|6-\frac{1}{2}x\right| = -8$$
$$\{\ \}$$

11.
$$\begin{aligned} 0.05x+0.25(3x-5) &= 10.75 \\ 0.05b+0.75b-1.25 &= 10.75 \\ 0.8b-1.25 &= 10.75 \\ 100(0.8b-1.25) &= 100(10.75) \\ 80b-125 &= 1075 \\ 80b-125+125 &= 1075+125 \\ 80b &= 1200 \\ \frac{80b}{80} &= \frac{1200}{80} \\ b &= 15 \end{aligned}$$
$$\{15\}$$

12.
$$5x-8y=16$$
$$5x-5x-8y=16-5x$$
$$-8y=16-5x$$
$$\frac{-8y}{-8}=\frac{16-5x}{-8}$$
$$y=\frac{16-5x}{-8}$$
$$\text{or}\quad y=\frac{16}{-8}-\frac{5x}{-8}$$
$$y=\frac{5}{8}x-2$$

13.
$$A=\frac{1}{2}h(a+b)$$
$$2A=2\left(\frac{1}{2}h(a+b)\right)$$
$$2A=h(a+b)$$
$$2A=ah+bh$$
$$2A-bh=ah+bh-bh$$
$$2A-bh=ah+0$$
$$2A-bh=ah$$
$$\frac{2A-bh}{h}=\frac{ah}{h}$$
$$\frac{2A-bh}{h}=a$$
$$a=\frac{2A-bh}{h}$$
$$a=\frac{2A}{h}-\frac{bh}{h}$$
$$a=\frac{2A}{h}-b$$

14.
$$-\frac{7}{5}x>\frac{14}{25}$$
$$-\frac{5}{7}\left(-\frac{7}{5}x\right)<-\frac{5}{7}\left(\frac{14}{25}\right)$$
$$x<-\frac{2}{5}$$
$$\left(-\infty,-\frac{2}{5}\right)$$

15.
$$-5(x+7)-4\ge 3x-(x+4)$$
$$-5x-35-4\ge 3x-x-4$$
$$-5x-39\ge 2x-4$$
$$-5x-2x-39\ge 2x-2x-4$$
$$-7x-39\ge -4$$
$$-7x-39+39\ge -4+39$$
$$-7x\ge 35$$
$$\frac{-7x}{-7}\le\frac{35}{-7}$$
$$x\le -5$$
$$(-\infty,-5]$$

16.
$$-410\le 80x-10<230$$
$$-410+10\le 80x-10+10<230+10$$
$$-400\le 80x<240$$
$$\frac{-400}{80}\le\frac{80x}{80}<\frac{240}{80}$$
$$-5\le x<3$$
$$[-5,3)$$

17.

$7x+3>9$	and	$-5x\ge -25$
$7x+3-3>9-3$		$\frac{-5x}{-5}\le\frac{-25}{-5}$
$7x>6$		$x\le 5$
$\frac{7x}{7}>\frac{6}{7}$		
$x>\frac{6}{7}$		$\left(\frac{6}{7},5\right]$

18.

$3x+5<-7$	or	$6>-2(x-3)$
$3x+5-5<-7-5$		$6>-2x+6$
$3x<-12$		$6+2x>-2x+2x+6$
$\frac{3x}{3}<\frac{-12}{3}$		$6+2x>6$
$x<-4$		$6-6+2x>6-6$
		$2x>0$
$(-\infty,-4)\cup(0,\infty)$		$\frac{2x}{2}>\frac{0}{2}$
		$x>0$

19.
$$|7-8x|<21$$
$$-21<7-8x<21$$
$$-21-7<7-7-8x<21-7$$
$$-28<-8x<14$$
$$\frac{-28}{-8}>\frac{-8x}{-8}>\frac{14}{-8}$$
$$\frac{7}{2}>x>-\frac{7}{4}$$
$$-\frac{7}{4}<x<\frac{7}{2}$$
$$\left(-\frac{7}{4},\frac{7}{2}\right)$$

20.
$$\left|\frac{x-4}{3}\right|+5\ge 7$$
$$\left|\frac{x-4}{3}\right|+5-5\ge 7-5$$
$$\left|\frac{x-4}{3}\right|\ge 2$$

$$\frac{x-4}{3}\le -2 \quad \text{or} \quad \frac{x-4}{3}\ge 2$$
$$3\left(\frac{x-4}{3}\right)\le 3(-2) \qquad 3\left(\frac{x-4}{3}\right)\ge 3(2)$$
$$x-4\le -6 \qquad x-4\ge 6$$
$$x-4+4\le -6+4 \qquad x-4+4\ge 6+4$$
$$x\le -2 \qquad x\ge 10$$

$$(-\infty,-2]\cup[10,\infty)$$

21.
$$\left|\frac{3}{5}x+1\right|+4>2$$
$$\left|\frac{3}{5}x+1\right|+4-4>2-4$$
$$\left|\frac{3}{5}x+1\right|>-2$$
$$(-\infty,\infty)$$

22. Let x represent the unknown number.

$$2x-5=3(x+2)$$
$$2x-5=3x+6$$
$$2x-3x-5=3x-3x+6$$
$$-x-5=6$$
$$-x-5+5=6+5$$
$$-x=11$$
$$\frac{-x}{-1}=\frac{11}{-1}$$
$$x=-11$$
$$\{-11\}$$

The number is -11.

23. Use the formula $D=RT$.

$D=56\frac{1}{4}$ miles

$R=75$ miles per hour

$T=$ unknown hours

$$D=RT$$
$$56\frac{1}{4}=75T$$
$$\frac{225}{4}=75T$$
$$\frac{225}{4}\div 75=75T\div 75$$
$$\frac{3}{4}=T$$
$$\left\{\frac{3}{4}\right\}$$

Sheila drove for $\frac{3}{4}$ of an hour or 45 minutes.

24. Prepare We are to find the amount of money invested in each of two mutual funds, given the total amount to be invested and the interest rate of each mutual fund.

Plan We must understand how to calculate the interest earned from each mutual fund. This is accomplished by multiplying the amount invested in the account by the interest rate (which must first be converted into decimal form).

Process Make a chart using the formula, $I=\Pr t$.

Investment	*P*	*r*	*t*	*I*
7.5%	x	0.075	1	$0.075x$
5%	$8000-x$	0.05	1	$0.05(8000-x)$

The total interest earned from both accounts is the sum of the interest earned from each account. We can now write the equation and solve.

$$\begin{aligned} 0.075x+0.05(8000-x) &= 537.5 \\ 0.075x+400-0.05x &= 537.5 \\ 0.025x+400 &= 537.5 \\ 0.025x+400-400 &= 537.5-400 \\ 0.025x &= 137.5 \\ \frac{0.025x}{0.025} &= \frac{137.5}{0.025} \\ x &= 5500 \end{aligned}$$

The amount invested at 7.5% is \$5,500.
The amount invested at 5% is \$2,500.

Ponder Are the amounts reasonable, that is, is their sum \$8,000 and is the total interest earned \$537.50? The sum of the two amounts, $5500+2500$ is \$8,000. The interest earned at 7.5% interest is $(0.075)(5500)$ which is \$412.50 and the interest earned at 5% is $(0.05)(2500)$ which is \$125. The sum of the interest is $412.50+125$ which is equal to \$537.50.

25. Prepare We are to find the grade that Ignacio must make on his final exam in order to make an A for the semester, given the scores for exams 1, 2, and 4 and given that the final exam will replace the grade from exam 3.

Plan We must understand how to calculate the average grade for the semester and that this average must be large enough to receive an A for the course.

Process Let $x=$ the grade that Ignacio must receive on the final exam in order to receive an A for the semester. Since all the exam grades will weigh equally, we simply add up all the exam grades and divide the sum by 5. In order for Ignacio to receive an A, this average must equal at least 90.

$$\begin{aligned} \frac{84+92+x+88+x}{5} &\geq 90 \\ \frac{2x+264}{5} &\geq 90 \\ 5\left(\frac{2x+264}{5}\right) &\geq 5(90) \\ 2x+264 &\geq 450 \\ 2x+264-264 &\geq 450-264 \\ 2x &\geq 186 \\ \frac{2x}{2} &\geq \frac{186}{2} \\ x &\geq 93 \end{aligned}$$

Ignacio must make a 93 or better on the final exam in order to earn an A for the semester.

Ponder Is this grade reasonable? We simply need to use this grade to compute Ignacio's average. We must also remember that the final exam grade will also replace the grade for exam 3.

$$\begin{aligned} \frac{84+92+93+88+93}{5} &= \frac{450}{5} \\ &= 90 \end{aligned}$$

Since the average of the 5 exam grades is 90, Ignacio will receive an A for the semester.