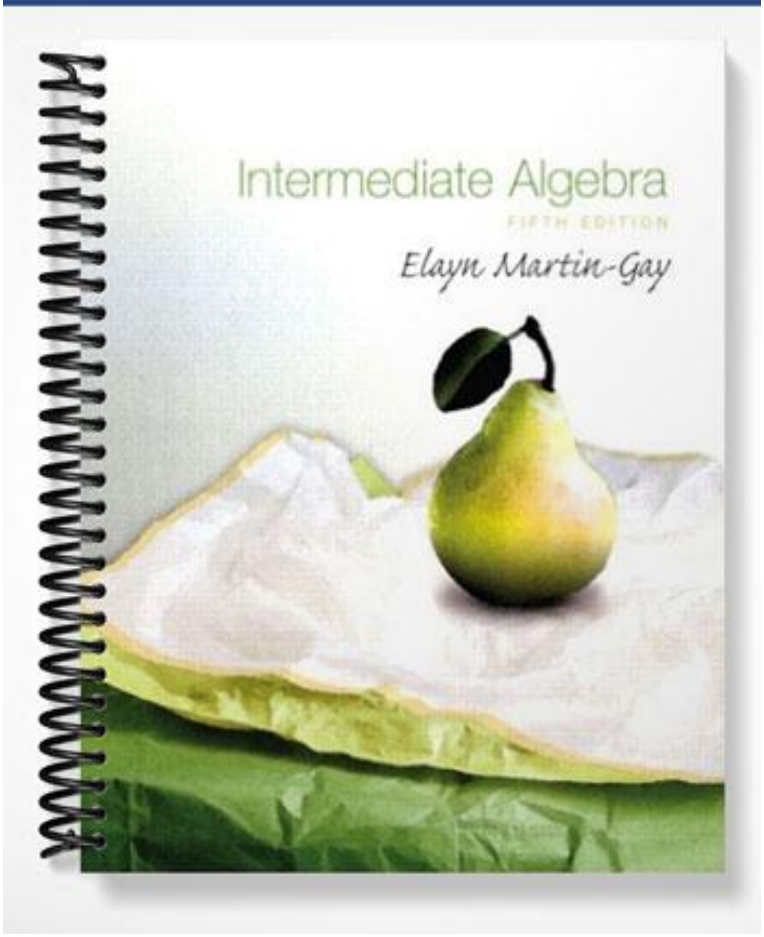
SOLUTIONS MANUAL



Chapter 2

Section 2.1

Practice Exercises

1.
$$\begin{aligned} 3x+7&=22\\ 3x+7-7&=22-7\\ 3x&=15\\ \frac{3x}{3}&=\frac{15}{3}\\ x&=5 \end{aligned}$$

2.
$$\begin{aligned} 2.5&=3-2.5t\\ 2.5-3&=3-2.5t-3\\ -0.5&=-2.5t\\ \frac{-0.5}{-2.5}&=\frac{-2.5t}{-2.5}\\ 0.2&=t \end{aligned}$$

3.
$$\begin{aligned} -8x-4+6x&=5x+11-4x\\ -2x-4&=x+11\\ -2x-4-x&=x+11-x\\ -3x-4&=11\\ -3x-4+4&=11+4\\ -3x&=15\\ \frac{-3x}{-3}&=\frac{15}{-3}\\ x&=-5 \end{aligned}$$

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

5.
$$\begin{aligned} \frac{y}{2}-\frac{y}{5}&=\frac{1}{4}\\ 20\left(\frac{y}{2}-\frac{y}{5}\right)&=20\left(\frac{1}{4}\right)\\ 20\left(\frac{y}{2}\right)-20\left(\frac{y}{5}\right)&=5\\ 10y-4y&=5\\ 6y&=5\\ \frac{6y}{6}&=\frac{5}{6}\\ y&=\frac{5}{6} \end{aligned}$$

6.
$$\begin{aligned} x-\frac{x-2}{12}&=\frac{x+3}{4}+\frac{1}{4}\\ 12\left(x-\frac{x-2}{12}\right)&=12\left(\frac{x+3}{4}+\frac{1}{4}\right)\\ 12\cdot x-12\left(\frac{x-2}{12}\right)&=12\left(\frac{x+3}{4}\right)+12\cdot\frac{1}{4}\\ 12x-(x-2)&=3(x+3)+3\\ 12x-x+2&=3x+9+3\\ 11x+2&=3x+12\\ 11x+2-3x&=3x+12-3x\\ 8x+2&=12\\ 8x+2-2&=12-2\\ 8x&=10\\ \frac{8x}{8}&=\frac{10}{8}\\ x&=\frac{5}{4} \end{aligned}$$

7.
$$\begin{aligned} 0.15x-0.03&=0.2x+0.12\\ 100(0.15x-0.03)&=100(0.2x+0.12)\\ 100(0.15x)-100(0.03)&=100(0.2x)+100(0.12)\\ 15x-3&=20x+12\\ 15x-20x&=12+3\\ -5x&=15\\ \frac{-5x}{-5}&=\frac{15}{-5}\\ x&=-3 \end{aligned}$$

8.
$$\begin{aligned} 4x-3&=4(x+5)\\ 4x-3&=4x+20\\ 4x-3-4x&=4x+20-4x\\ -3&=20 \end{aligned}$$

This equation is false no matter what value the variable x might have. Thus, there is no solution. The solution set is { } or $\varnothing$.

9. $5x-2=3+5(x-1)$
$5x-2=3+5x-5$
$5x-2=-2+5x$
$5x-2+2=-2+5x+2$
$5x=5x$
$5x-5x=5x-5x$
$0=0$
Since 0 = 0 is a true statement for every value of x, all real numbers are solutions. The solution set is $\{x|x \text{ is a real number}\}$.

Vocabulary and Readiness Check

1. Equations with the same solution set are called equivalent equations.

2. A value for the variable in an equation that makes the equation a true statement is called a solution of the equation.

3. By the addition property of equality, $y = -3$ and $y - 7 = -3 - 7$ are equivalent equations.

4. By the multiplication property of equality, $2y = -3$ and $\frac{2y}{2}=\frac{-3}{2}$ are equivalent equations.

5. $\frac{1}{3}x-5$ expression

6. $2(x-3)=7$ equation

7. $\frac{5}{9}x+\frac{1}{3}=\frac{2}{9}-x$ equation

8. $\frac{5}{9}x+\frac{1}{3}-\frac{2}{9}-x$ expression

9. $2x + 3 = 2x + 3$
Since the two sides of the equation are identical, the equation is true for any value of x. All real numbers are solutions.

10. $2x + 1 = 2x + 3$
Adding 1 to a number and adding 3 to the same number will not result in equal numbers for any value of x. There is no solution.

11. $5x - 2 = 5x - 7$
Subtracting 2 from a number and subtracting 7 from the same number will not result in equal numbers for any value of x. There is no solution.

12. $5x - 3 = 5x - 3$
Since the two sides of the equation are identical, the equation is true for any value of x. All real numbers are solutions.

Exercise Set 2.1

2. $-2x=18$
$\frac{-2x}{-2}=\frac{18}{-2}$
$x=-9$
Check: $-2x=18$
$-2(-9)\stackrel{?}{=}18$
$18=18$ True
The solution is −9.

4. $-25=y+30$
$-25-30=y+30-30$
$-55=y$
Check: $-25=y+30$
$-25\stackrel{?}{=}-55+30$
$-25=-25$ True
The solution is −55.

6. $y-8.6=-6.3$
$y-8.6+8.6=-6.3+8.6$
$y=2.3$
Check: $y-8.6=-6.3$
$2.3-8.6\stackrel{?}{=}-6.3$
$-6.3=-6.3$ True
The solution is 2.3.

8. $5y-3=11+3y$
$5y-3y=11+3$
$2y=14$
$\frac{2y}{2}=\frac{14}{2}$
$y=7$
Check: $5y-3=11+3y$
$5(7)-3\stackrel{?}{=}11+3(7)$
$35-3\stackrel{?}{=}11+21$
$32=32$ True
The solution is 7.

10. $10.3-6x=-2.3$
$10.3-6x-10.3=-2.3-10.3$
$-6x=-12.6$
$\frac{-6x}{-6}=\frac{-12.6}{-6}$
$x=2.1$

Check: $10.3-6x=-2.3$
$10.3-6(2.1) \stackrel{?}{=} -2.3$
$10.3-12.6 \stackrel{?}{=} -2.3$
$-2.3=-2.3$ True
The solution is 2.1.

12. $4x+14=6x+8$
$4x-6x=8-14$
$-2x=-6$
$\frac{-2x}{-2}=\frac{-6}{-2}$
$x=3$
Check: $4x+14=6x+8$
$4(3)+14 \stackrel{?}{=} 6(3)+8$
$12+14 \stackrel{?}{=} 18+8$
$26=26$ True
The solution is 3.

14. $13x-15x+8=4x+2-24$
$-2x+8=4x-22$
$-2x-4x=-22-8$
$-6x=-30$
$x=5$
Check: $13x-15x+8=4x+2-24$
$13(5)-15(5)+8 \stackrel{?}{=} 4(5)+2-24$
$65-75+8 \stackrel{?}{=} 20+2-24$
$-2=-2$ True
The solution is 5.

16. $6+3x+x=-x+8-26+24$
$6+4x=-x+6$
$5x=0$
$x=0$
Check: $6+3x+x=-x+8-26+24$
$6+3(0)+0 \stackrel{?}{=} -0+8-26+24$
$6=6$ True
The solution is 0.

18. $2(4x+3)=7x+5$
$8x+6=7x+5$
$x+6=5$
$x=-1$
Check: $2(4x+3)=7x+5$
$2(4(-1)+3) \stackrel{?}{=} 7(-1)+5$
$2(-1) \stackrel{?}{=} -7+5$
$-2=-2$ True
The solution is -1.

20. $6x=4(x-5)$
$6x=4x-20$
$2x=-20$
$x=-10$
Check: $6x=4(x-5)$
$6(-10) \stackrel{?}{=} 4(-10-5)$
$-60 \stackrel{?}{=} 4(-15)$
$-60=-60$ True
The solution is -10.

22. $-4(3n-2)-n=-11(n-1)$
$-12n+8-n=-11n+11$
$-13n+8=-11n+11$
$-13n+11n=11-8$
$-2n=3$
$n=-\frac{3}{2}$
Check:
$-4(3n-2)-n=-11(n-1)$
$-4\left(3\cdot\left(-\frac{3}{2}\right)-2\right)-\left(-\frac{3}{2}\right) \stackrel{?}{=} -11\left(-\frac{3}{2}-1\right)$
$-4\left(-\frac{13}{2}\right)+\frac{3}{2} \stackrel{?}{=} -11\left(-\frac{5}{2}\right)$
$\frac{55}{2}=\frac{55}{2}$ True
The solution is $-\frac{3}{2}$.

24. $\frac{x}{2}+\frac{x}{5}=\frac{5}{4}$
$20\left(\frac{x}{2}+\frac{x}{5}\right)=20\left(\frac{5}{4}\right)$
$10x+4x=25$
$14x=25$
$x=\frac{25}{14}$
Check: $\frac{x}{2}+\frac{x}{5}=\frac{5}{4}$
$\frac{25}{14}\cdot\frac{1}{2}+\frac{25}{14}\cdot\frac{1}{5} \stackrel{?}{=} \frac{5}{4}$
$\frac{25}{28}+\frac{5}{14} \stackrel{?}{=} \frac{5}{4}$
$\frac{5}{4}=\frac{5}{4}$ True
The solution is $\frac{25}{14}$.

26. $\frac{4r}{5}-\frac{r}{10}=7$

$10\left(\frac{4r}{5}-\frac{r}{10}\right)=10(7)$

$2(4r)-r=70$

$8r-r=70$

$7r=70$

$r=10$

Check: $\frac{4r}{5}-\frac{r}{10}=7$

$\frac{4(10)}{5}-\frac{10}{10}\stackrel{?}{=}7$

$8-1\stackrel{?}{=}7$

$7=7$ True

The solution is 10.

28. $\frac{2+h}{9}+\frac{h-1}{3}=\frac{1}{3}$

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

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

$2+h+3h-3=3$

$4h-1=3$

$4h=4$

$h=1$

Check: $\frac{2+h}{9}+\frac{h-1}{3}=\frac{1}{3}$

$\frac{2+1}{9}+\frac{1-1}{3}\stackrel{?}{=}\frac{1}{3}$

$\frac{3}{9}+\frac{0}{3}\stackrel{?}{=}\frac{1}{3}$

$\frac{1}{3}=\frac{1}{3}$ True

The solution is 1.

30. $0.3x+2.4=0.1x+4$

$10(0.3x+2.4)=10(0.1x+4)$

$3x+24=1x+40$

$2x=16$

$x=8$

Check: $0.3x+2.4=0.1x+4$

$0.3(8)+2.4\stackrel{?}{=}0.1(8)+4$

$2.4+2.4\stackrel{?}{=}0.8+4$

$4.8=4.8$ True

The solution is 8.

32. $\frac{2z+7}{8}-2=z+\frac{z-1}{2}$

$8\left(\frac{2z+7}{8}-2\right)=8\left(z+\frac{z-1}{2}\right)$

$2z+7-16=8z+4(z-1)$

$2z+7-16=8z+4z-4$

$2z-9=12z-4$

$-10z=5$

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

Check: $\frac{2z+7}{8}-2=z+\frac{z-1}{2}$

$\frac{2\left(-\frac{1}{2}\right)+7}{8}-2\stackrel{?}{=}-\frac{1}{2}+\frac{-\frac{1}{2}-1}{2}$

$\frac{6}{8}-2\stackrel{?}{=}-\frac{1}{2}-\frac{3}{4}$

$-\frac{5}{4}=-\frac{5}{4}$ True

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

34. $2.4(2x+3)=-0.1(2x+3)$

$10[2.4(2x+3)]=10[-0.1(2x+3)]$

$48x+72=-2x-3$

$50x=-75$

$x=-1.5$

Check: $2.4(2x+3)=-0.1(2x+3)$

$2.4(2(-1.5)+3)\stackrel{?}{=}-0.1(2(-1.5)+3)$

$2.4(-3+3)\stackrel{?}{=}-0.1(-3+3)$

$2.4(0)\stackrel{?}{=}-0.1(0)$

$0=0$ True

The solution is -1.5.

36. $6(4n+4)=8(3+3n)$

$24n+24=24+24n$

$24n+24-24n=24+24n-24n$

$24=24$

$0=0$

Therefore, all real numbers are solutions.

38. $4(x+2)+4=4x-8$

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

$4x+12=4x-8$

$12=-8$

This is false for any x. Therefore, no solution exists, $\varnothing$.

40. $5(x-4)+x=6(x-2)-8$
$5x-20+x=6x-12-8$
$6x-20=6x-20$
$-20=-20$
This is true for all x. Therefore, all real numbers are solutions.

42. $9(x-2)=8(x-3)+x$
$9x-18=8x-24+x$
$9x-18=9x-24$
$-18=-24$
This is false for any x. Therefore, no solution exists, $\varnothing$.

44. $\frac{a}{2}+\frac{7}{4}=5$
$4\left(\frac{a}{2}+\frac{7}{4}\right)=4\cdot 5$
$2a+7=20$
$2a=13$
$a=\frac{13}{2}$

46. $4x-7=2x-7$
$4x-2x=-7+7$
$2x=0$
$x=0$

48. $3x+2(x+4)=5(x+1)+3$
$3x+2x+8=5x+5+3$
$5x+8=5x+8$
$0=0$
Therefore, all real numbers are solutions.

50. $-(w+0.2)=0.3(4-w)$
$-w-0.2=1.2-0.3w$
$-w+0.3w=1.2+0.2$
$-0.7w=1.4$
$w=-2$

52. $\frac{1}{3}(8+2c)=\frac{1}{5}(3c-5)$
$\frac{8}{3}+\frac{2}{3}c=\frac{3}{5}c-1$
$\frac{8}{3}+1=\frac{3}{5}c-\frac{2}{3}c$
$\frac{8}{3}+\frac{3}{3}=\frac{9}{15}c-\frac{10}{15}c$
$\frac{11}{3}=-\frac{1}{15}c$
$-\frac{15}{1}\cdot\frac{11}{3}=c$
$-55=c$

54. $9c-3(6-5c)=c-2(3c+9)$
$9c-18+15c=c-6c-18$
$24c-18=-5c-18$
$24c+5c=-18+18$
$29c=0$
$c=0$

56. $10x-2(x+4)=8(x-2)+6$
$10x-2x-8=8x-16+6$
$8x-8=8x-10$
$8x-8x=-10+8$
$0=-2$
This is false for any x. Therefore, the solution set is $\varnothing$.

58. $\frac{n+1}{8}-\frac{2-n}{3}=\frac{5}{6}$
$24\left(\frac{n+1}{8}-\frac{2-n}{3}\right)=24\left(\frac{5}{6}\right)$
$3(n+1)-8(2-n)=4(5)$
$3n+3-16+8n=20$
$11n-13=20$
$11n=33$
$n=3$

60. $10y-18-4y=12y-13$
$6y-18=12y-13$
$6y-12y=-13+18$
$-6y=5$
$y=-\frac{5}{6}$

62. $-4(2x-3)-(10x+7)-2=-(12x-5)-(4x+9)-1$

$-8x+12-10x-7-2=-12x+5-4x-9-1$

$-18x+3=-16x-5$

$-2x=-8$

$x=4$

64. $\frac{1}{5}(2y-1)-2=\frac{1}{2}(3y-5)+3$

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

$2(2y-1)-20=5(3y-5)+30$

$4y-22=15y+5$

$-11y=27$

$y=-\frac{27}{11}$

66. $3[8-4(n-2)]+5n=-20+2[5(1-n)-6n]$

$3[8-4n+8]+5n=-20+2[5-5n-6n]$

$3(16-4n)+5n=-20+2(5-11n)$

$48-12n+5n=-20+10-22n$

$48-7n=-10-22n$

$15n=-58$

$n=-\frac{58}{15}$

68. Sum means to add: The sum of 8 and a number: $8+x$

70. The difference means to subtract. The difference of 8 and a number: $8-x$

72. Two more than three times a number: $3x+2$

74. $-3(-4)=12$ not -12;

$-3(x-4)=10$

$-3x+12=10$

$-3x=-2$

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

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

76. $3\left(\frac{x}{3}+7\right)=x+21;$

$$\frac{x}{3}+7=\frac{5x}{3}$$
$$3\left(\frac{x}{3}+7\right)=3\left(\frac{5x}{3}\right)$$
$$x+21=5x$$
$$21=4x$$
$$\frac{21}{4}=\frac{4x}{4}$$
$$\frac{21}{4}=x$$

78. Answers may vary

80. Answers may vary

82. $-7.6y-10=-1.1y+12$

$$-7.6y=-1.1y+22$$

From this we see that $K = 22$.

84. $$\frac{x}{6}+4=\frac{x}{3}$$
$$6\left(\frac{x}{6}+4\right)=6\left(\frac{x}{3}\right)$$
$$x+24=2x$$

From this we see that $K = 24$.

86. Answers may vary

88. $7x^2+2x-3=6x(x+4)+x^2$

$$7x^2+2x-3=6x^2+24x+x^2$$
$$7x^2+2x-3=7x^2+24x$$
$$2x-3=24x$$
$$-3=22x$$
$$x=-\frac{3}{22}$$

90. $x(x+1)+16=x(x+5)$

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

92. $-9.112y=-47.537304$

$$y=5.217$$

Check: $-9.112y=-47.537304$

$$-9.112(5.217)\stackrel{?}{=}-47.537304$$
$$-47.537304=-47.537304 \quad \text{True}$$

94. $1.25x - 20.175 = -8.15$

$1.25x = -8.15 + 20.175$

$1.25x = 12.025$

$x = 9.62$

Check: $1.25x - 20.175 = -8.15$

$1.25(9.62) - 20.175 \stackrel{?}{=} -8.15$

$-8.15 = -8.15$ True

Section 2.2

Practice Exercises

1. a. In words:

first integer	plus	second odd integer	plus	third odd integer
↓	↓	↓	↓	↓
x	+	$(x + 2)$	+	$(x + 4)$

Translate:

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

b. In words:

side	+	side	+	side	+	side
↓	↓	↓	↓	↓	↓	↓
x	+	$2x$	+	$(x + 2)$	+	$(2x - 3)$

Translate:

Then $x + 2x + (x + 2) + (2x - 3) = x + 2x + x + 2 + 2x - 3 = 6x - 1$

2. If x = number of arrivals and departures at Frankfurt airport,
then $x + 15.7$ = number at London, and $x + 1.6$ = number at Paris.

In words:

number at Frankfurt	+	number at London	+	number at Paris
↓	↓	↓	↓	↓
x	+	$(x + 15.7)$	+	$(x + 1.6)$

Translate:

Then $x + (x + 15.7) + (x + 1.6) = x + x + 15.7 + x + 1.6 = 3x + 17.3$

3. Let x = the first number, then $3x - 8$ = the second number, and $5x$ = the third number.
The sum of the three numbers is 118.

$x + (3x - 8) + 5x = 118$

$x + 3x + 5x - 8 = 118$

$9x - 8 = 118$

$9x = 126$

$x = 14$

The numbers are 14, $3x - 8 = 3(14) - 8 = 34$, and $5x = 5(14) = 70$.

4. Let x = the original price. Then $0.4x$ = the discount. The original price, minus the discount, is equal to \$270.

$x - 0.4x = 270$

$0.6x = 270$

$x = \dfrac{270}{0.6} = 450$

The original price was \$450.

5. Let x = width, then $2x - 16$ = length.
The perimeter is 160 inches.

$$2(x) + 2(2x - 16) = 160$$
$$2x + 4x - 32 = 160$$
$$6x - 32 = 160$$
$$6x = 192$$
$$x = 32$$

$2x - 16 = 2(32) - 16 = 48$
The width is 32 inches and the length is 48 inches.

6. Let x = first odd integer, then $x + 2$ = second odd integer, and $x + 4$ = third odd integer.
The sum of the integers is 81.

$$x + (x + 2) + (x + 4) = 81$$
$$3x + 6 = 81$$
$$3x = 75$$
$$x = 25$$

$x + 2 = 27$
$x + 4 = 29$
The integers are 25, 27, and 29.

Vocabulary and Readiness Check

1. 130% of a number __>__ the number.

2. 70% of a number __<__ the number.

3. 100% of a number __=__ the number.

4. 200% of a number __>__ the number.

	First Integer	All Described Integers
5. Four consecutive integers	31	31, 32, 33, 34
6. Three consecutive odd integers	31	31, 33, 35
7. Three consecutive even integers	18	18, 20, 22
8. Four consecutive even integers	92	92, 94, 96, 98
9. Three consecutive integers	y	y, $y + 1$, $y + 2$
10. Three consecutive even integers	z(z is even)	z, $z + 2$, $z + 4$
11. Four consecutive integers	p	p, $p + 1$, $p + 2$, $p + 3$
12. Three consecutive odd integers	s (s is odd)	s, $s + 2$, $s + 4$

Exercise Set 2.2

2. The perimeter is the sum of the lengths of the four sides.
$$x+(x-5)+x+(x-5)=x+x+x+x-5-5$$
$$=4x-10$$

4. Let x = first odd integer, then
$x + 2$ = second odd integer, and
$x + 4$ = third odd integer.
$$x+(x+2)+(x+4)=x+x+x+2+4=3x+6$$

6. Find the sum of y quarters worth 25¢ each, $7y$ dimes worth 10¢ each, and $(2y - 1)$ nickels worth 5¢ each.
$$25y+10(7y)+5(2y-1)=25y+70y+10y-5$$
$$=105y-5$$
The total amount is $(105y - 5)$ cents.

8. $4x + 5(3x - 15) = 4x + 15x - 75 = 19x - 75$

10. The length of the side denoted by ? is $18 - 10 = 8$. Similarly, the length of the unmarked side is
$(x + 14) - (x + 8) = x + 14 - x - 8 = 6$.
The perimeter of the floor plan is
$18 + (x + 8) + 10 + 6 + 8 + (x + 14) = 2x + 64$

12. Let x = the number.
$$2(x+3)=5x-1-4x$$
$$2x+6=x-1$$
$$x=-7$$
The number is −7.

14. Let x = the first number, then
$x - 6$ = the second number, and
$2x$ = the third number.
$$x+(x-6)+2x=306$$
$$4x-6=306$$
$$4x=312$$
$$x=78$$
$x - 6 = 72$
$2x = 156$
The numbers are 78, 72, and 156.

16. $90\% \cdot 70 = 0.90 \cdot 70 = 63$
$70 - 63 = 7$
7 million acres are not federally owned.

18. 25.5% of $958 = 0.255 \cdot 958 \approx 244$
Approximately 244 tornadoes occurred during April 2006.

20. 9.1% of $17{,}029{,}300 = 0.091 \cdot 17{,}029{,}300$
$$\approx 1{,}549{,}666$$
Approximately 1,549,666 worked in the restaurant and food service industry in California.

22. Look for the largest sector, which is 55%. 15–60 minutes is the most common time spent on e-mail per day.

24. 9% of $278 = 0.09 \cdot 278 = 25.02$
About 25 employees spend between 2 and 3 hours per day using e-mail.

26. Let x = average cost in 2005.
$$x+0.068x=96.73$$
$$1.068x=96.73$$
$$x\approx 90.57$$
The average hotel room cost in 2005 was $90.57.

28. $3x + x + (x + 10) = 180$
$$5x+10=180$$
$$5x=170$$
$$x=34$$
$3x = 3(34) = 102$
$x + 10 = 34 + 10 = 44$
The angles measure 34°, 44°, and 102°.

30. $(2x) + (3.5x) + (3x + 7) = 75$
$$8.5x+7=75$$
$$8.5x=68$$
$$x=8$$
$2x = 2(8) = 16$
$3.5x = 3.5(8) = 28$
$3x + 7 = 3(8) + 7 = 31$
The sides measure 16 centimeters, 28 centimeters, and 31 centimeters.

32. $7.3x + (9.2x - 3) + 7.3x + (9.2x - 3) = 324$
$$33x-6=324$$
$$33x=330$$
$$x=10$$
$7.3x = 7.3(10) = 73$
$9.2x - 3 = 9.2(10) - 3 = 89$
The sides measure 73 feet, 73 feet, 89 feet, and 89 feet.

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

$$x + x + 2 + x + 4 = 327$$
$$3x + 6 = 327$$
$$3x = 321$$
$$x = 107$$

The numbers are 107, 109, 111.

36. Let x = first integer, then
$x + 1$ = second integer, and
$x + 2$ = third integer.

$$x + (x + 1) + 3(x + 2) = 2637$$
$$x + x + 1 + 3x + 6 = 2637$$
$$5x + 7 = 2637$$
$$5x = 2630$$
$$x = 526$$

$x + 1 = 527$
$x + 2 = 528$
The score for Alabama was 526, for Louisiana was 527, and for Michigan was 528.

38. $\left(\frac{3}{2}x + 1\right) + x + (x - 1) = 105$

$$\frac{7}{2}x = 105$$
$$x = 105 \cdot \frac{2}{7}$$
$$x = 30$$

$\frac{3}{2}x + 1 = \frac{3}{2}(30) + 1 = 46$
$x - 1 = 30 - 1 = 29$

Occupation	**Percent Increase in Number of Jobs from 2000 to 2012**
Computer software engineers	46%
Management analysts	30%
Receptionist and information clerks	29%
Total	105%

40. Let x = thousands of fishers, then
$2x + 8$ = thousands of telephone operators, and
$10x - 1$ = thousands of sewing machine operators

$$x + (2x + 8) + (10x - 1) = 137$$
$$13x + 7 = 137$$
$$13x = 130$$
$$x = 10$$

$2x + 8 = 2(10) + 8 = 28$
$10x - 1 = 10(10) - 1 = 99$
The declines are as follows:
telephone operators: 28 thousand;
sewing machine operators: 99 thousand;
fishers: 10 thousand.

42. Let x = NY governor's salary, then
$x + 27{,}500$ = CA governor's salary, and
$x + 27{,}500 - 120{,}724$ = AK governor's salary.

$$x + (x + 27{,}500) + (x + 27{,}500 - 120{,}724) = 471{,}276$$
$$3x - 65{,}724 = 471{,}276$$
$$3x = 537{,}000$$
$$x = 179{,}000$$

$x + 27{,}500 = 206{,}500$
$x + 27{,}500 - 120{,}724 = 85{,}776$
The governor salaries are as follows:
CA: \$206,500; NY: \$179,000; AK: \$85,776

44. Let x = price before taxes.

$$x + 0.09x = 158.60$$
$$1.09x = 158.60$$
$$x = 145.50$$

The price of the book was \$145.50.

46. Let x = population in 2005.

$$33.2 = x + 0.015x$$
$$33.2 = 1.015x$$
$$32.7 = x$$

The population in 2005 was 32.7 million.

48. Let x = measure of complement; then $2x + 30$ = measure of angle.

$$x + 2x + 30 = 90$$
$$3x = 60$$
$$x = 20$$

$2x + 30 = 2(20) + 30 = 70$
The angles measure 20° and 70°.

50. Let x = base angle; then $3x - 10$ = third angle.

$$2x + 3x - 10 = 180$$
$$5x - 10 = 180$$
$$5x = 190$$
$$x = 38$$

$3x - 10 = 3 \cdot 38 - 10 = 104$
The angles measure 38°, 38°, and 104°.

52. Let x = length of side of pentagon, then $x + 7$ = length of side of square.

$$5x = 4(x + 7)$$
$$5x = 4x + 28$$
$$x = 28$$

$x + 7 = 28 + 7 = 35$
The pentagon has a side length of 28 inches and the square has a side length of 35 inches.

54. Let x = first integer, then
$x + 1$ = second integer, and
$x + 2$ = third integer, and
$x + 3$ = fourth integer.

$$(x+1)+(x+3)=110$$
$$2x+4=110$$
$$2x=106$$
$$x=53$$

$x + 1 = 54$
$x + 2 = 55$
$x + 3 = 56$
The integers are 53, 54, 55, and 56.

56.
$$(x+2)+2x+x+(2x-3)=110$$
$$6x-1=110$$
$$6x=111$$
$$x=18.5$$

$x + 2 = 18.5 + 2 = 20.5$
$2x = 2(18.5) = 37$
$2x - 3 = 2(18.5) - 3 = 34$
The bases measure 18.5 meters and 37 meters, and the sides measure 20.5 meters and 34 meters.

58.
$$x+(x+15.7)+(x+1.6)=173.9$$
$$3x+17.3=173.9$$
$$3x=156.6$$
$$x=52.2$$

$x + 15.7 = 52.2 + 15.7 = 67.9$
$x + 1.6 = 52.2 + 1.6 = 53.8$
The arrivals and departures are as follows: London: 67.9 million, Paris: 53.8 million, Frankfurt: 52.2 million

60. Let x = height of Galter Pavilion; then
$x + 67$ = height of Guy's Tower and
$x + 47$ = height of Queen Mary

$$x+(x+67)+(x+47)=1320$$
$$3x+114=1320$$
$$3x=1206$$
$$x=402$$

$x + 67 = 402 + 67 = 469$
$x + 47 = 402 + 47 = 449$
Galter Pavilion: 402 ft
Guy's Tower: 469 ft
Queen Mary: 449 ft

62. Let x = number of seats in Heinz Field; then
$x + 11{,}675$ = number of seats in Mile High.

$$x+(x+11{,}675)=140{,}575$$
$$2x+11{,}675=140{,}575$$
$$2x=128{,}900$$
$$x=64{,}450$$

$x + 11{,}675 = 64{,}450 + 11{,}675 = 76{,}125$
Mile High stadium has 76,125 seats and Heinz Field has 64,450 seats.

64. a. Let x = deaths in 1950s.

$$x-0.592x=579$$
$$0.408x=579$$
$$x\approx 1419$$

There were 1419 deaths caused by tornadoes in the 1950s.

b. Answers may vary

66. Let x = number of returns filed electronically in 2005.

$x + 1.088x$ = number in 2006

$$x+1.088x=74.2$$
$$2.088x=74.2$$
$$x\approx 35.5$$

Approximately 35.5 million tax returns were filed electronically in 2005.

68. Let x = first integer (Dye), then
$x + 1$ = second integer (Berkman), and
$x + 2$ = third integer (Soriano).

$$x+(x+1)+(x+2)=135$$
$$3x+3=135$$
$$3x=132$$
$$x=44$$

$x + 1 = 45$
$x + 2 = 46$
The home runs are as follows: Soriano: 46; Berkman: 45; Dye: 44

70.
$$4ab-3bc=4(-5)(-8)-3(-8)(2)$$
$$=160+48$$
$$=208$$

72. $n^2-m^2=(-3)^2-(-8)^2=9-64=-55$

74. $P+PRT=3000+3000(0.0325)(2)=3195$

76. Answers may vary

78. Answers may vary

80. Let x = the total number of trees used for newsprint each year. Since 27% of newsprint is recycled, 100 – 27 = 73% is not recycled. 73% of the total number of trees is 30 million trees.

$$0.73x=30$$
$$x\approx 41.1$$

The total number of trees is about 41.1 million. 27% of these are recycled.

$0.27(41.1) \approx 11$
About 11 million trees' worth of newsprint is recycled each year.

82. $R = C$
$24x = 100 + 20x$
$4x = 100$
$x = 25$
It will take 25 skateboards to break even.

84. The company loses money.

86. To get the answers shown here, use your calculator values for each year rather than the rounded values to compute the number for the following year.
2007: 74.2 + 0.042(74.2) ≈ 77.3 million
2008: 77.3 + 0.042(77.3) ≈ 80.6 million
2009: 80.6 + 0.042(80.6) ≈ 83.9 million
2010: 83.9 + 0.042(83.9) ≈ 87.5 million
2011: 87.5 + 0.042(87.5) ≈ 91.1 million

Section 2.3

Practice Exercises

1. $I = Prt$
$\frac{I}{Pr} = \frac{Prt}{Pr}$
$\frac{I}{Pr} = t$ or $t = \frac{I}{Pr}$

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

3. $A = P + Prt$
$A - P = P + Prt - P$
$A - P = Prt$
$\frac{A - P}{Pt} = \frac{Prt}{Pt}$
$\frac{A - P}{Pt} = r$ or $r = \frac{A - P}{Pt}$

4. Let $P = 8000$, $r = 6\% = 0.06$, $t = 4$, $n = 2$.
$A = P\left(1 + \frac{r}{n}\right)^{nt}$
$A = 8000\left(1 + \frac{0.06}{2}\right)^{2 \cdot 4}$
$A = 8000(1.03)^8$
$A \approx 8000(1.266770081)$
$A \approx 10{,}134.16$
Russ will have $10,134.16 in his account.

5. Let $d = 192$ and $r = 7.5$.
$d = rt$
$192 = 7.5t$
$\frac{192}{7.5} = \frac{7.5t}{7.5}$
$25.6t = t$
They spent 25.6 hours cycling, or 25 hours 36 minutes.

Exercise Set 2.3

2. $W = gh$
$\frac{W}{h} = \frac{gh}{h}$
$\frac{W}{h} = g$
$g = \frac{W}{h}$

4. $V = lwh$
$\frac{V}{wh} = \frac{lwh}{wh}$
$\frac{V}{wh} = l$
$l = \frac{V}{wh}$

6. $2x + 3y = 17$
$2x + 3y - 2x = 17 - 2x$
$3y = 17 - 2x$
$\frac{3y}{3} = \frac{17 - 2x}{3}$
$y = \frac{17 - 2x}{3}$

8.
$$A = 3M - 2N$$
$$A + 2N = 3M$$
$$2N = 3M - A$$
$$\frac{2N}{2} = \frac{3M - A}{2}$$
$$N = \frac{3M - A}{2}$$

10.
$$y = mx + b$$
$$y - b = mx$$
$$\frac{y - b}{m} = \frac{mx}{m}$$
$$x = \frac{y - b}{m}$$

12.
$$A = Prt + P$$
$$A = P(rt + 1)$$
$$\frac{A}{rt + 1} = \frac{P(rt + 1)}{rt + 1}$$
$$P = \frac{A}{rt + 1}$$

14.
$$A = 5H(b + B)$$
$$A = 5Hb + 5HB$$
$$A - 5HB = 5Hb$$
$$\frac{A - 5HB}{5H} = \frac{5Hb}{5H}$$
$$\frac{A - 5HB}{5H} = b$$
$$b = \frac{A - 5HB}{5H}$$

16.
$$S = 2\pi r^2 + 2\pi rh$$
$$S - 2\pi r^2 = 2\pi rh$$
$$\frac{S - 2\pi r^2}{2\pi r} = \frac{2\pi rh}{2\pi r}$$
$$\frac{S - 2\pi r^2}{2\pi r} = h$$
$$h = \frac{S - 2\pi r^2}{2\pi r}$$

18.
$$A = P(1 + rt)$$
$$A = P + Prt$$
$$A - P = Prt$$
$$\frac{A - P}{Pr} = \frac{Prt}{Pr}$$
$$\frac{A - P}{Pr} = t$$
$$t = \frac{A - P}{Pr}$$

20.
$$C = \frac{5}{9}(F - 32)$$
$$9C = 5(F - 32)$$
$$9C = 5F - 160$$
$$9C + 160 = 5F$$
$$\frac{9C + 160}{5} = \frac{5F}{5}$$
$$\frac{9C + 160}{5} = F$$
$$F = \frac{9}{5}C + 32$$

22.
$$L = a + (n - 1)d$$
$$L - a = (n - 1)d$$
$$\frac{L - a}{n - 1} = \frac{(n - 1)d}{n - 1}$$
$$\frac{L - a}{n - 1} = d$$
$$d = \frac{L - a}{n - 1}$$

24.
$$T = 3vs - 4ws + 5vw$$
$$T + 4ws = 3vs + 5vw$$
$$T + 4ws = v(3s + 5w)$$
$$\frac{T + 4ws}{3s + 5w} = \frac{v(3s + 5w)}{3s + 5w}$$
$$\frac{T + 4ws}{3s + 5w} = v$$
$$v = \frac{T + 4ws}{3s + 5w}$$

26. $A = P\left(1+\frac{r}{n}\right)^{nt} = 5000\left(1+\frac{0.06}{n}\right)^{15n}$

n	1	2	4	12	365
A	\$11,982.79	\$12,136.31	\$12,216.10	\$12,270.47	\$12,297.11

28. a. Using the formula $A = P\left(1+\frac{r}{n}\right)^{nt}$, we have

$$A = 25{,}000\left(1+\frac{0.05}{2}\right)^{2\cdot 2}$$
$$= 25{,}000(1.025)^4$$
$$\approx 25{,}000(1.103812891)$$
$$\approx 27{,}595.32$$

The amount in the account is \$27,595.32.

b. $A = 25{,}000\left(1+\frac{0.05}{4}\right)^{4\cdot 2}$
$$= 25{,}000(1.0125)^8$$
$$\approx 25{,}000(1.104486101)$$
$$\approx 27{,}612.15$$

The amount in the account is \$27,612.15.

c. $A = 25{,}000\left(1+\frac{0.05}{12}\right)^{12\cdot 2}$
$$\approx 25{,}000(1.00416666)^{24}$$
$$\approx 25{,}000(1.104941335)$$
$$\approx 27{,}623.53$$

The amount in the account is \$27,623.53.

30. Using the formula $F = \frac{9}{5}C + 32$, we have

$$F = \frac{9}{5}C + 32 = \frac{9}{5}(-15) + 32 = -27 + 32 = 5$$

The temperature was 5°F.

32. We use $d = rt$ and want to find r, the average rate or speed. Notice that the total distance traveled is $2 \cdot 154 = 308$.

$$d = rt$$
$$308 = r\left(5\frac{1}{2}\right)$$
$$308 = 5.5r$$
$$r = \frac{308}{5.5}$$
$$r = 56$$

Their average speed was 56 mph.

34. The total area of the ceiling is $18(12) = 216$ square feet. Each package can cover up to 50 square feet. Thus, the number of packages needed is $\frac{216}{50} = 4.32$. Therefore, 5 packages must be purchased.

36. Using the formula $A = P\left(1+\frac{r}{n}\right)^{nt}$, we have

$A = 4000\left(1+\frac{0.055}{2}\right)^{2\cdot 3}$

$A = 4000(1.0275)^6$

$A \approx 4000(1.176768361)$

$A \approx 4707.07$

Yes, the amount is enough.

38. Note that the wall covers $21 \cdot 8 = 168$ square feet. Because we wish to paint three coats, we actually must cover a total of $168 \cdot 3 = 504$ square feet. Since each gallon covers 300 square feet, we need $\frac{504}{300} = 1.68$ gallons of paint. 2 gallons should be purchased.

40. Note that the radius of the circle is equal to $22{,}248 + 4000 = 26{,}248$.

$C = 2\pi r$

$C = 2\pi(26{,}248)$

$C = 52{,}496\pi$

$C \approx 164{,}921.0479$

The "length" of the Clarke belt is approximately 164,921 miles.

42. $V = \pi r^2 h$

$V = \pi(2.3)^2(18.3)$

$V = 96.807\pi \text{ m}^3$

$V \approx 304.12816 \text{ m}^3$

The volume of the cargo bay is approximately 304.12816 cubic meters.

44. $8 \text{ miles} \times \frac{5280 \text{ ft}}{1 \text{ mile}} = 42{,}240 \text{ ft}$

$7.5 \text{ hours} \times \frac{60 \text{ min}}{1 \text{ hour}} \times \frac{60 \text{ sec}}{1 \text{ min}} = 27{,}000 \text{ sec}$

Using $d = rt$ we have:

$42{,}240 = r(27{,}000)$

$r = \frac{42{,}240}{27{,}000} \approx 1.6$

The drill can be removed at a rate of 1.6 ft/sec.

46. Using the formula $V = \frac{4}{3}\pi r^3$, we have

$V = \frac{4}{3}\pi(20.6)^3$

$V \approx 36{,}618$

The volume of Eartha is about 36,618 cu ft.

48. $d = rt$

$135 = 60t$

$t = 2.25$

It will take Mark 2.25 hours or 2 hours 15 minutes.

50. $C = 4h + 9f + 4p$

$4h = C - 9f - 4p$

$h = \frac{C - 9f - 4p}{4}$

52. $C = 4h + 9f + 4p$

$C = 4(30) + 9(9) + 4(2)$

$C = 209$

There are 209 calories in this serving.

54. $f = \frac{C - 4h - 4p}{9}$

$f = \frac{120 - 4(21) - 4(5)}{9}$

$f \approx 1.8$

There are 1.8 grams of fat per serving.

56. 2, 3 satisfy $x > 1$.

58. $-3, -2, -1, 0, 1, 2, 3$, satisfy $x - 3 \geq -7$ or $x \geq -4$.

60. Answers may vary

62. Answers may vary

64. 12 times a year; answers may vary

66. $N = R^* \times f_p \times n_e \times f_l \times f_i \times f_c \times L$

$n_e = \frac{N}{R^* \times f_p \times f_l \times f_i \times f_c \times L}$

68. $P(\text{green}) = \frac{1}{8}$

70. $P(\text{black}) = \frac{1}{8}$

72. $P(\text{green or blue}) = P(\text{green}) + P(\text{blue})$
$$= \frac{1}{8} + \frac{3}{8}$$
$$= \frac{4}{8}$$
$$= \frac{1}{2}$$

74. $P(\text{red, green, or black})$
$= P(\text{red}) + P(\text{green}) + P(\text{black})$
$$= \frac{1}{8} + \frac{1}{8} + \frac{1}{8}$$
$$= \frac{3}{8}$$

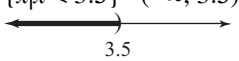
76. $P(\text{white}) = 0$

78. 0

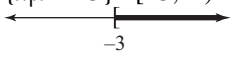
Section 2.4

Practice Problems

1. a. $\{x|x < 3.5\}$ $(-\infty, 3.5)$



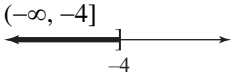
b. $\{x|x \geq -3\}$ $[-3, \infty)$



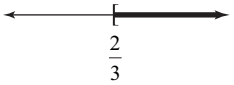
c. $\{x|-1 \leq x < 4\}$ $[-1, 4)$

2.
$$x + 5 > 9$$
$$x + 5 - 5 > 9 - 5$$
$$x > 4$$
$(4, \infty)$

3.
$$8x + 21 \leq 2x - 3$$
$$8x + 21 - 2x \leq 2x - 3 - 2x$$
$$6x + 21 \leq -3$$
$$6x + 21 - 21 \leq -3 - 21$$
$$6x \leq -24$$
$$\frac{6x}{6} \leq \frac{-24}{6}$$
$$x \leq -4$$
$(-\infty, -4]$

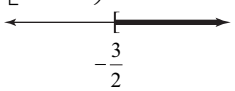


4. a.
$$\frac{2}{5}x \geq \frac{4}{15}$$
$$\frac{5}{2} \cdot \frac{2}{5}x \geq \frac{5}{2} \cdot \frac{4}{15}$$
$$x \geq \frac{2}{3}$$
$\left[\frac{2}{3}, \infty\right)$



b.
$$-2.4x < 9.6$$
$$\frac{-2.4x}{-2.4} > \frac{9.6}{-2.4}$$
$$x > -4$$
$(-4, \infty)$

5.
$$-(4x + 6) \leq 2(5x + 9) + 2x$$
$$-4x - 6 \leq 10x + 18 + 2x$$
$$-4x - 6 \leq 12x + 18$$
$$-4x - 6 + 4x \leq 12x + 18 + 4x$$
$$-6 \leq 16x + 18$$
$$-6 - 18 \leq 16x + 18 - 18$$
$$-24 \leq 16x$$
$$\frac{-24}{16} \leq \frac{16x}{16}$$
$$-\frac{3}{2} \leq x$$
$\left[-\frac{3}{2}, \infty\right)$



6. $\frac{3}{5}(x-3) \geq x-7$

$5\left[\frac{3}{5}(x-3)\right] \geq 5(x-7)$

$3(x-3) \geq 5(x-7)$

$3x-9 \geq 5x-35$

$3x-9-5x \geq 5x-35-5x$

$-2x-9 \geq -35$

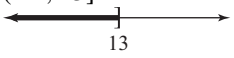
$-2x-9+9 \geq -35+9$

$-2x \geq -26$

$\frac{-2x}{-2} \leq \frac{-26}{-2}$

$x \leq 13$

$(-\infty, 13]$



7. $4(x-2) < 4x+5$

$4x-8 < 4x+5$

$4x-8-4x < 4x+5-4x$

$-8 < 5$

This is a true statement for all values of x. The solution set is $\{x|x \text{ is a real number}\}$ or $(-\infty, \infty)$.

8. In words: | 900 | + | commission (15% of sales) | ≥ | 2400 |

Translate: $900 + 0.15x \geq 2400$

$900 + 0.15x - 900 \geq 2400 - 900$

$0.15x \geq 1500$

$x \geq 10{,}000$

Sales must be greater than or equal to \$10,000 per month.

9. $-9.2t + 527.33 < 250$

$-9.2t < -277.33$

$t > 30.14$

The annual consumption of cigarettes will be less than 250 billion more than 30.14 years after 1990, or in approximately 31 + 1990 = 2021 and after.

Vocabulary and Readiness Check

1. d. $(-\infty, -5)$

2. c. $[-11, \infty)$

3. b. $\left(-2.5, \frac{7}{4}\right]$

4. a. $\left[-\frac{10}{3}, 0.2\right)$

5. The set $\{x|x \geq -0.4\}$ written in interval notation is $[-0.4, \infty)$.

6. The set $\{x|x < -0.4\}$ written in interval notation is $(-\infty, -0.4)$.

7. The set $\{x|x \leq -0.4\}$ written in interval notation is $(-\infty, -0.4]$.

8. The set $\{x|x > -0.4\}$ written in interval notation is $(-0.4, \infty)$.

9. $3x > -14$ no

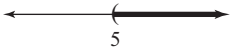
10. $-3x \leq 14$ yes

11. $-3x < -14$ yes

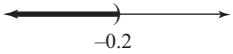
12. $-x \geq 23$ yes

Exercise Set 2.4

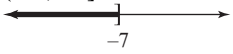
2. $\{x|x > 5\}$
$(5, \infty)$



4. $\{x|x < -0.2\}$
$(-\infty, -0.2)$



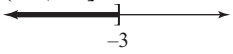
6. $\{x|-7 \geq x\}$
$(-\infty, -7]$



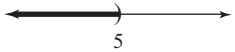
8. $\{x|-5 \leq x \leq -1\}$
$[-5, -1]$

10. $\{x|-3 > x \geq -7\}$
$[-7, -3)$

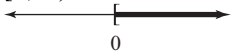
12. $x + 2 \leq -1$
$x \leq -3$
$(-\infty, -3]$



14. $11x < 10x + 5$
$x < 5$
$(-\infty, 5)$



16. $7x - 1 \geq 6x - 1$
$x \geq 0$
$[0, \infty)$

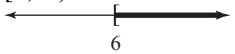


18. $\frac{5}{6}x \geq 5$

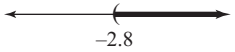
$\frac{6}{5} \cdot \frac{5}{6}x \geq \frac{6}{5} \cdot 5$

$x \geq 6$

$[6, \infty)$



20. $4x > -11.2$
$x > -2.8$
$(-2.8, \infty)$

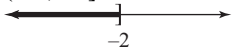


22. $-4x \geq 8$

$\frac{-4x}{-4} \leq \frac{8}{-4}$

$x \leq -2$

$(-\infty, -2]$



24. $8 - 5x \leq 23$
$-5x \leq 15$
$x \geq -3$
$[-3, \infty)$

26. $20 + x < 6x - 15$
$20 - 5x < -15$
$-5x < -35$

$\frac{-5x}{-5} > \frac{-35}{-5}$

$x > 7$
$(7, \infty)$

28. $6(2 - 3x) \geq 12$
$12 - 18x \geq 12$
$-18x \geq 0$
$x \leq 0$
$(-\infty, 0]$

30. $5(x+4) \le 4(2x+3)$
$5x+20 \le 8x+12$
$-3x \le -8$
$x \ge \frac{8}{3}$
$\left[\frac{8}{3}, \infty\right)$

32. $\frac{1-2x}{3}+\frac{3x+7}{7} > 1$
$21\left(\frac{1-2x}{3}+\frac{3x+7}{7}\right) > 21(1)$
$7(1-2x)+3(3x+7) > 21$
$7-14x+9x+21 > 21$
$-5x+28 > 21$
$-5x > -7$
$x < \frac{7}{5}$
$\left(-\infty, \frac{7}{5}\right)$

34. $-2(4x+2) > -5[1+2(x-1)]$
$-8x-4 > -5(1+2x-2)$
$-8x-4 > -5(2x-1)$
$-8x-4 > -10x+5$
$2x-4 > 5$
$2x > 9$
$x > \frac{9}{2}$
$\left(\frac{9}{2}, \infty\right)$

36. $x-9 < -12$
$x-9+9 < -12+9$
$x < -3$
$(-\infty, -3)$

38. $-x > -2$
$\frac{-x}{-1} < \frac{-2}{-1}$
$x < 2$
$(-\infty, 2)$

40. $-6x \le 4.2$
$\frac{-6x}{-6} \ge \frac{4.2}{-6}$
$x \ge -0.7$
$[-0.7, \infty)$

42. $\frac{3}{4}-\frac{2}{3} \ge \frac{x}{6}$
$12\left(\frac{3}{4}-\frac{2}{3}\right) \ge 12\left(\frac{x}{6}\right)$
$9-8 \ge 2x$
$1 \ge 2x$
$\frac{1}{2} \ge x$
$\left(-\infty, \frac{1}{2}\right]$

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

46. $\frac{4}{5}(x+1) \le x+1$
$5\left[\frac{4}{5}(x+1)\right] \le 5(x+1)$
$4(x+1) \le 5(x+1)$
$4x+4 \le 5x+5$
$-x+4 \le 5$
$-x \le 1$
$x \ge -1$
$[-1, \infty)$

48. $0.7x-x > 0.45$
$-0.3x > 0.45$
$x < -1.5$
$(-\infty, -1.5)$

50. $7(2x+3)+4x \le 7+5(3x-4)+x$
$14x+21+4x \le 7+15x-20+x$
$18x+21 \le -13+16x$
$2x+21 \le -13$
$2x \le -34$
$x \le -17$
$(-\infty, -17]$

52. $13y-(9y+2) \le 5(y-6)+10$
$13y-9y-2 \le 5y-30+10$
$4y-2 \le 5y-20$
$-2 \le y-20$
$18 \le y$ or $y \ge 18$
$[18, \infty)$

54. $\frac{2}{3}(x+3) < \frac{1}{6}(2x-8)+2$

$6\left[\frac{2}{3}(x+3)\right] < 6\left[\frac{1}{6}(2x-8)+2\right]$

$4(x+3) < (2x-8)+12$

$4x+12 < 2x+4$

$2x+12 < 4$

$2x < -8$

$x < -4$

$(-\infty, -4)$

56. $\frac{3-4x}{6} - \frac{1-2x}{12} \le -2$

$12\left(\frac{3-4x}{6} - \frac{1-2x}{12}\right) \le 12(-2)$

$2(3-4x) - (1-2x) \le -24$

$6-8x-1+2x \le -24$

$5-6x \le -24$

$-6x \le -29$

$x \ge \frac{29}{6}$

$\left[\frac{29}{6}, \infty\right)$

58. $\frac{x-4}{2} - \frac{x-2}{3} > \frac{5}{6}$

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

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

$3x-12-2x+4 > 5$

$x-8 > 5$

$x > 13$

$(13, \infty)$

60. $\frac{3x+2}{18} - \frac{1+2x}{6} \le -\frac{1}{2}$

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

$3x+2-3(1+2x) \le -9$

$3x+2-3-6x \le -9$

$-3x-1 \le -9$

$-3x \le -8$

$x \ge \frac{8}{3}$

$\left[\frac{8}{3}, \infty\right)$

62. $0.2(8x-2) < 1.2(x-3)$

$10[0.2(8x-2)] < 10[1.2(x-3)]$

$2(8x-2) < 12(x-3)$

$16x-4 < 12x-36$

$4x-4 < -36$

$4x < -32$

$x < -8$

$(-\infty, -8)$

64. $\frac{7}{12}x - \frac{1}{3} \le \frac{3}{8}x - \frac{5}{6}$

$24\left[\frac{7}{12}x - \frac{1}{3}\right] \le 24\left[\frac{3}{8}x - \frac{5}{6}\right]$

$2 \cdot 7x - 8 \le 3 \cdot 3x - 4 \cdot 5$

$14x - 8 \le 9x - 20$

$5x - 8 \le -20$

$5x \le -12$

$x \le -\frac{12}{5}$

$\left(-\infty, -\frac{12}{5}\right]$

66. $3x+1 < 3(x-2)$

$3x+1 < 3x-6$

$1 < -6$

$\varnothing$

68. $8(x+3) \le 7(x+5)+x$

$8x+24 \le 7x+35+x$

$8x+24 \le 8x+35$

$24 \le 35$

$(-\infty, \infty)$

70. a. Let x be the time on the last trial.

$\frac{1}{4}(6.85+7.04+6.92+x) < 7.0$

$6.85+7.04+6.92+x < 28.0$

$20.81+x < 28.0$

$x < 7.19$

$\{x | x < 7.19\}$

b. A time of 7.19 minutes or less will result in an average time under 7.0 minutes.

72. a. Let x be the number of half-hours parked.

$1+0.6(x-1) \le 4$

$1+0.6x-0.6 \le 4$

$0.6x+0.4 \le 4$

$0.6x \le 3.6$

$x \le 6$

Since 6 represents half-hours, then 3 represents hours.

$\{x | x \le 3\}$

b. You can park for 3 hours or less.

74. a.
$$0.41+0.17(x-1)\le 2.50$$
$$100[0.41+0.17(x-1)]\le 100(2.50)$$
$$41+17(x-1)\le 250$$
$$41+17x-17\le 250$$
$$17x+24\le 250$$
$$17x\le 226$$
$$x\le 13.3$$
$\{x|x\le 13\}$

b. Thirteen ounces or less can be mailed for $2.50 or less.

76. a. Let x be the number of daily miles driven.
$$36<24+0.15x$$
$$12<0.15x$$
$$\frac{12}{0.15}<\frac{0.15x}{0.15}$$
$$80<x$$
$\{x|x>80\}$

b. If you drive more than 80 miles a day, plan A is more economical.

78. Given that $F\ge 977$, we know the following:
$$C\ge\frac{5}{9}(F-32)$$
$$C\ge\frac{5}{9}(977-32)$$
$$C\ge\frac{5}{9}(945)$$
$$C\ge 525$$
$\{C|C\ge 525°\}$
So stibnite melts when the temperature is at least 525°C.

80. a.
$$-9.2t+527.33<50$$
$$-9.2t<-477.33$$
$$t>51.9$$
t is more than 51.9, so $t\ge 52$.
1990 + 52 = 2042
The consumption will be less than 50 billion per year for the entire year 2042 and after.

b. Answers may vary

82. The consumption of nonfat milk is decreasing. The graph of the line is going down over time.

84. $t = 2010 - 2000 = 10$
$y = -0.07t + 3.5$
$y = -0.07(10) + 3.5$
$y = -0.7 + 3.5$
$y = 2.8$
The consumption of nonfat milk in 2010 will be 2.8 gallons per person per year.

86.
$$-0.07t+3.5<3$$
$$-0.07t<-0.5$$
$$t>7.14$$
2000 + 7 = 2007
Consumption of nonfat milk will be less than 3 gallons per person per year during 2007.

88. Answers may vary

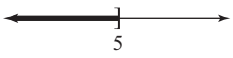
90. $x\ge 0$ and $x\le 7$
The integers are 0, 1, 2, 3, 4, 5, 6, 7.

92. $x<6$ and $x<-5$
The integers are –6, –7, –8, ...

94.
$$3x-12=3$$
$$3x-12+12=3+12$$
$$3x=15$$
$$\frac{3x}{3}=\frac{15}{3}$$
$$x=5$$

96.
$$-5x-4=-x-4$$
$$-5x+x=-4+4$$
$$-4x=0$$
$$\frac{-4x}{-4}=\frac{0}{-4}$$
$$x=0$$

98. $\{x|x>-4\}$; $(-4,\infty)$

100.


$(-\infty, 5]$

102. $\{x|-3.7\le x<4\}$


104.
$$2x-3<5$$
$$2x-3+3<5+3$$
$$2x<8$$
$$\frac{2x}{2}<\frac{8}{2}$$
$$x<4$$
$(-\infty, 4)$

106. Answers may vary

108. Answers may vary

110. Answers may vary

The Bigger Picture

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

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

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

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

5.
$$\begin{aligned} \frac{7}{5}+\frac{y}{10} &= 2 \\ 10\left(\frac{7}{5}+\frac{y}{10}\right) &= 10(2) \\ 2(7)+y &= 20 \\ 14+y &= 20 \\ 14+y-14 &= 20-14 \\ y &= 6 \end{aligned}$$

6.
$$\begin{aligned} 5+2x &= 2(x+1) \\ 5+2x &= 2x+2 \\ 5+2x-2x &= 2x+2-2x \\ 5 &= 2 \quad \text{False} \end{aligned}$$
This false statement indicates that there is no solution. The solution set is $\varnothing$.

7.
$$\begin{aligned} 4(x-2)+3x &\geq 9(x-1)-2 \\ 4x-8+3x &\geq 9x-9-2 \\ 7x-8 &\geq 9x-11 \\ 7x-8-9x &\geq 9x-11-9x \\ -2x-8 &\geq -11 \\ -2x-8+8 &\geq -11+8 \\ -2x &\geq -3 \\ \frac{-2x}{-2} &\leq \frac{-3}{-2} \\ x &\leq \frac{3}{2} \end{aligned}$$
$\left(-\infty, \frac{3}{2}\right]$

8.
$$\begin{aligned} 6(x+1)-2 &= 6x+4 \\ 6x+6-2 &= 6x+4 \\ 6x+4 &= 6x+4 \\ 6x+4-6x &= 6x+4-6x \\ 4 &= 4 \quad \text{True} \end{aligned}$$
This true statement indicates that all real numbers are solutions of the equation. The solution set is $(-\infty, \infty)$.

Integrated Review

1.
$$\begin{aligned} -4x &= 20 \\ \frac{-4x}{-4} &= \frac{20}{-4} \\ x &= -5 \end{aligned}$$

2.
$$\begin{aligned} -4x &< 20 \\ \frac{-4x}{-4} &> \frac{20}{-4} \\ x &> -5 \end{aligned}$$
$(-5, \infty)$

3. $\frac{3x}{4} \geq 2$

$4\left(\frac{3x}{4}\right) \geq 4(2)$

$3x \geq 8$

$x \geq \frac{8}{3}$

$\left[\frac{8}{3}, \infty\right)$

4. $5x + 3 \geq 2 + 4x$

$x + 3 \geq 2$

$x \geq -1$

$[-1, \infty)$

5. $6(y-4) = 3(y-8)$

$6y - 24 = 3y - 24$

$3y = 0$

$y = 0$

6. $-4x \leq \frac{2}{5}$

$-20x \leq 2$

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

$\left[-\frac{1}{10}, \infty\right)$

7. $-3x \geq \frac{1}{2}$

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

$-6x \geq 1$

$x \leq -\frac{1}{6}$

$\left(-\infty, -\frac{1}{6}\right]$

8. $5(y+4) = 4(y+5)$

$5y + 20 = 4y + 20$

$y = 0$

9. $7x < 7(x-2)$

$7x < 7x - 14$

$0 < -14$ (False)

No Solution; $\varnothing$

10. $\frac{-5x+11}{2} \leq 7$

$2\left(\frac{-5x+11}{2}\right) \leq 2(7)$

$-5x + 11 \leq 14$

$-5x \leq 3$

$x \geq -\frac{3}{5}$

$\left[-\frac{3}{5}, \infty\right)$

11. $-5x + 1.5 = -19.5$

$-5x + 1.5 - 1.5 = -19.5 - 1.5$

$-5x = -21$

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

$x = 4.2$

12. $-5x + 4 = -26$

$-5x = -30$

$x = 6$

13. $5 + 2x - x = -x + 3 - 14$

$5 + x = -x - 11$

$5 + 2x = -11$

$2x = -16$

$x = -8$

14. $12x + 14 < 11x - 2$

$x + 14 < -2$

$x < -16$

$(-\infty, -16)$

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

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

$4x - 5x = 10(x-2)$

$-x = 10x - 20$

$-11x = -20$

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

16. $12x - 12 = 8(x-1)$

$12x - 12 = 8x - 8$

$4x - 12 = -8$

$4x = 4$

$x = 1$

17. $2(x-3) > 70$
$2x - 6 > 70$
$2x > 76$
$x > 38$
$(38, \infty)$

18. $-3x - 4.7 = 11.8$
$-3x - 4.7 + 4.7 = 11.8 + 4.7$
$-3x = 16.5$
$\frac{-3x}{-3} = \frac{16.5}{-3}$
$x = -5.5$

19. $-2(b-4) - (3b-1) = 5b + 3$
$-2b + 8 - 3b + 1 = 5b + 3$
$-5b + 9 = 5b + 3$
$-10b = -6$
$b = \frac{-6}{-10} = \frac{3}{5}$

20. $8(x+3) < 7(x+5) + x$
$8x + 24 < 7x + 35 + x$
$8x + 24 < 8x + 35$
$24 < 35$ (True for all x)
All real numbers; $(-\infty, \infty)$

21. $\frac{3t+1}{8} = \frac{5+2t}{7} + 2$
$56\left(\frac{3t+1}{8}\right) = 56\left(\frac{5+2t}{7}\right) + 56(2)$
$7(3t+1) = 8(5+2t) + 112$
$21t + 7 = 40 + 16t + 112$
$21t + 7 = 16t + 152$
$5t = 145$
$t = 29$

22. $4(x-6) - x = 8(x-3) - 5x$
$4x - 24 - x = 8x - 24 - 5x$
$3x - 24 = 3x - 24$
$-24 = -24$ (True for all x)
The solution is all real numbers.

23. $\frac{x}{6} + \frac{3x-2}{2} < \frac{2}{3}$
$6\left(\frac{x}{6} + \frac{3x-2}{2}\right) < 6\left(\frac{2}{3}\right)$
$x + 3(3x-2) < 4$
$x + 9x - 6 < 4$
$10x - 6 < 4$
$10x < 10$
$x < 1$
$(-\infty, 1)$

24. $\frac{y}{3} + \frac{y}{5} = \frac{y+3}{10}$
$30\left(\frac{y}{3}\right) + 30\left(\frac{y}{5}\right) = 30\left(\frac{y+3}{10}\right)$
$10y + 6y = 3(y+3)$
$16y = 3y + 9$
$13y = 9$
$y = \frac{9}{13}$

25. $5(x-6) + 2x > 3(2x-1) - 4$
$5x - 30 + 2x > 6x - 3 - 4$
$7x - 30 > 6x - 7$
$x > 23$
$(23, \infty)$

26. $14(x-1) - 7x \le 2(3x-6) + 4$
$14x - 14 - 7x \le 6x - 12 + 4$
$7x - 14 \le 6x - 8$
$x \le 6$
$(-\infty, 6]$

27. $\frac{1}{4}(3x+2) - x \ge \frac{3}{8}(x-5) + 2$
$8\left[\frac{1}{4}(3x+2) - x\right] \ge 8\left[\frac{3}{8}(x-5) + 2\right]$
$2(3x+2) - 8x \ge 3(x-5) + 16$
$6x + 4 - 8x \ge 3x - 15 + 16$
$-2x + 4 \ge 3x + 1$
$3 \ge 5x$
$\frac{3}{5} \ge x$ or $x \le \frac{3}{5}$
$\left(-\infty, \frac{3}{5}\right]$

28. $\frac{1}{3}(x-10)-4x>\frac{5}{6}(2x+1)-1$

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

$2(x-10)-24x>5(2x+1)-6$

$2x-20-24x>10x+5-6$

$-22x-20>10x-1$

$-19>32x$

$-\frac{19}{32}>x \quad \text{or} \quad x<-\frac{19}{32}$

$\left(-\infty,-\frac{19}{32}\right)$

Section 2.5

Practice Exercises

1. $A=\{1,3,5,7,9\}$ and $B=\{1,2,3,4\}$
The numbers 1 and 3 are in sets A and B.
The intersection is $\{1,3\}$. $A\cap B=\{1,3\}$.

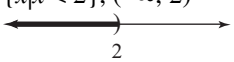
2. $x+3<8$ and $2x-1<3$

$x<5$ and $2x<4$

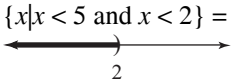
$x<5$ and $x<2$

$\{x|x<5\}, (-\infty, 5)$

$\{x|x<2\}, (-\infty, 2)$



$\{x|x<5 \text{ and } x<2\}=\{x|x<2\}$



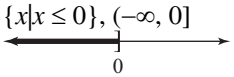
The solution set is $(-\infty, 2)$.

3. $4x\le 0$ and $3x+2>8$

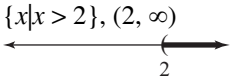
$x\le 0$ and $3x>6$

$x\le 0$ and $x>2$

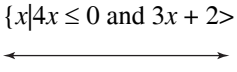
$\{x|x\le 0\}, (-\infty, 0]$



$\{x|x>2\}, (2, \infty)$



$\{x|4x\le 0 \text{ and } 3x+2>8\}=\{\ \}$ or $\varnothing$



4. $3<5-x<9$

$3-5<5-x-5<9-5$

$-2<-x<4$

$\frac{-2}{-1}>\frac{-x}{-1}>\frac{4}{-1}$

$2>x>-4$

or $-4<x<2$

The solution set is $(-4, 2)$.

5. $-4\le\frac{x}{2}-1\le 3$

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

$-8\le x-2\le 6$

$-8+2\le x-2+2\le 6+2$

$-6\le x\le 8$

The solution set is $[-6, 8]$.

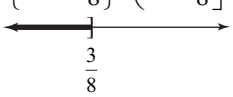
6. $A=\{1,3,5,7,9\}$ and $B=\{2,3,4,5,6\}$.
The numbers that are in either set or both sets are $\{1,2,3,4,5,6,7,9\}$. This set is the union, $A\cup B$.

7. $8x+5\le 8$ or $x-1\ge 2$

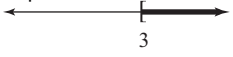
$8x\le 3$ or $x\ge 3$

$x\le\frac{3}{8}$ or $x\ge 3$

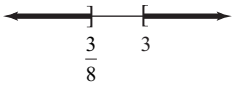
$\left\{x\middle|x\le\frac{3}{8}\right\}, \left(-\infty, \frac{3}{8}\right]$



$\{x|x\ge 3\}, [3, \infty)$



$\left\{x\middle|x\le\frac{3}{8} \text{ or } x\ge 3\right\}=\left(-\infty, \frac{3}{8}\right]\cup[3, \infty)$



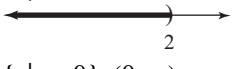
The solution set is $\left(-\infty, \frac{3}{8}\right]\cup[3, \infty)$.

8. $-3x-2>-8$ or $5x>0$

$-3x>-6$ or $x>0$

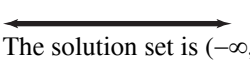
$x<2$ or $x>0$

$\{x|x<2\}, (-\infty, 2)$



$\{x|x>0\}, (0, \infty)$

$\{x|x<2 \text{ or } x>0\}, (-\infty, \infty)$



The solution set is $(-\infty, \infty)$.

Vocabulary and Readiness Check

1. Two inequalities joined by the words "and" or "or" are called compound inequalities.

2. The word and means intersection.

3. The word or means union.

4. The symbol $\cap$ means intersection.

5. The symbol $\cup$ represents union.

6. The symbol $\varnothing$ is the empty set.

7. The inequality $-2 \le x < 1$ means $-2 \le x$ and $x < 1$.

8. $\{x|x < 0 \text{ and } x > 0\} = \varnothing$.

Exercise Set 2.5

2. $C \cap D = \{4, 5\}$

4. $A \cup D = \{x|x \text{ is an even integer or } x = 5 \text{ or } x = 7\}$

6. $A \cap B = \varnothing$

8. $B \cup D = \{x|x \text{ is an odd integer or } x = 4 \text{ or } x = 6\}$

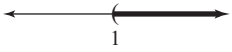
10. $B \cap C = \{3, 5\}$

12. $A \cup C = \{x|x \text{ is an even integer or } x = 3 \text{ or } x = 5\}$

14. $x \le 0$ and $x \ge -2$
$-2 \le x \le 0$
$[-2, 0]$

16. $x < 2$ and $x > 4$
$\varnothing$

18. $x \ge -4$ and $x > 1$
$x > 1$
$(1, \infty)$



20. $x + 2 \ge 3$ and $5x - 1 \ge 9$
$x \ge 1$ and $5x \ge 10$
$x \ge 2$
$x \ge 2$
$[2, \infty)$

22. $2x + 4 > 0$ and $4x > 0$
$2x > -4$ and $x > 0$
$x > -2$
$(0, \infty)$

24. $-7x \le -21$ and $x - 20 \le -15$
$x \ge 3$ and $x \le 5$
$3 \le x \le 5$
$[3, 5]$

26. $-2 \le x + 3 \le 0$
$-5 \le x \le -3$
$[-5, -3]$

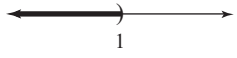
28. $1 < 4 + 2x < 7$
$1 - 4 < 4 + 2x - 4 < 7 - 4$
$-3 < 2x < 3$
$\frac{-3}{2} < x < \frac{3}{2}$
$\left(-\frac{3}{2}, \frac{3}{2}\right)$

30. $-2 < \frac{1}{2}x - 5 < 1$
$3 < \frac{1}{2}x < 6$
$6 < x < 12$
$(6, 12)$

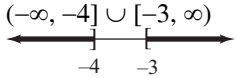
32. $-4 \le \frac{-2x+5}{3} \le 1$
$3(-4) \le 3\left(\frac{-2x+5}{3}\right) \le 3(1)$
$-12 \le -2x + 5 \le 3$
$-17 \le -2x \le -2$
$\frac{17}{2} \ge x \ge 1$
$1 \le x \le \frac{17}{2}$
$\left[1, \frac{17}{2}\right]$

34. $x \ge -2$ or $x \le 2$
$(-\infty, \infty)$

36. $x < 0$ or $x < 1$
$(-\infty, 1)$



38. $x \ge -3$ or $x \le -4$
$(-\infty, -4] \cup [-3, \infty)$



40. $-5x \le 10$ or $3x - 5 \ge 1$
$x \ge -2$ or $3x \ge 6$
$x \ge 2$

$x \ge -2$
$[-2, \infty)$

42. $x + 9 < 0$ or $4x > -12$
$x < -9$ or $x > -3$
$(-\infty, -9) \cup (-3, \infty)$

44. $5(x-1) \ge -5$ or $5 - x \le 11$
$x - 1 \ge -1$ or $-x \le 6$
$x \ge 0$ or $x \ge -6$

$x \ge -6$
$[-6, \infty)$

46. $x < \frac{5}{7}$ and $x < 1$

$x < \frac{5}{7}$

$\left(-\infty, \frac{5}{7}\right)$

48. $x < \frac{5}{7}$ or $x < 1$

$x < 1$
$(-\infty, 1)$

50. $3 < 5x + 1 < 11$
$2 < 5x < 10$
$\frac{2}{5} < x < 2$

$\left(\frac{2}{5}, 2\right)$

52. $\frac{2}{3} < x + \frac{1}{2} < 4$
$6\left(\frac{2}{3}\right) < 6\left(x + \frac{1}{2}\right) < 6(4)$
$4 < 6x + 3 < 24$
$1 < 6x < 21$
$\frac{1}{6} < x < \frac{7}{2}$

$\left(\frac{1}{6}, \frac{7}{2}\right)$

54. $2x - 1 \ge 3$ and $-x > 2$
$2x \ge 4$ and $x < -2$
$x \ge 2$ and $x < -2$

$\varnothing$

56. $\frac{3}{8}x + 1 \le 0$ or $-2x < -4$
$\frac{3}{8}x \le -1$ or $x > 2$
$x \le -\frac{8}{3}$ or $x > 2$

$\left(-\infty, -\frac{8}{3}\right] \cup (2, \infty)$

58. $-2 < \frac{-2x-1}{3} < 2$
$3(-2) < 3\left(\frac{-2x-1}{3}\right) < 3(2)$
$-6 < -2x - 1 < 6$
$-5 < -2x < 7$
$\frac{-5}{-2} > x > \frac{7}{-2}$
$-\frac{7}{2} < x < \frac{5}{2}$

$\left(-\frac{7}{2}, \frac{5}{2}\right)$

60. $-5 < 2(x+4) < 8$
$-5 < 2x + 8 < 8$
$-13 < 2x < 0$
$-\frac{13}{2} < x < 0$

$\left(-\frac{13}{2}, 0\right)$

62. $5x \le 0$ and $-x + 5 < 8$
$x \le 0$ and $-x < 3$
$x \le 0$ and $x > -3$
$(-3, 0]$

64. $-x < 7$ or $3x + 1 < -20$
$x > -7$ or $3x < -21$
$x > -7$ or $x < -7$
$(-\infty, -7) \cup (-7, \infty)$

66. $-2x < -6$ or $1 - x > -2$
$x > 3$ or $-x > -3$
$x > 3$ or $x < 3$
$(-\infty, 3) \cup (3, \infty)$

68.
$$-\frac{1}{2} \le \frac{3x-1}{10} < \frac{1}{2}$$
$$10\left(-\frac{1}{2}\right) \le 10\left(\frac{3x-1}{10}\right) < 10\left(\frac{1}{2}\right)$$
$$-5 \le 3x-1 < 5$$
$$-4 \le 3x < 6$$
$$-\frac{4}{3} \le x < 2$$
$$\left[-\frac{4}{3}, 2\right)$$

70.
$$-\frac{1}{4} < \frac{6-x}{12} < -\frac{1}{6}$$
$$12\left(-\frac{1}{4}\right) < 12\left(\frac{6-x}{12}\right) < 12\left(-\frac{1}{6}\right)$$
$$-3 < 6-x < -2$$
$$-9 < -x < -8$$
$$9 > x > 8$$
$(8, 9)$

72.
$$-0.7 \le 0.4x + 0.8 < 0.5$$
$$-1.5 \le 0.4x < -0.3$$
$$-3.75 \le x < -0.75$$
$[-3.75, -0.75)$

74. $|-7 - 19| = |-26| = 26$

76. $|-4| - (-4) + |-20| = 4 + 4 + 20 = 28$

78.
$$|x| = 5$$
$$x = -5, 5$$

80.
$$|x| = -2$$
$\varnothing$

82. The years that consumption of bottled water were less than 15 gallons per person were 1998 and 1999. The years that consumption of diet soda were greater than 14 gallons per person were 2003, 2004, and 2005. The union of the years is 1998, 1999, 2003, 2004, and 2005.

84.
$$-10 \le C \le 18$$
$$-10 \le \frac{5}{9}(F-32) \le 18$$
$$\frac{9}{5}(-10) \le \frac{9}{5}\left(\frac{5}{9}(F-32)\right) \le \frac{9}{5}(18)$$
$$-18 \le F-32 \le \frac{162}{5}$$
$$14 \le F \le 64.4$$
$14° \le F \le 64.4°$

86. Let x be Wendy's grade on the final exam.
$$80 \le \frac{1}{6}(2x + 80 + 90 + 82 + 75) \le 89$$
$$480 \le 2x + 327 \le 534$$
$$153 \le 2x \le 207$$
$$76.5 \le x \le 103.5$$
$$76.5 \le x \le 100$$
If Wendy scores between 76.5 and 100 inclusive on her final exam, she will receive a B in the course.

88. $x + 3 < 2x + 1 < 4x + 6$
$$x+3 < 2x+1 \quad \text{and} \quad 2x+1 < 4x+6$$
$$2 < x \quad \text{and} \quad -5 < 2x$$
$$x > 2 \quad \text{and} \quad -\frac{5}{2} < x$$
$$x > 2 \quad \text{and} \quad x > -\frac{5}{2}$$
$(2, \infty)$

90. $7x - 1 \le 7 + 5x \le 3(1 + 2x)$
$$7x-1 \le 7+5x \quad \text{and} \quad 7+5x \le 3+6x$$
$$2x \le 8 \quad \text{and} \quad 4 \le x$$
$$x \le 4 \quad \text{and} \quad x \ge 4$$
$\{4\}$

92. $1 + 2x < 3(2 + x) < 1 + 4x$
$$1+2x < 6+3x \quad \text{and} \quad 6+3x < 1+4x$$
$$-5 < x \quad \text{and} \quad 5 < x$$
$$x > -5 \quad \text{and} \quad x > 5$$
$(5, \infty)$

The Bigger Picture

1.
$$x-2 \le 1 \quad \text{and} \quad 3x-1 \ge -4$$
$$x \le 3 \quad \text{and} \quad 3x \ge -3$$
$$x \ge -1$$
$$-1 \le x \le 3$$
$[-1, 3]$

2.
$$-2 < x-1 < 5$$
$$-2+1 < x-1+1 < 5+1$$
$$-1 < x < 6$$
$(-1, 6)$

3.
$$-2x + 2.5 = -7.7$$
$$-2x = -10.2$$
$$x = 5.1$$

4. $-5x > 20$
$\frac{-5x}{-5} < \frac{20}{-5}$
$x < -4$
$(-\infty, -4)$

5. $x \le -3$ or $x \le -5$
$x \le -3$
$(-\infty, -3]$

6. $5x < -10$ or $3x - 4 > 2$
$x < -2$ or $3x > 6$
$x > 2$
$(-\infty, -2) \cup (2, \infty)$

7. $\frac{5t}{2} - \frac{3t}{4} = 7$
$4\left(\frac{5t}{2} - \frac{3t}{4}\right) = 4(7)$
$2(5t) - 3t = 28$
$10t - 3t = 28$
$7t = 28$
$t = 4$

8. $5(x-3) + x + 2 \ge 3(x+2) + 2x$
$5x - 15 + x + 2 \ge 3x + 6 + 2x$
$6x - 13 \ge 5x + 6$
$6x - 5x \ge 13 + 6$
$x \ge 19$
$[19, \infty)$

Section 2.6

Practice Exercises

1. $|q| = 7$
$q = 7$ or $q = -7$
The solution set is $\{-7, 7\}$.

2. $|2x - 3| = 5$
$2x - 3 = 5$ or $2x - 3 = -5$
$2x = 8$ or $2x = -2$
$x = 4$ or $x = -1$
The solution set is $\{-1, 4\}$.

3. $\left|\frac{x}{5} + 1\right| = 15$
$\frac{x}{5} + 1 = 15$ or $\frac{x}{5} + 1 = -15$
$\frac{x}{5} = 14$ or $\frac{x}{5} = -16$
$x = 70$ or $x = -80$
The solutions are -80 and 70.

4. $|3x| + 8 = 14$
$|3x| = 6$
$3x = 6$ or $3x = -6$
$x = 2$ or $x = -2$
The solutions are -2 and 2.

5. $|z| = 0$
The solution is 0.

6. $3|z| + 9 = 7$
$3|z| = -2$
$|z| = -\frac{2}{3}$
The absolute value of a number is never negative, so there is no solution. The solution set is { } or $\varnothing$.

7. $\left|\frac{5x+3}{4}\right| = -8$
The absolute value of a number is never negative, so there is no solution. The solution set is { } or $\varnothing$.

8. $|2x + 4| = |3x - 1|$
$2x + 4 = 3x - 1$ or $2x + 4 = -(3x - 1)$
$-x + 4 = -1$ $2x + 4 = -3x + 1$
$-x = -5$ $5x + 4 = 1$
$x = 5$ $5x = -3$
$x = -\frac{3}{5}$
The solutions are $-\frac{3}{5}$ and 5.

9. $|x - 2| = |8 - x|$
$x - 2 = 8 - x$ or $x - 2 = -(8 - x)$
$2x - 2 = 8$ $x - 2 = -8 + x$
$2x = 10$ $-2 = -8$ False
$x = 5$
The solution is 5.

Vocabulary and Readiness Check

1. $|x-2|=5$
C. $x-2=5$ or $x-2=-5$

2. $|x-2|=0$
A. $x-2=0$

3. $|x-2|=|x+3|$
B. $x-2=x+3$ or $x-2=-(x+3)$

4. $|x+3|=5$
E. $x+3=5$ or $x+3=-5$

5. $|x+3|=-5$
D. $\varnothing$

Exercise Set 2.6

2. $|y|=15$
$y=-15$ or $y=15$

4. $|6n|=12.6$
$6n=12.6$ or $6n=-12.6$
$n=2.1$ or $n=-2.1$

6. $|6+2n|=4$
$6+2n=-4$ or $6+2n=4$
$2n=-10$ or $2n=-2$
$n=-5$ or $n=-1$

8. $\left|\frac{n}{3}+2\right|=4$
$\frac{n}{3}+2=-4$ or $\frac{n}{3}+2=4$
$\frac{n}{3}=-6$ or $\frac{n}{3}=2$
$n=-18$ or $n=6$

10. $|x|+1=3$
$|x|=2$
$x=-2$ or $x=2$

12. $|2x|-6=4$
$|2x|=10$
$2x=-10$ or $2x=10$
$x=-5$ or $x=5$

14. $|7z|=0$
$7z=0$
$z=0$

16. $|3z-2|+8=1$
$|3z-2|=-7$
which is impossible.
The solution set is $\varnothing$.

18. $|3y+2|=0$
$3y+2=0$
$3y=-2$
$y=-\frac{2}{3}$

20. $|x|=2$

22. $|9y+1|=|6y+4|$
$9y+1=-(6y+4)$ or $9y+1=6y+4$
$9y+1=-6y-4$ or $3y=3$
$15y=-5$ or $y=1$
$y=-\frac{1}{3}$ or $y=1$

24. $|2x-5|=|2x+5|$
$2x-5=-(2x+5)$ or $2x-5=2x+5$
$2x-5=-2x-5$ or $-5=5$
$4x=0$ or false
$x=0$
The only solution is 0.

26. Answers may vary

28. $|x|=1$
$x=1$ or $x=-1$

30. $|y|=8$
$y=8$ or $y=-8$

32. The absolute value of any expression is never negative, so no solution exists. The solution set is $\varnothing$.

34. $|4m+5|=5$
$4m+5=5$ or $4m+5=-5$
$4m=0$ or $4m=-10$
$m=0$ or $m=-\frac{10}{4}$
$m=0$ or $m=-\frac{5}{2}$

36. $|7z|+1=22$
$|7z|=21$
$7z=21$ or $7z=-21$
$z=3$ or $z=-3$

38. The absolute value of any expression is never negative, so no solution exists. The solution set is $\varnothing$.

40. $|x+4|-4=1$

$|x+4|=5$

$x+4=5$ or $x+4=-5$

$x=1$ or $x=-9$

42. The absolute value of any expression is never negative, so no solution exists. The solution set is $\varnothing$.

44. The absolute value of any expression is never negative, so no solution exists. The solution set is $\varnothing$.

46. $|5x-2|=0$

$5x-2=0$

$5x=2$

$x=\frac{2}{5}$

48. $|2+3m|-9=-7$

$|2+3m|=2$

$2+3m=2$ or $2+3m=-2$

$3m=0$ or $3m=-4$

$m=0$ or $m=-\frac{4}{3}$

50. $|8-6c|=1$

$8-6c=1$ or $8-6c=-1$

$-6c=-7$ or $-6c=-9$

$c=\frac{-7}{-6}$ or $c=\frac{-9}{-6}$

$c=\frac{7}{6}$ or $c=\frac{3}{2}$

52. $|3x+5|=|-4|$

$|3x+5|=4$

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

$3x=-1$ or $3x=-9$

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

54. $|3+6n|=|4n+11|$

$3+6n=4n+11$ or $3+6n=-(4n+11)$

$2n=8$ or $3+6n=-4n-11$

$n=4$ or $10n=-14$

$n=4$ or $n=-\frac{7}{5}$

56. $|4-5y|=-|-3|$

$|4-5y|=-3$

The absolute value of any expression is never negative, so no solution exists. The solution set is $\varnothing$.

58. $|4n+5|=|4n+3|$

$4n+5=-(4n+3)$ or $4n+5=4n+3$

$4n+5=-4n-3$ or $5=3$

$8n=-8$ or false

$n=-1$

The only solution is -1.

60. $\left|\frac{1+3n}{4}\right|=4$

$\frac{1+3n}{4}=4$ or $\frac{1+3n}{4}=-4$

$1+3n=16$ or $1+3n=-16$

$3n=15$ or $3n=-17$

$n=5$ or $n=-\frac{17}{3}$

62. $8+|4m|=24$

$|4m|=16$

$4m=16$ or $4m=-16$

$m=4$ or $m=-4$

64. $\left|\frac{5x+2}{2}\right|=|-6|$

$\left|\frac{5x+2}{2}\right|=6$

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

$5x+2=12$ or $5x+2=-12$

$5x=10$ or $5x=-14$

$x=2$ or $x=-\frac{14}{5}$

66. $|5z-1| = |7-z|$

$5z-1 = -(7-z)$ or $5z-1 = 7-z$

$5z-1 = -7+z$ or $6z = 8$

$4z = -6$ or $z = \frac{4}{3}$

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

68. $\left|\frac{2r-6}{5}\right| = |-2|$

$\left|\frac{2r-6}{5}\right| = 2$

$\frac{2r-6}{5} = 2$ or $\frac{2r-6}{5} = -2$

$2r-6 = 10$ or $2r-6 = -10$

$2r = 16$ or $2r = -4$

$r = 8$ or $r = -2$

70. $|8-y| = |y+2|$

$8-y = -(y+2)$ or $8-y = y+2$

$8-y = -y-2$ or $6 = 2y$

$8 = -2$ or $3 = y$

false or $3 = y$

The only solution is 3.

72. $\left|\frac{5d+1}{6}\right| = -|-9|$

$\left|\frac{5d+1}{6}\right| = -9$

The absolute value of any expression is never negative, so no solution exists. The solution set is $\varnothing$.

74. Answers may vary. Possible answer:
In some cases, one of the equations yields no solution. One example is problem 70 above. The equation 8 = –2 is false.

76. 3%(360°) = 0.03(360°) = 10.8°

78. $|x| \le 3$
Answers may vary
3, 2, 1, 0, –1, for example

80. $|y| > -10$
Answers may vary
0, 1, 2, 3, 4, for example

82. $|x-1| = 5$

84. $|x| = 6$

86. $|x-2| = |3x-4|$

Section 2.7

Practice Exercises

1. $|x| < 2$
The solution set of this inequality contains all numbers whose distance from 0 is less than 2.
The solution set is (–2, 2).

2. $|b+1| < 3$

$-3 < b+1 < 3$

$-3-1 < b+1-1 < 3-1$

$-4 < b < 2$

(–4, 2)

3. $|3x-2|+5 \le 9$

$|3x-2| \le 9-5$

$|3x-2| \le 4$

$-4 \le 3x-2 \le 4$

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

$-2 \le 3x \le 6$

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

$\left[-\frac{2}{3}, 2\right]$

4. $\left|3x+\frac{5}{8}\right| < -4$

The absolute value of a number is always nonnegative and can never be less than –4. The solution set is { } or $\varnothing$.

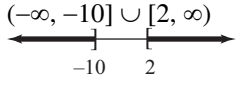
5. $|y+4| \ge 6$

$y+4 \le -6$ or $y+4 \ge 6$

$y+4-4 \le -6-4$ or $y+4-4 \ge 6-4$

$y \le -10$ or $y \ge 2$

$(-\infty, -10] \cup [2, \infty)$



6. $|4x+3|+5>3$

$|4x+3|+5-5>3-5$

$|4x+3|>-2$

The absolute value of any number is always nonnegative and thus is always greater than –2.

$(-\infty, \infty)$

7. $\left|\frac{x}{2}-3\right|-5>-2$

$\left|\frac{x}{2}-3\right|-5+5>-2+5$

$\left|\frac{x}{2}-3\right|>3$

$\frac{x}{2}-3<-3$ or $\frac{x}{2}-3>3$

$2\left(\frac{x}{2}-3\right)<2(-3)$ or $2\left(\frac{x}{2}-3\right)>2(3)$

$x-6<-6$ or $x-6>6$

$x<0$ or $x>12$

$(-\infty, 0)\cup(12, \infty)$

8. $\left|\frac{3(x-2)}{5}\right|\le 0$

$\frac{3(x-2)}{5}=0$

$5\left[\frac{3(x-2)}{5}\right]=5(0)$

$3(x-2)=0$

$3x-6=0$

$3x=6$

$x=2$

The solution set is $\{2\}$.

Vocabulary and Readiness Check

1. D

2. E

3. C

4. B

5. A

Exercise Set 2.7

2. $|x|<6$

$-6<x<6$

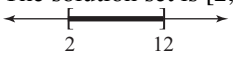
The solution set is (–6, 6).

4. $|y-7|\le 5$

$-5\le y-7\le 5$

$2\le y\le 12$

The solution set is [2, 12].



6. $|x+4|<6$

$-6<x+4<6$

$-10<x<2$

The solution set is (–10, 2).

8. $|5x-3|\le 18$

$-18\le 5x-3\le 18$

$-15\le 5x\le 21$

$-3\le x\le \frac{21}{5}$

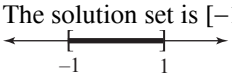
The solution set is $\left[-3, \frac{21}{5}\right]$.

10. $|x|+6\le 7$

$|x|\le 1$

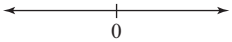
$-1\le x\le 1$

The solution set is [–1, 1].



12. $|8x-3|<-2$

The absolute value of an expression is never negative, so no solution exists. The solution set is $\varnothing$.



14. $|z+2|-7<-3$

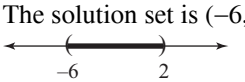
$|z+2|<4$

$-4<z+2<4$

$-4-2<z+2-2<4-2$

$-6<z<2$

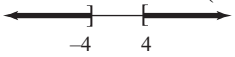
The solution set is (–6, 2).



16. $|y| \geq 4$

$y \leq -4$ or $y \geq 4$

The solution set is $(-\infty, -4] \cup [4, \infty)$.

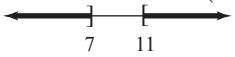


18. $|x - 9| \geq 2$

$x - 9 \leq -2$ or $x - 9 \geq 2$

$x \leq 7$ or $x \geq 11$

The solution set is $(-\infty, 7] \cup [11, \infty)$.



20. $|x| - 1 > 3$

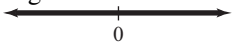
$|x| > 4$

$x < -4$ or $x > 4$

The solution set is $(-\infty, -4) \cup (4, \infty)$.

22. $|4x - 11| > -1$

An absolute value is always greater than a negative number. Thus, the answer is $(-\infty, \infty)$.



24. $|10 + 3x| + 1 > 2$

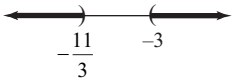
$|10 + 3x| > 1$

$10 + 3x < -1$ or $10 + 3x > 1$

$3x < -11$ or $3x > -9$

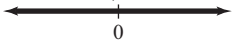
$x < -\frac{11}{3}$ or $x > -3$

The solution set is $\left(-\infty, -\frac{11}{3}\right) \cup (-3, \infty)$.



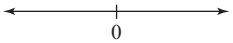
26. $|x| \geq 0$

An absolute value is always greater than or equal to 0. Thus, the answer is $(-\infty, \infty)$.



28. $|5x - 6| < 0$

The absolute value of an expression is never negative, so no solution exists. The solution set is $\varnothing$.



30. $|z| < 8$

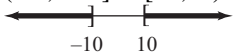
$-8 < z < 8$

$(-8, 8)$

32. $|x| \geq 10$

$x \leq -10$ or $x \geq 10$

$(-\infty, -10] \cup [10, \infty)$



34. $|-3 + x| \leq 10$

$-10 \leq -3 + x \leq 10$

$-7 \leq x \leq 13$

$[-7, 13]$

36. $|1 + 0.3x| \geq 0.1$

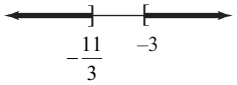
$1 + 0.3x \leq -0.1$ or $1 + 0.3x \geq 0.1$

$0.3x \leq -1.1$ or $0.3x \geq -0.9$

$\frac{0.3x}{0.3} \leq -\frac{1.1}{0.3}$ or $\frac{0.3x}{0.3} \geq -\frac{0.9}{0.3}$

$x \leq -\frac{11}{3}$ or $x \geq -3$

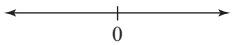
$\left(-\infty, -\frac{11}{3}\right] \cup [-3, \infty)$



38. $8 + |x| < 1$

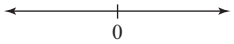
$|x| < -7$

An absolute value is never negative, so no solution exists. The solution set is $\varnothing$.



40. $|x| \leq -7$

An absolute value is never negative, so no solution exists. The solution set is $\varnothing$.



42. $|5x + 2| < 8$

$-8 < 5x + 2 < 8$

$-10 < 5x < 6$

$-2 < x < \frac{6}{5}$

The solution set is $\left(-2, \frac{6}{5}\right)$.

44. $|-1+x|-6>2$

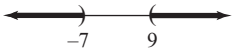
$|-1+x|-6+6>2+6$

$|-1+x|>8$

$-1+x<-8$ or $-1+x>8$

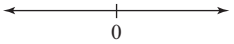
$x<-7$ or $x>9$

$(-\infty, -7)\cup(9, \infty)$



46. $|x|<0$

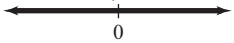
An absolute value is never negative, so no solution exists. The solution set is $\varnothing$.



48. $5+|x|\geq 4$

$|x|\geq -1$

An absolute value is always greater than or equal to 0. Thus, the answer is $(-\infty, \infty)$.



50. $-3+|5x-2|\leq 4$

$|5x-2|\leq 7$

$-7\leq 5x-2\leq 7$

$-5\leq 5x\leq 9$

$-1\leq x\leq \frac{9}{5}$

The solution set is $\left[-1, \frac{9}{5}\right]$.

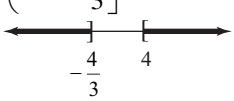
52. $\left|\frac{3}{4}x-1\right|\geq 2$

$\frac{3}{4}x-1\leq -2$ or $\frac{3}{4}x-1\geq 2$

$\frac{3}{4}x\leq -1$ or $\frac{3}{4}x\geq 3$

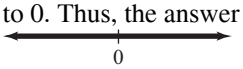
$x\leq -\frac{4}{3}$ or $x\geq 4$

$\left(-\infty, -\frac{4}{3}\right]\cup[4, \infty)$



54. $|4+9x|\geq -6$

An absolute value is always greater than or equal to 0. Thus, the answer is $(-\infty, \infty)$.



56. $\left|\frac{5x+6}{2}\right|\leq 0$

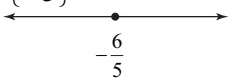
$\frac{5x+6}{2}=0$

$5x+6=0$

$5x=-6$

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

$\left\{-\frac{6}{5}\right\}$



58. $|7x-3|-1\leq 10$

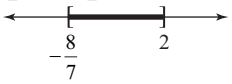
$|7x-3|\leq 11$

$-11\leq 7x-3\leq 11$

$-8\leq 7x\leq 14$

$-\frac{8}{7}\leq x\leq 2$

$\left[-\frac{8}{7}, 2\right]$



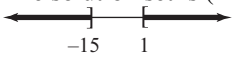
60. $\left|\frac{7+x}{2}\right|\geq 4$

$\frac{7+x}{2}\leq -4$ or $\frac{7+x}{2}\geq 4$

$7+x\leq -8$ or $7+x\geq 8$

$x\leq -15$ or $x\geq 1$

The solution set is $(-\infty, -15]\cup(1, \infty]$.



62. $-9+|3+4x|<-4$

$-9+|3+4x|+9<-4+9$

$|3+4x|<5$

$-5<3+4x<5$

$-8<4x<2$

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

$-2<x<\frac{1}{2}$

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

64. $\left|\frac{3}{5}+4x\right|-6<-1$

$\left|\frac{3}{5}+4x\right|<5$

$-5<\frac{3}{5}+4x<5$

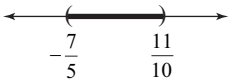
$-25<3+20x<25$

$-28<20x<22$

$-\frac{28}{20}<\frac{20x}{20}<\frac{22}{20}$

$-\frac{7}{5}<x<\frac{11}{10}$

$\left(-\frac{7}{5}, \frac{11}{10}\right)$



66. $|2x-3|>7$

$2x-3<-7$ or $2x-3>7$

$2x<-4$ or $2x>10$

$x<-2$ or $x>5$

$(-\infty, -2)\cup(5, \infty)$

68. $|5-6x|=29$

$5-6x=-29$ or $5-6x=29$

$-6x=-34$ or $-6x=24$

$x=\frac{17}{3}$ or $x=-4$

The solution set is $\left\{-4, \frac{17}{3}\right\}$.

70. $|x+4|\geq 20$

$x+4\leq -20$ or $x+4\geq 20$

$x\leq -24$ or $x\geq 16$

The solution set is $(-\infty, -24]\cup[16, \infty)$.

72. $|9+4x|\geq 0$

An absolute value is always greater than or equal to 0. Thus, the answer is $(-\infty, \infty)$.

74. $8+|5x-3|\geq 11$

$|5x-3|\geq 3$

$5x-3\leq -3$ or $5x-3\geq 3$

$5x\leq 0$ or $5x\geq 6$

$x\leq 0$ or $x\geq \frac{6}{5}$

The solution set is $(-\infty, 0]\cup\left[\frac{6}{5}, \infty\right)$.

76. $|5x-3|+2=4$

$|5x-3|=2$

$5x-3=-2$ or $5x-3=2$

$5x=1$ or $5x=5$

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

The solution set is $\left\{\frac{1}{5}, 1\right\}$.

78. $|4x-4|=-3$

An absolute value is never negative, so no solution exists. The solution set is $\varnothing$.

80. $\left|\frac{6-x}{4}\right|=5$

$\frac{6-x}{4}=-5$ or $\frac{6-x}{4}=5$

$6-x=-20$ or $6-x=20$

$26=x$ or $-14=x$

The solution set is $\{-14, 26\}$.

82. $\left|\frac{4x-7}{5}\right| < 2$

$$-2 < \frac{4x-7}{5} < 2$$
$$-10 < 4x - 7 < 10$$
$$-3 < 4x < 17$$
$$-\frac{3}{4} < x < \frac{17}{4}$$

The solution set is $\left(-\frac{3}{4}, \frac{17}{4}\right)$.

84. $P(\text{rolling a 5}) = \frac{1}{6}$

86. $P(\text{rolling a 0}) = 0$

88. $P(\text{rolling a 1, 2, 3, 4, 5, or 6}) = 1$

90.
$$3x - 4y = 12$$
$$3x - 4(-1) = 12$$
$$3x + 4 = 12$$
$$3x = 8$$
$$x = \frac{8}{3}$$

92.
$$3x - 4y = 12$$
$$3(4) - 4y = 12$$
$$12 - 4y = 12$$
$$-4y = 0$$
$$y = 0$$

94. $|x| > 4$

96. $|x| > 1$

98. Answers may vary

100.
$$\left|0.2 - \frac{51}{256}\right| = |0.2 - 0.19921875|$$
$$= |0.00078125|$$
$$= 0.00078125$$

The absolute error is 0.00078125.

The Bigger Picture

1.
$$9x - 14 = 11x + 2$$
$$9x - 11x = 14 + 2$$
$$-2x = 16$$
$$x = -8$$

2. $|x - 4| = 17$

$x - 4 = -17$ or $x - 4 = 17$

$x = -13$ or $x = 21$

3. $x - 1 \le 5$ or $3x - 2 \le 10$

$x \le 6$ or $3x \le 12$

$x \le 6$ or $x \le 4$

$(-\infty, 6]$

4. $-x < 7$ and $4x \le 20$

$x > -7$ and $x \le 5$

$(-7, 5]$

5. $|x - 2| = |x + 15|$

$x - 2 = x + 15$ or $x - 2 = -(x + 15)$

$-2 = 15$ False $x - 2 = -x - 15$

$2x - 2 = -15$

$2x = -13$

$x = -\frac{13}{2}$

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

6.
$$9y - 6y + 1 = 4y + 10 - y + 3$$
$$3y + 1 = 3y + 13$$
$$1 = 13$$

$\varnothing$

7.
$$1.5x - 3 = 1.2x - 18$$
$$1.5x - 1.2x = 3 - 18$$
$$0.3x = -15$$
$$x = -50$$

8.
$$\frac{7x+1}{8} - 3 = x + \frac{2x+1}{4}$$
$$8\left(\frac{7x+1}{8} - 3\right) = 8\left(x + \frac{2x+1}{4}\right)$$
$$7x + 1 - 8 \cdot 3 = 8x + 2(2x + 1)$$
$$7x + 1 - 24 = 8x + 4x + 2$$
$$7x - 23 = 12x + 2$$
$$7x - 12x = 2 + 23$$
$$-5x = 25$$
$$x = -5$$

9. $|5x+2|-10 \le -3$

$|5x+2| \le 7$

$-7 \le 5x+2 \le 7$

$-9 \le 5x \le 5$

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

$\left[-\frac{9}{5}, 1\right]$

10. $|x+11| > 2$

$x+11 > 2$ or $x+11 < -2$

$x > -9$ or $x < -13$

$(-\infty, -13) \cup (-9, \infty)$

11. $|9x+2|-1 = 24$

$|9x+2| = 25$

$9x+2 = -25$ or $9x+2 = 25$

$9x = -27$ or $9x = 23$

$x = -3$ or $x = \frac{23}{9}$

12. $\left|\frac{3x-1}{2}\right| = |2x+5|$

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

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

$3x-1 = -4x-10$ or $3x-1 = 4x+10$

$3x+4x = -10+1$ or $3x-4x = 10+1$

$7x = -9$ or $-x = 11$

$x = -\frac{9}{7}$ or $x = -11$

Chapter 2 Vocabulary Check

1. The statement "$x < 5$ or $x > 7$" is called a compound inequality.

2. An equation in one variable that has no solution is called a contradiction.

3. The intersection of two sets is the set of all elements common to both sets.

4. The union of two sets is the set of all elements that belong to either of the sets.

5. An equation in one variable that has every number (for which the equation is defined) as a solution is called an identity.

6. The equation $d = rt$ is also called a formula.

7. A number's distance from 0 is called its absolute value.

8. When a variable in an equation is replaced by a number and the resulting equation is true, then that number is called a solution of the equation.

9. The integers 17, 18, 19 are examples of consecutive integers.

10. The statement $5x - 0.2 < 7$ is an example of a linear inequality in one variable.

11. The statement $5x - 0.2 = 7$ is an example of a linear equation in one variable.

Chapter 2 Review

1.
$$\begin{aligned} 4(x-5) &= 2x-14 \\ 4x-20 &= 2x-14 \\ 2x &= 6 \\ x &= 3 \end{aligned}$$

2.
$$\begin{aligned} x+7 &= -2(x+8) \\ x+7 &= -2x-16 \\ 3x &= -23 \\ x &= -\frac{23}{3} \end{aligned}$$

3.
$$\begin{aligned} 3(2y-1) &= -8(6+y) \\ 6y-3 &= -48-8y \\ 14y &= -45 \\ y &= -\frac{45}{14} \end{aligned}$$

4.
$$\begin{aligned} -(z+12) &= 5(2z-1) \\ -z-12 &= 10z-5 \\ -11z &= 7 \\ z &= -\frac{7}{11} \end{aligned}$$

5.
$$\begin{aligned} n-(8+4n) &= 2(3n-4) \\ n-8-4n &= 6n-8 \\ -3n &= 6n \\ -9n &= 0 \\ n &= 0 \end{aligned}$$

6.
$$\begin{aligned} 4(9v+2) &= 6(1+6v)-10 \\ 36v+8 &= 6+36v-10 \\ 36v+8 &= 36v-4 \\ 8 &= -4 \end{aligned}$$

No solution, or $\varnothing$

7.
$$\begin{aligned} 0.3(x-2) &= 1.2 \\ 10[0.3(x-2)] &= 10(1.2) \\ 3(x-2) &= 12 \\ 3x-6 &= 12 \\ 3x &= 18 \\ x &= 6 \end{aligned}$$

8.
$$\begin{aligned} 1.5 &= 0.2(c-0.3) \\ 1.5 &= 0.2c-0.06 \\ 100(1.5) &= 100(0.2c-0.06) \\ 150 &= 20c-6 \\ 156 &= 20c \\ 7.8 &= c \end{aligned}$$

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

All real numbers

10.
$$\begin{aligned} 6(m-1)+3(2-m) &= 0 \\ 6m-6+6-3m &= 0 \\ 3m &= 0 \\ m &= 0 \end{aligned}$$

11.
$$\begin{aligned} 6-3(2g+4)-4g &= 5(1-2g) \\ 6-6g-12-4g &= 5-10g \\ -6-10g &= 5-10g \\ -6 &= 5 \end{aligned}$$

No solution, $\varnothing$

12.
$$\begin{aligned} 20-5(p+1)+3p &= -(2p-15) \\ 20-5p-5+3p &= -2p+15 \\ 15-2p &= -2p+15 \\ 15 &= 15 \end{aligned}$$

All real numbers

13.
$$\begin{aligned} \frac{x}{3}-4 &= x-2 \\ 3\left(\frac{x}{3}-4\right) &= 3(x-2) \\ x-12 &= 3x-6 \\ -2x &= 6 \\ x &= -3 \end{aligned}$$

14. $\frac{9}{4}y = \frac{2}{3}y$

$12\left(\frac{9}{4}y\right) = 12\left(\frac{2}{3}y\right)$

$27y = 8y$

$19y = 0$

$y = 0$

15. $\frac{3n}{8} - 1 = 3 + \frac{n}{6}$

$24\left(\frac{3n}{8} - 1\right) = 24\left(3 + \frac{n}{6}\right)$

$9n - 24 = 72 + 4n$

$5n = 96$

$n = \frac{96}{5}$

16. $\frac{z}{6} + 1 = \frac{z}{2} + 2$

$6\left(\frac{z}{6} + 1\right) = 6\left(\frac{z}{2} + 2\right)$

$z + 6 = 3z + 12$

$-2z = 6$

$z = -3$

17. $\frac{y}{4} - \frac{y}{2} = -8$

$4\left(\frac{y}{4} - \frac{y}{2}\right) = 4(-8)$

$y - 2y = -32$

$-y = -32$

$y = 32$

18. $\frac{2x}{3} - \frac{8}{3} = x$

$2x - 8 = 3x$

$-8 = x$

19. $\frac{b-2}{3} = \frac{b+2}{5}$

$5(b-2) = 3(b+2)$

$5b - 10 = 3b + 6$

$2b = 16$

$b = 8$

20. $\frac{2t-1}{3} = \frac{3t+2}{15}$

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

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

$10t - 5 = 3t + 2$

$7t = 7$

$t = 1$

21. $\frac{2(t+1)}{3} = \frac{2(t-1)}{3}$

$3\left[\frac{2(t+1)}{3}\right] = 3\left[\frac{2(t-1)}{3}\right]$

$2(t+1) = 2(t-1)$

$2t + 2 = 2t - 2$

$2 = -2$

No solution, $\varnothing$

22. $\frac{3a-3}{6} = \frac{4a+1}{15} + 2$

$30\left(\frac{3a-3}{6}\right) = 30\left(\frac{4a+1}{15} + 2\right)$

$5(3a-3) = 2(4a+1) + 30(2)$

$15a - 15 = 8a + 2 + 60$

$15a - 15 = 8a + 62$

$7a = 77$

$a = 11$

23. Let x = the number.

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

$2x - 6 = 3x + 1$

$-7 = x$

The number is -7.

24. Let x = smaller number, then

$x + 5$ = larger number.

$x + x + 5 = 285$

$2x = 280$

$x = 140$

$x + 5 = 145$

The numbers are 140 and 145.

25. $40\% \cdot 130 = 0.40 \cdot 130 = 52$

26. $1.5\% \cdot 8 = 0.015 \cdot 8 = 0.12$

27. Let x = number of CDs sold in 2000.

$x - 0.25x = 705.4$

$0.75x = 705.4$

$x \approx 940.5$

There were 940.5 million music CDs sold by U.S. manufacturers in 2000.

28. Let n = the first integer, then
$n + 1$ = the second integer,
$n + 2$ = the third integer, and
$n + 3$ = the fourth integer.

$$(n+1)+(n+2)+(n+3)-2n=16$$
$$n+6=16$$
$$n=10$$

Therefore, the integers are 10, 11, 12, and 13.

29. Let x = smaller odd integer, then
$x + 2$ = larger odd integer.

$$5x=3(x+2)+54$$
$$5x=3x+6+54$$
$$2x=60$$
$$x=30$$

Since this is not odd, no such consecutive odd integers exist.

30. Let x = width of the playing field, then
$2x - 5$ = length of the playing field.

$$2x+2(2x-5)=230$$
$$2x+4x-10=230$$
$$6x=240$$
$$x=40$$

Then $2x - 5 = 2(40) - 5 = 75$. The field is 75 meters long and 40 meters wide.

31. Let m = number of miles of driven.

$$2(19.95)+0.12(m-200)=46.86$$
$$39.90+0.12m-24=46.86$$
$$0.12m+15.90=46.86$$
$$0.12m=30.96$$
$$m=258$$

32. Solve $R = C$.

$$16.50x=4.50x+3000$$
$$12x=3000$$
$$x=250$$

Thus, 250 calculators must be produced and sold in order to break even.

33. $V = LWH$

$$W=\frac{V}{LH}$$

34. $C = 2\pi r$

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

35. $5x-4y=-12$

$$5x+12=4y$$
$$y=\frac{5x+12}{4}$$

36. $5x-4y=-12$

$$5x=4y-12$$
$$x=\frac{4y-12}{5}$$

37. $y-y_1=m(x-x_1)$

$$m=\frac{y-y_1}{x-x_1}$$

38.

$$y-y_1=m(x-x_1)$$
$$y-y_1=mx-mx_1$$
$$y-y_1+mx_1=mx$$
$$\frac{y-y_1+mx_1}{m}=x$$

39.

$$E=I(R+r)$$
$$E=IR+Ir$$
$$I-IR=Ir$$
$$\frac{E-IR}{I}=r$$

40.

$$S=vt+gt^2$$
$$S-vt=gt^2$$
$$\frac{S-vt}{t^2}=g$$

41. $T=gr+gvt$

$$T=g(r+vt)$$
$$g=\frac{T}{r+vt}$$

42.

$$I=Prt+P$$
$$I=P(rt+1)$$
$$\frac{I}{rt+1}=P$$

43. $A=P\left(1+\frac{r}{n}\right)^{nt}=3000\left(1+\frac{0.03}{n}\right)^{7n}$

a. $A=3000\left(1+\frac{0.03}{2}\right)^{14}\approx \$3695.27$

b. $A=3000\left(1+\frac{0.03}{52}\right)^{364}\approx \$3700.81$

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

$C = \frac{5}{9}(90 - 32)$

$C = \frac{5}{9}(58)$

$C = \frac{290}{9} \approx 32.2$

90°F is $\left(\frac{290}{9}\right)$°C ≈ 32.2°C.

45. Let x = original width, then
$x + 2$ = original length.

$(x+4)(x+2+4) = x(x+2) + 88$

$(x+4)(x+6) = x^2 + 2x + 88$

$x^2 + 10x + 24 = x^2 + 2x + 88$

$8x = 64$

$x = 8$

$x + 2 = 10$

The original width is 8 in. and the original length is 10 in.

46. Area $= 18 \times 21 = 378$ ft^2

Packages $= \frac{378}{24} = 15.75$

There are 16 packages needed.

47. $3(x-5) > -(x+3)$

$3x - 15 > -x - 3$

$4x > 12$

$x > 3$

$(3, \infty)$

48. $-2(x+7) \geq 3(x+2)$

$-2x - 14 \geq 3x + 6$

$-5x \geq 20$

$x \leq -4$

$(-\infty, -4]$

49. $4x - (5 + 2x) < 3x - 1$

$4x - 5 - 2x < 3x - 1$

$2x - 5 < 3x - 1$

$-x < 4$

$x > -4$

$(-4, \infty)$

50. $3(x-8) < 7x + 2(5-x)$

$3x - 24 < 7x + 10 - 2x$

$3x - 24 < 5x + 10$

$-2x < 34$

$x > -17$

$(-17, \infty)$

51. $24 \geq 6x - 2(3x-5) + 2x$

$24 \geq 6x - 6x + 10 + 2x$

$24 \geq 10 + 2x$

$14 \geq 2x$

$7 \geq x$

$(-\infty, 7]$

52. $\frac{x}{3} + \frac{1}{2} > \frac{2}{3}$

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

$2x + 3 > 4$

$2x > 1$

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

$\left(\frac{1}{2}, \infty\right)$

53. $x + \frac{3}{4} < -\frac{x}{2} + \frac{9}{4}$

$4\left(x + \frac{3}{4}\right) < 4\left(-\frac{x}{2} + \frac{9}{4}\right)$

$4x + 3 < -2x + 9$

$6x < 6$

$x < 1$

$(-\infty, 1)$

54. $\frac{x-5}{2} \leq \frac{3}{8}(2x+6)$

$8\left(\frac{x-5}{2}\right) \leq 8\left[\frac{3}{8}(2x+6)\right]$

$4(x-5) \leq 3(2x+6)$

$4x - 20 \leq 6x + 18$

$-2x \leq 38$

$x \geq -19$

$[-19, \infty)$

55. Let n = number of pounds of laundry.

$15 < 0.5(10) + 0.4(n - 10)$

$15 < 5 + 0.4n - 4$

$15 < 1 + 0.4n$

$14 < 0.4n$

$35 < n$

It is more economical to use the housekeeper for more than 35 pounds of laundry per week.

56. $500 \le F \le 1000$

$500 \le \frac{9}{5}C + 32 \le 1000$

$468 \le \frac{9}{5}C \le 968$

$260 \le C \le 538$

Rounded to the nearest degree, firing temperatures range from 260°C to 538°C.

57. Let x = the score from the last judge.

$$\frac{9.5+9.7+9.9+9.7+9.7+9.6+9.5+x}{8} \ge 9.65$$

$$67.6 + x \ge 77.2$$

$$x \ge 9.6$$

The last judge must give Nana at least a 9.6 for her to win the silver medal.

58. Let x = the amount saved each summer.

$4000 \le 2x + 500 \le 8000$

$3500 \le 2x \le 7500$

$1750 \le x \le 3750$

She must save between \$1750 and \$3750 each summer.

59. $1 \le 4x - 7 \le 3$

$8 \le 4x \le 10$

$2 \le x \le \frac{5}{2}$

$\left[2, \frac{5}{2}\right]$

60. $-2 \le 8 + 5x < -1$

$-10 \le 5x \le -9$

$-2 \le x \le -\frac{9}{5}$

$\left[-2, \frac{9}{5}\right)$

61. $-3 < 4(2x - 1) < 12$

$-3 < 8x - 4 < 12$

$1 < 8x < 16$

$\frac{1}{8} < x < 2$

$\left(\frac{1}{8}, 2\right)$

62. $-6 < x - (3 - 4x) < -3$

$-6 < x - 3 + 4x < -3$

$-6 < 5x - 3 < -3$

$-3 < 5x < 0$

$-\frac{3}{5} < x < 0$

$\left(-\frac{3}{5}, 0\right)$

63. $\frac{1}{6} < \frac{4x-3}{3} \le \frac{4}{5}$

$30\left(\frac{1}{6}\right) < 30\left(\frac{4x-3}{3}\right) \le 30\left(\frac{4}{5}\right)$

$5 < 10(4x - 3) \le 24$

$5 < 40x - 30 \le 24$

$35 < 40x < 54$

$\frac{7}{8} < x \le \frac{27}{20}$

$\left(\frac{7}{8}, \frac{27}{20}\right]$

64. $x \le 2$ and $x > -5$

$-5 < x \le 2$

$(-5, 2]$

65. $3x - 5 > 6$ or $-x < -5$

$3x > 11$ or $x > 5$

$x > \frac{11}{3}$ or $x > 5$

$x > \frac{11}{3}$

$\left(\frac{11}{3}, \infty\right)$

66. $|x - 7| = 9$

$x - 7 = 9$ or $x - 7 = -9$

$x = 16$ or $x = -2$

67. $|8 - x| = 3$

$8 - x = 3$ or $8 - x = -3$

$-x = -5$ or $-x = -11$

$x = 5$ or $x = 11$

68. $|2x + 9| = 9$

$2x + 9 = 9$ or $2x + 9 = -9$

$2x = 0$ or $2x = -18$

$x = 0$ or $x = -9$

69. $|-3x+4|=7$

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

$-3x=3$ or $-3x=-11$

$x=-1$ or $x=\frac{11}{3}$

70. $|3x-2|+6=10$

$|3x-2|=4$

$3x-2=4$ or $3x-2=-4$

$3x=6$ or $3x=-2$

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

71. $5+|6x+1|=5$

$|6x+1|=0$

$6x+1=0$

$6x=-1$

$x=-\frac{1}{6}$

72. $-5=|4x-3|$

The solution set is $\varnothing$.

73. $|5-6x|+8=3$

$|5-6x|=-5$

The solution set is $\varnothing$.

74. $-8=|x-3|-10$

$2=|x-3|$

$x-3=2$ or $x-3=-2$

$x=5$ or $x=1$

75. $\left|\frac{3x-7}{4}\right|=2$

$\frac{3x-7}{4}=2$ or $\frac{3x-7}{4}=-2$

$3x-7=8$ or $3x-7=-8$

$3x=15$ or $3x=-1$

$x=5$ or $x=-\frac{1}{3}$

76. $|6x+1|=|15+4x|$

$6x+1=15+4x$ or $6x+1=-(15+4x)$

$2x=14$ or $6x+1=-15-4x$

$x=7$ or $10x=-16$

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

77. $|5x-1|<9$

$-9<5x-1<9$

$-8<5x<10$

$-\frac{8}{5}<x<2$

$\left(-\frac{8}{5}, 2\right)$

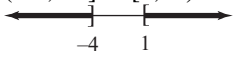
78. $|6+4x|\geq 10$

$6+4x\leq -10$ or $6+4x\geq 10$

$4x\leq -16$ or $4x\geq 4$

$x\leq -4$ or $x\geq 1$

$(-\infty, -4]\cup[1, \infty)$



79. $|3x|-8>1$

$|3x|>9$

$3x<-9$ or $3x>9$

$x<-3$ or $x>3$

$(-\infty, -3)\cup(3, \infty)$

80. $9+|5x|<24$

$|5x|<15$

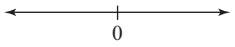
$-15<5x<15$

$-3<x<3$

$(-3, 3)$

81. $|6x-5|\leq -1$

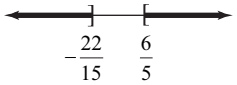
The solution set is $\varnothing$.



82. $\left|3x+\frac{2}{5}\right| \ge 4$

$$3x+\frac{2}{5} \le -4 \quad \text{or} \quad 3x+\frac{2}{5} \ge 4$$
$$5\left(3x+\frac{2}{5}\right) \le 5(-4) \quad \text{or} \quad 5\left(3x+\frac{2}{5}\right) \ge 5(4)$$
$$15x+2 \le -20 \quad \text{or} \quad 15x+2 \ge 20$$
$$15x \le -22 \quad \text{or} \quad 15x \ge 18$$
$$x \le -\frac{22}{15} \quad \text{or} \quad x \ge \frac{6}{5}$$

$\left(-\infty, -\frac{22}{15}\right] \cup \left[\frac{6}{5}, \infty\right)$

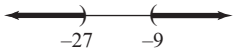


83. $\left|\frac{x}{3}+6\right|-8 > -5$

$$\left|\frac{x}{3}+6\right| > 3$$

$$\frac{x}{3}+6 < -3 \quad \text{or} \quad \frac{x}{3}+6 > 3$$
$$\frac{x}{3} < -9 \quad \text{or} \quad \frac{x}{3} > -3$$
$$x < -27 \quad \text{or} \quad x > -9$$

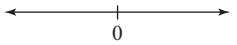
$(-\infty, -27) \cup (-9, \infty)$



84. $\left|\frac{4(x-1)}{7}\right|+10 < 2$

$$\left|\frac{4(x-1)}{7}\right| < -8$$

The solution set is $\varnothing$.



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

$$30\left(\frac{x-2}{5}+\frac{x+2}{2}\right)=30\left(\frac{x+4}{3}\right)$$
$$6(x-2)+15(x+2)=10(x+4)$$
$$6x-12+15x+30=10x+40$$
$$21x+18=10x+40$$
$$11x=22$$
$$x=2$$

86. $\frac{2z-3}{4}-\frac{4-z}{2}=\frac{z+1}{3}$

$$12\left(\frac{2z-3}{4}-\frac{4-z}{2}\right)=12\left(\frac{z+1}{3}\right)$$
$$3(2z-3)-6(4-z)=4(z+1)$$
$$6z-9-24+6z=4z+4$$
$$12z-33=4z+4$$
$$8z=37$$
$$z=\frac{37}{8}$$

87. Let x = number of tourists for France, then
$x + 9$ = number of tourists for United States, and
$x + 44$ = number of tourists for China.

$$x+(x+9)+(x+44)=332$$
$$3x+53=332$$
$$3x=279$$
$$x=93$$

$x + 9 = 102$
$x + 44 = 137$
China is predicted to have 137 million tourists, whereas the United States is predicted to have 102 million and France, 93 million.

88. $A=\frac{h}{2}(B+b)$

$$2A=hB+hb$$
$$2A-hb=hB$$
$$\frac{2A-hb}{h}=B$$

89. $V=\frac{1}{3}\pi r^2 h$

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

90. $V_{\text{box}} = lwh = 8 \cdot 5 \cdot 3 = 120 \text{ in}^3$, while
$V_{\text{cyl}} = \pi r^2 h = \pi \cdot 3^2 \cdot 6 = 54\pi \approx 170 \text{ in}^3$
Therefore, the cylinder holds more ice cream.

91. $d = rt$ or $r = \frac{d}{t}$
11:00 A.M. to 1:15 P.M. is 2.25 hours.

$$r=\frac{130}{2.25} \approx 58$$

His average speed was 58 mph.

92. $48 + x \geq 5(2x + 4) - 2x$
$48 + x \geq 10x + 20 - 2x$
$48 + x \geq 8x + 20$
$28 \geq 7x$
$4 \geq x$
$(-\infty, 4]$

93. $\dfrac{3(x-2)}{5} > \dfrac{-5(x-2)}{3}$
$15\left[\dfrac{3(x-2)}{5}\right] > 15\left[\dfrac{-5(x-2)}{3}\right]$
$9(x-2) > -25(x-2)$
$9x - 18 > -25x + 50$
$34x > 68$
$x > 2$
$(2, \infty)$

94. $0 \leq \dfrac{2(3x+4)}{5} \leq 3$
$5(0) \leq 5\left[\dfrac{2(3x+4)}{5}\right] \leq 5(3)$
$0 \leq 2(3x+4) \leq 15$
$0 \leq 6x + 8 \leq 15$
$-8 \leq 6x \leq 7$
$-\dfrac{4}{3} \leq x \leq \dfrac{7}{6}$
$\left[-\dfrac{4}{3}, \dfrac{7}{6}\right]$

95. $x \leq 2$ or $x > -5$
$(-\infty, \infty)$

96. $-2x \leq 6$ and $-2x + 3 < -7$
$x \geq -3$ and $-2x < -10$
$x \geq -3$ and $x > 5$
$x > 5$
$(5, \infty)$

97. $|7x| - 26 = -5$
$|7x| = 21$
$7x = 21$ or $7x = -21$
$x = 3$ or $x = -3$

98. $\left|\dfrac{9-2x}{5}\right| = -3$
The solution set is $\varnothing$.

99. $|x - 3| = |7 + 2x|$
$x - 3 = 7 + 2x$ or $x - 3 = -(7 + 2x)$
$-10 = x$ or $x - 3 = -7 - 2x$
$3x = -4$
$x = -\dfrac{4}{3}$

100. $|6x - 5| \geq -1$
Since $|6x - 5|$ is nonnegative for all numbers x, the solution set is $(-\infty, \infty)$.

101. $\left|\dfrac{4x-3}{5}\right| < 1$
$-1 < \dfrac{4x-3}{5} < 1$
$-5 < 4x - 3 < 5$
$-2 < 4x < 8$
$-\dfrac{1}{2} < x < 2$
$\left(-\dfrac{1}{2}, 2\right)$

Chapter 2 Test

1. $8x + 14 = 5x + 44$
$3x = 30$
$x = 10$

2. $9(x+2) = 5[11 - 2(2 - x) + 3]$
$9x + 18 = 5[11 - 4 + 2x + 3]$
$9x + 18 = 5[10 + 2x]$
$9x + 18 = 50 + 10x$
$-x = 32$
$x = -32$

3. $3(y-4) + y = 2(6 + 2y)$
$3y - 12 + y = 12 + 4y$
$4y - 12 = 12 + 4y$
$-12 = 12$
No solution, $\varnothing$

4. $7n - 6 + n = 2(4n - 3)$
$8n - 6 = 8n - 6$
$-6 = -6$
All real numbers

5. $\dfrac{7w}{4}+5=\dfrac{3w}{10}+1$

$20\left(\dfrac{7w}{4}+5\right)=20\left(\dfrac{3w}{10}+1\right)$

$35w+100=6w+20$

$29w=-80$

$w=-\dfrac{80}{29}$

6. $\dfrac{z+7}{9}+1=\dfrac{2z+1}{6}$

$18\left(\dfrac{z+7}{9}+1\right)=18\left(\dfrac{2z+1}{6}\right)$

$2(z+7)+18=3(2z+1)$

$2z+14+18=6z+3$

$2z+32=6z+3$

$2z-6z=3-32$

$-4z=-29$

$z=\dfrac{29}{4}$

7. $|6x-5|-3=-2$

$|6x-5|=1$

$6x-5=1$ or $6x-5=-1$

$6x=6$ or $6x=4$

$x=1$ or $x=\dfrac{2}{3}$

8. $|8-2t|=-6$

No solution, $\varnothing$

9. $|2x-3|=|4x+5|$

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

$2x-4x=5+3$ or $2x-3=-4x-5$

$-2x=8$ or $2x+4x=-5+3$

$x=-4$ or $6x=-2$

$x=-4$ or $x=-\dfrac{1}{3}$

10. $|x-5|=|x+2|$

$x-5=x+2$ or $x-5=-(x+2)$

$-5=2$ False or $x-5=-x-2$

$2x=3$

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

Since $-5=2$ is not possible, the only solution is $\dfrac{3}{2}$.

11. $3x-4y=8$

$3x-8=4y$

$y=\dfrac{3x-8}{4}$

12. $S=gt^2+gvt$

$S=g(t^2+vt)$

$g=\dfrac{S}{t^2+vt}$

13. $F=\dfrac{9}{5}C+32$

$F-32=\dfrac{9}{5}C$

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

14. $3(2x-7)-4x>-(x+6)$

$6x-21-4x>-x-6$

$2x-21>-x-6$

$3x>15$

$x>5$

$(5,\infty)$

15. $\dfrac{3x-2}{3}-\dfrac{5x+1}{4}\ge 0$

$12\left[\dfrac{3x-2}{3}-\dfrac{5x+1}{4}\right]\ge 12(0)$

$4(3x-2)-3(5x+1)\ge 0$

$12x-8-15x-3\ge 0$

$-3x-11\ge 0$

$-3x\ge 11$

$x\le -\dfrac{11}{3}$

$\left(-\infty,-\dfrac{11}{3}\right]$

16. $-3<2(x-3)\le 4$

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

$3<2x\le 10$

$\dfrac{3}{2}<x\le 5$

$\left(\dfrac{3}{2},5\right]$

17. $|3x+1|>5$

$3x+1<-5$ or $3x+1>5$

$3x<-6$ or $3x>4$

$x<-2$ or $x>\frac{4}{3}$

$(-\infty,-2)\cup\left(\frac{4}{3},\infty\right)$

18. $|x-5|-4<-2$

$|x-5|<2$

$-2<x-5<2$

$3<x<7$

$(3,7)$

19. $x\ge 5$ and $x\ge 4$

$[5,\infty)$

20. $x\ge 5$ or $x\ge 4$

$[4,\infty)$

21. $-1\le\frac{2x-5}{3}<2$

$3(-1)\le 3\left(\frac{2x-5}{3}\right)<3(2)$

$-3\le 2x-5<6$

$-3+5\le 2x-5+5<6+5$

$2\le 2x<11$

$\frac{2}{2}\le\frac{2x}{2}<\frac{11}{2}$

$1\le x<\frac{11}{2}$

$\left[1,\frac{11}{2}\right)$

22. $6x+1>5x+4$ or $1-x>-4$

$x>3$ or $5>x$

$(-\infty,\infty)$

23. $12\%\cdot 80=0.12\cdot 80=9.6$

24. Let x = number employed in 2004.

$x+0.55x=357{,}000$

$1.55x=357{,}000$

$x\approx 230{,}323$

There were 230,323 employees in 2004.

25. Recall that $C=2\pi r$. Here $C=78.5$.

$78.5=2\pi r$

$r=\frac{78.5}{2\pi}=\frac{39.25}{\pi}$

Also, recall that $A=\pi r^2$.

$A=\pi\left(\frac{39.25}{\pi}\right)^2\approx\frac{39.25^2}{3.14}\approx 490.63$

Dividing this by 60 yields approximately 8.18. Therefore, about 8 hunting dogs could safely be kept in the pen.

26. Solve $R>C$.

$7.4x>3910+2.8x$

$4.6x>3910$

$x>850$

Therefore, more than 850 sunglasses must be produced and sold in order for them to yield a profit.

27. $A=P\left(1+\frac{r}{n}\right)^{nt}$

$=2500\left(1+\frac{0.035}{4}\right)^{4\cdot 10}$

$=\$3542.27$

28. Let x = population of New York, then

$x+1.3$ = population of Seoul, Korea, and

$2x-10.2$ = population of Tokyo.

$x+(x+1.3)+(2x-10.2)=78.3$

$4x-8.9=78.3$

$4x=87.2$

$x=21.8$

$x+1.3=23.1$

$2x-10.2=33.4$

The populations are as follows:
New York: 21.8 million,
Seoul: 23.1 million,
Tokyo: 33.4 million.

Chapter 2 Cumulative Review

1. a. $\{101, 102, 103, ...\}$

b. $\{2, 3, 4, 5\}$

2. a. $\{-2, -1, 0, 1, 2, 3, 4\}$

b. $\{4\}$

3. a. $|3|=3$

b. $\left|-\frac{1}{7}\right|=\frac{1}{7}$

c. $-|2.7|=-2.7$

d. $-|-8| = -8$

e. $|0| = 0$

4. a. The opposite of $\frac{2}{3}$ is $-\frac{2}{3}$.

b. The opposite of -9 is 9.

c. The opposite of 1.5 is -1.5.

5. a. $-3 + (-11) = -14$

b. $3 + (-7) = -4$

c. $-10 + 15 = 5$

d. $-8.3 + (-1.9) = -10.2$

e. $-\frac{2}{3} + \frac{3}{7} = -\frac{14}{21} + \frac{9}{21} = -\frac{5}{21}$

6. a. $-2 - (-10) = -2 + 10 = 8$

b. $1.7 - 8.9 = -7.2$

c. $-\frac{1}{2} - \frac{1}{4} = -\frac{2}{4} - \frac{1}{4} = -\frac{3}{4}$

7. a. $\sqrt{9} = 3$ since $3^2 = 9$.

b. $\sqrt{25} = 5$ since $5^2 = 25$.

c. $\sqrt{\frac{1}{4}} = \frac{1}{2}$ since $\left(\frac{1}{2}\right)^2 = \frac{1}{4}$.

d. $-\sqrt{36} = -6$ since $6^2 = 36$.

e. $\sqrt{-36}$ is not a real number.

8. a. $-3(-2) = 6$

b. $-\frac{3}{4}\left(-\frac{4}{7}\right) = \frac{3}{7}$

c. $\frac{0}{-2} = 0$

d. $\frac{-20}{-2} = 10$

9. Let $x = 4$, $y = -3$.

a. $3x - 7y = 3(4) - 7(-3) = 12 + 21 = 33$

b. $-2y^2 = -2(-3)^2 = -2(9) = -18$

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

10. a. $\sqrt[4]{1} = 1$ since $1^4 = 1$.

b. $\sqrt[3]{8} = 2$ since $2^3 = 8$.

c. $\sqrt[4]{81} = 3$ since $3^4 = 81$.

11. a. $x + 5 = 20$

b. $2(3 + y) = 4$

c. $x - 8 = 2x$

d. $\frac{z}{9} = 9 + z$

12. a. $-3 > -5$ since -3 is to the right of -5 on the number line.

b. $\frac{-12}{-4} = 3$

c. $0 > -2$ since 0 is to the right of -2 on the number line.

13. $7x + 5 = 5 + 7x$

14. $5 \cdot (7x) = (5 \cdot 7)x = 35x$

15.
$$\begin{aligned}2x + 5 &= 9 \\ 2x &= 4 \\ x &= 2\end{aligned}$$

16.
$$\begin{aligned}11.2 &= 1.2 - 5x \\ 10 &= -5x \\ -2 &= x\end{aligned}$$

17. $6x-4=2+6(x-1)$
$6x-4=2+6x-6$
$6x-4=6x-4$
$-4=-4,$ which is always true.
All real numbers

18. $2x+1.5=-0.2+1.6x$
$0.4x=-1.7$
$x=-4.25$

19. a. Let x = the first integer. Then
$x+1$ = the second integer and
$x+2$ = the third integer.
$x+(x+1)+(x+2)=3x+3$

b. $x+(5x)+(6x-3)=12x-3$

20. a. Let x = the first integer. Then
$x+1$ = the second integer and
$x+2$ = the third integer.
$x+(x+1)+(x+2)=3x+3$

b. $4(3x+1)=12x+4$

21. Let x = first number, then
$2x+3$ = second number and
$4x$ = third number.
$x+(2x+3)+4x=164$
$7x+3=164$
$7x=161$
$x=23$
$2x+3=2(23)+3=49$
$4x=4(23)=92$
The three numbers are 23, 49 and 92.

22. Let x = first number, then
$3x+2$ = second number.
$(3x+2)-x=24$
$2x+2=24$
$2x=22$
$x=11$
$3x+2=3(11)+2=35$
The two numbers are 11 and 35.

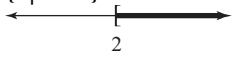
23. $3y-2x=7$
$3y=2x+7$
$y=\dfrac{2x+7}{3},$ or $y=\dfrac{2x}{3}+\dfrac{7}{3}$

24. $7x-4y=10$
$7x=4y+10$
$x=\dfrac{4y+10}{7},$ or $x=\dfrac{4y}{7}+\dfrac{10}{7}$

25. $A=\dfrac{1}{2}(B+b)h$
$2A=(B+b)h$
$2A=Bh+bh$
$2A-Bh=bh$
$\dfrac{2A-Bh}{h}=b$

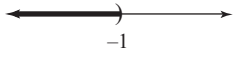
26. $P=2l+2w$
$P-2w=2l$
$\dfrac{P-2w}{2}=l$

27. a. $\{x|x\geq 2\}$



$[2,\infty)$

b. $\{x|x<-1\}$

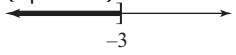


$(-\infty,-1)$

c. $\{x|0.5<x\leq 3\}$

(0.5, 3]

28. a. $\{x|x\leq -3\}$



$(-\infty,-3]$

b. $\{x|-2\leq x<0.1\}$

$[-2, 0.1)$

29. $-(x-3)+2\leq 3(2x-5)+x$
$-x+3+2\leq 6x-15+x$
$-x+5\leq 7x-15$
$20\leq 8x$
$\dfrac{5}{2}\leq x$
$\left[\dfrac{5}{2},\infty\right)$

30. $2(7x-1)-5x>-(-7x)+4$
$14x-2-5x>7x+4$
$9x-2>7x+4$
$2x>6$
$x>3$
$(3,\infty)$

31. $2(x+3) > 2x+1$
$2x+6 > 2x+1$
$6 > 1$; True for all real numbers x.
$(-\infty, \infty)$

32. $4(x+1)-3 < 4x+1$
$4x+4-3 < 4x+1$
$4x+1 < 4x+1$
$1 < 1$ Never true
$\varnothing$

33. $A = \{2, 4, 6, 8\}$, $B = \{3, 4, 5, 6\}$; the numbers 4 and 6 are in both sets so the intersection of A and B is $\{4, 6\}$.

34. The elements in either set or both sets are -2, -1, 0, 1, 2, 3, 4, and 5, so the union is $\{-2, -1, 0, 1, 2, 3, 4, 5\}$.

35. $x-7 < 2$ and $2x+1 < 9$
$x < 9$ and $2x < 8$
$x < 4$
$x < 4$
$(-\infty, 4)$

36. $x+3 \le 1$ or $3x-1 < 8$
$x \le -2$ or $3x < 9$
$x < 3$
$x < 3$
$(-\infty, 3)$

37. $A = \{2, 4, 6, 8\}$ and $B = \{3, 4, 5, 6\}$, so the union of A and B is $\{2, 3, 4, 5, 6, 8\}$.

38. $\varnothing$; there are no elements in common.

39. $-2x-5 < -3$ or $6x < 0$
$-2x < 2$ or $x < 0$
$x > -1$
All real numbers
$(-\infty, \infty)$

40. $-2x-5 < -3$ and $6x < 0$
$-2x < 2$ and $x < 0$
$x > -1$
$-1 < x < 0$
$(-1, 0)$

41. $|p| = 2$
$p = 2$ or $p = -2$

42. $|x| = 5$
$x = 5$ or $x = -5$

43. $\left|\frac{x}{2}-1\right| = 11$
$\frac{x}{2}-1 = 11$ or $\frac{x}{2}-1 = -11$
$\frac{x}{2} = 12$ or $\frac{x}{2} = -10$
$x = 24$ or $x = -20$

44. $\left|\frac{y}{3}+2\right| = 10$
$\frac{y}{3}+2 = 10$ or $\frac{y}{3}+2 = -10$
$\frac{y}{3} = 8$ or $\frac{y}{3} = -12$
$y = 24$ or $y = -36$

45. $|x-3| = |5-x|$
$x-3 = 5-x$ or $x-3 = -(5-x)$
$2x = 8$ or $x-3 = -5+x$
$x = 4$ or $-3 = -5$
Since $-3 = -5$ is not possible, the only solution is 4.

46. $|x+3| = |7-x|$
$x+3 = 7-x$ or $x+3 = -(7-x)$
$2x = 4$ or $x-3 = -7+x$
$x = 2$ or $-3 = -7$
Since $-3 = -7$ is not possible, the only solution is 2.

47. $|x| \le 3$
$-3 \le x \le 3$
$[-3, 3]$

48. $|x| > 1$
$x < -1$ or $x > 1$
$(-\infty, -1) \cup (1, \infty)$

49. $|2x+9|+5 > 3$
$|2x+9| > -2$
Since $|2x+9|$ is nonnegative for all numbers x, the solution set is $(-\infty, \infty)$.

50. $|3x+1|+9 < 1$
$|3x+1| < -8$
The solution set is $\varnothing$.