Chapter 2

Section 2.1 Practice Exercises

1. $14 - x = 21$

$14 - (-7) \stackrel{?}{=} 21$

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

$21 = 21$ True

Since a true statement results, -7 is a solution.

2. $x - 10 = 2x - 14$

$(8) - 10 \stackrel{?}{=} 2(8) - 14$

$-2 \stackrel{?}{=} 16 - 14$

$-2 = 2$ False

Since a false statement results, 8 is not a solution.

3. $3x + 6 = 21$

$3x + 6 - 6 = 21 - 6$

$3x = 15$

$\frac{3x}{3} = \frac{15}{3}$

$x = 5$

The solution set is $\{5\}$.

4. $4.5 = 3 + 2.5x$

$4.5 - 3 = 3 + 2.5x - 3$

$1.5 = 2.5x$

$\frac{1.5}{2.5} = \frac{2.5x}{2.5}$

$0.6 = x$

The solution set is $\{0.6\}$.

5. $-2x + 2 - 3x = 8x + 20 - 7x$

$-5x + 2 = 1x + 20$

$-5x + 2 - 1x = 1x + 20 - 1x$

$-6x + 2 = 20$

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

$-6x = 18$

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

$x = -3$

The solution set is $\{-3\}$.

6. $4(x - 2) = 6x - 10$

$4x - 8 = 6x - 10$

$4x - 8 - 4x = 6x - 10 - 4x$

$-8 = 2x - 10$

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

$2 = 2x$

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

$1 = x$

The solution set is $\{1\}$.

7. $\frac{x}{6} - \frac{x}{8} = \frac{1}{8}$

$24\left(\frac{x}{6} - \frac{x}{8}\right) = 24\left(\frac{1}{8}\right)$

$24\left(\frac{x}{6}\right) - 24\left(\frac{x}{8}\right) = 3$

$4x - 3x = 3$

$x = 3$

The solution set is $\{3\}$.

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

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

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

$3(x-1) + 3(2) = 9x - (2x+3)$

$3x - 3 + 6 = 9x - 2x - 3$

$3x + 3 = 7x - 3$

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

$3 = 4x - 3$

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

$6 = 4x$

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

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

The solution set is $\left\{\frac{3}{2}\right\}$.

9.
$$0.2x+0.1=0.12x-0.06$$
$$100(0.2x+0.1)=100(0.12x-0.06)$$
$$100(0.2x)+100(0.1)=100(0.12x)-100(0.06)$$
$$20x+10=12x-6$$
$$20x+10-12x=12x-6-12x$$
$$8x+10=-6$$
$$8x+10-10=-6-10$$
$$8x=-16$$
$$\frac{8x}{8}=\frac{-16}{8}$$
$$x=-2$$
The solution set is $\{-2\}$.

10.
$$5x-1=5(x+3)$$
$$5x-1=5x+15$$
$$5x-1-5x=5x+15-5x$$
$$-1=15 \quad \text{False}$$
The solution set is $\varnothing$ or $\{\ \}$.

11.
$$-4(x-1)=-4x-9+13$$
$$-4x+4=-4x+4$$
$$-4x+4+4x=-4x+4+4x$$
$$4=4$$
$$4-4=4-4$$
$$0=0 \quad \text{True}$$
The solution set is $\{x|x \text{ is a real number}\}$.

Vocabulary, Readiness & Video Check 2.1

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.

13. When x is replaced with -2 in the given equation, a true statement results.

14. The addition property of equality allows us to add the same number to (or subtract the same number from) both sides of an equation and have an equivalent equation.
The multiplication property of equality allows us to multiply (or divide) both sides of an equation by the same nonzero number and have an equivalent equation.

15. distributive property

16. to make the calculations less tedious

17. a. When solving a linear equation and all variable terms subtract out and you have a true statement, then the equation has all real numbers for which the equation is defined as solutions.

b. When solving a linear equation and all variable terms subtract out and you have a false statement, then the equation has no solution.

Exercise Set 2.1

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

$\frac{15}{-3} \stackrel{?}{=} -5$

$-5 = -5$ True

Yes, 15 is a solution.

4. $x - 10 = -2$

$-8 - 10 \stackrel{?}{=} -2$

$-18 = -2$ False

No, −8 is not a solution.

6. $6 - 2x = 4$

$6 - 2(-1) \stackrel{?}{=} 4$

$6 + 2 \stackrel{?}{=} 4$

$8 = 4$ False

No, −1 is not a solution.

8. $x - 1 = x - 1$

$5 - 1 \stackrel{?}{=} 5 - 1$

$4 = 4$ True

Yes, 5 is a solution.

10. $5(x - 6) = 30$

$5(12 - 6) \stackrel{?}{=} 30$

$5(6) \stackrel{?}{=} 30$

$30 = 30$ True

Yes, 12 is a solution.

12. $7x + 1 = 6x - 1$

$7(2) + 1 \stackrel{?}{=} 6(2) - 1$

$14 + 1 \stackrel{?}{=} 12 - 1$

$15 = 11$ False

No, 2 is not a solution.

14. $-2x = 18$

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

$x = -9$

Check: $-2x = 18$

$-2(-9) \stackrel{?}{=} 18$

$18 = 18$ True

The solution set is $\{-9\}$.

16. $-25 = y + 30$

$-25 - 30 = y + 30 - 30$

$-55 = y$

Check: $-25 = y + 30$

$-25 \stackrel{?}{=} -55 + 30$

$-25 = -25$ True

The solution set is $\{-55\}$.

18. $y - 8.6 = -6.3$

$y - 8.6 + 8.6 = -6.3 + 8.6$

$y = 2.3$

Check: $y - 8.6 = -6.3$

$2.3 - 8.6 \stackrel{?}{=} -6.3$

$-6.3 = -6.3$ True

The solution set is $\{2.3\}$.

20. $5y - 3 = 11 + 3y$

$5y - 3 - 3y = 11 + 3y - 3y$

$2y - 3 = 11$

$2y - 3 + 3 = 11 + 3$

$2y = 14$

$\frac{2y}{2} = \frac{14}{2}$

$y = 7$

Check: $5y - 3 = 11 + 3y$

$5(7) - 3 \stackrel{?}{=} 11 + 3(7)$

$35 - 3 \stackrel{?}{=} 11 + 21$

$32 = 32$ True

The solution set is $\{7\}$.

22. $10.3 - 6x = -2.3$

$10.3 - 6x - 10.3 = -2.3 - 10.3$

$-6x = -12.6$

$\frac{-6x}{-6} = \frac{-12.6}{-6}$

$x = 2.1$

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 set is $\{2.1\}$.

24. $4x + 14 = 6x + 8$

$4x + 14 - 4x = 6x + 8 - 4x$

$14 = 2x + 8$

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

$6 = 2x$

$\frac{6}{2} = \frac{2x}{2}$

$3 = x$

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

26. $13x-15x+8=4x+2-24$
$-2x+8=4x-22$
$-2x+8-8=4x-22-8$
$-2x=4x-30$
$-2x-4x=4x-30-4x$
$-6x=-30$
$\frac{-6x}{-6}=\frac{-30}{-6}$
$x=5$
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 set is $\{5\}$.

28. $6+3x+x=-x+8-26+24$
$6+4x=-x+6$
$6+4x-6=-x+6-6$
$4x=-x$
$4x+x=-x+x$
$5x=0$
$\frac{5x}{5}=\frac{0}{5}$
$x=0$
Check: $6+3x+x=-x+8-26+24$
$6+3(0)+(0) \stackrel{?}{=} -(0)+8-26+24$
$6+0+0 \stackrel{?}{=} 0+8-26+24$
$6=6$ True
The solution set is $\{0\}$.

30. $2(4x+3)=7x+5$
$8x+6=7x+5$
$8x+6-6=7x+5-6$
$8x=7x-1$
$8x-7x=7x-1-7x$
$x=-1$
Check: $2(4x+3)=7x+5$
$2(4(-1)+3) \stackrel{?}{=} 7(-1)+5$
$2(-4+3) \stackrel{?}{=} -7+5$
$2(-1) \stackrel{?}{=} -2$
$-2=-2$ True
The solution set is $\{-1\}$.

32. $6x=4(x-5)$
$6x=4x-20$
$6x-4x=4x-20-4x$
$2x=-20$
$\frac{2x}{2}=\frac{-20}{2}$
$x=-10$
Check: $6x=4(x-5)$
$6(-10) \stackrel{?}{=} 4[(-10)-5]$
$-60 \stackrel{?}{=} 4(-15)$
$-60=-60$ True
The solution set is $\{-10\}$.

34. $-4(3n-2)-n=-11(n-1)$
$-12n+8-n=-11n+11$
$-13n+8=-11n+11$
$-13n+8-8=-11n+11-8$
$-13n=-11n+3$
$-13n+11n=-11n+3+11n$
$-2n=3$
$\frac{-2n}{-2}=\frac{3}{-2}$
$n=-\frac{3}{2}$
Check:
$-4(3n-2)-n=-11(n-1)$
$-4\left[3\left(-\frac{3}{2}\right)-2\right]-\left(-\frac{3}{2}\right) \stackrel{?}{=} -11\left[\left(-\frac{3}{2}\right)-1\right]$
$-4\left(-\frac{9}{2}-2\right)+\frac{3}{2} \stackrel{?}{=} -11\left(-\frac{5}{2}\right)$
$-4\left(-\frac{13}{2}\right)+\frac{3}{2} \stackrel{?}{=} \frac{55}{2}$
$\frac{52}{2}+\frac{3}{2} \stackrel{?}{=} \frac{55}{2}$
$\frac{55}{2}=\frac{55}{2}$ True
The solution set is $\left\{-\frac{3}{2}\right\}$.

36.
$$\frac{x}{2}+\frac{x}{5}=\frac{5}{4}$$
$$20\left(\frac{x}{2}+\frac{x}{5}\right)=20\left(\frac{5}{4}\right)$$
$$20\left(\frac{x}{2}\right)+20\left(\frac{x}{5}\right)=25$$
$$10x+4x=25$$
$$14x=25$$
$$\frac{14x}{14}=\frac{25}{14}$$
$$x=\frac{25}{14}$$

Check:
$$\frac{x}{2}+\frac{x}{5}=\frac{5}{4}$$
$$\frac{\left(\frac{25}{14}\right)}{2}+\frac{\left(\frac{25}{14}\right)}{5}\stackrel{?}{=}\frac{5}{4}$$
$$\frac{25}{28}+\frac{5}{14}\stackrel{?}{=}\frac{5}{4}$$
$$\frac{25}{28}+\frac{10}{28}\stackrel{?}{=}\frac{5}{4}$$
$$\frac{35}{28}\stackrel{?}{=}\frac{5}{4}$$
$$\frac{5}{4}=\frac{5}{4}\quad\text{True}$$

The solution set is $\left\{\frac{25}{14}\right\}$.

38.
$$\frac{4r}{5}-7=\frac{r}{10}$$
$$10\left(\frac{4r}{5}-7\right)=10\left(\frac{r}{10}\right)$$
$$10\left(\frac{4r}{5}\right)-10(7)=r$$
$$2(4r)-70=r$$
$$8r-70=r$$
$$8r-70-8r=r-8r$$
$$-70=-7r$$
$$\frac{-70}{-7}=\frac{-7r}{-7}$$
$$10=r$$

Check:
$$\frac{4(10)}{5}-7\stackrel{?}{=}\frac{(10)}{10}$$
$$8-7\stackrel{?}{=}1$$
$$1=1\quad\text{True}$$

The solution set is $\{10\}$.

40.
$$\frac{2+h}{9}+\frac{h-1}{3}=\frac{1}{3}$$
$$9\left(\frac{2+h}{9}+\frac{h-1}{3}\right)=9\left(\frac{1}{3}\right)$$
$$9\left(\frac{2+h}{9}\right)+9\left(\frac{h-1}{3}\right)=3$$
$$2+h+3(h-1)=3$$
$$2+h+3h-3=3$$
$$4h-1=3$$
$$4h-1+1=3+1$$
$$4h=4$$
$$\frac{4h}{4}=\frac{4}{4}$$
$$h=1$$

Check:
$$\frac{2+h}{9}+\frac{h-1}{3}=\frac{1}{3}$$
$$\frac{2+(1)}{9}+\frac{(1)-1}{3}\stackrel{?}{=}\frac{1}{3}$$
$$\frac{3}{9}+\frac{0}{3}\stackrel{?}{=}\frac{1}{3}$$
$$\frac{3}{9}\stackrel{?}{=}\frac{1}{3}$$
$$\frac{1}{3}=\frac{1}{3}\quad\text{True}$$

The solution set is $\{1\}$.

42.
$$0.3x+2.4=0.1x+4$$
$$10(0.3x+2.4)=10(0.1x+4)$$
$$10(0.3x)+10(2.4)=10(0.1x)+10(4)$$
$$3x+24=1x+40$$
$$3x+24-24=1x+40-24$$
$$3x=1x+16$$
$$3x-1x=1x+16-1x$$
$$2x=16$$
$$\frac{2x}{2}=\frac{16}{2}$$
$$x=8$$

Check:
$$0.3x+2.4=0.1x+4$$
$$0.3(8)+2.4\stackrel{?}{=}0.1(8)+4$$
$$2.4+2.4\stackrel{?}{=}0.8+4$$
$$4.8=4.8\quad\text{True}$$

The solution set is $\{8\}$.

44.
$$\frac{2z+7}{8}-2=z+\frac{z-1}{2}$$
$$8\left(\frac{2z+7}{8}-2\right)=8\left(z+\frac{z-1}{2}\right)$$
$$8\left(\frac{2z+7}{8}\right)-8(2)=8(z)+8\left(\frac{z-1}{2}\right)$$
$$2z+7-16=8z+4(z-1)$$
$$2z-9=8z+4z-4$$
$$2z-9=12z-4$$
$$2z-9+4=12z-4+4$$
$$2z-5=12z$$
$$2z-5-2z=12z-2z$$
$$-5=10z$$
$$\frac{-5}{10}=\frac{10z}{10}$$
$$-\frac{1}{2}=z$$

Check:
$$\frac{2z+7}{8}-2=z+\frac{z-1}{2}$$
$$\frac{2\left(-\frac{1}{2}\right)+7}{8}-2\stackrel{?}{=}\left(-\frac{1}{2}\right)+\frac{\left(-\frac{1}{2}\right)-1}{2}$$
$$\frac{-1+7}{8}-2\stackrel{?}{=}-\frac{1}{2}+\frac{-3}{4}$$
$$\frac{6}{8}-\frac{16}{8}\stackrel{?}{=}\frac{-4}{8}+\frac{-6}{8}$$
$$\frac{-10}{8}=\frac{-10}{8}\quad\text{True}$$

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

46.
$$2.4(2x+3)=-0.1(2x+78)$$
$$10[2.4(2x+3)]=10[-0.1(2x+78)]$$
$$24(2x+3)=-1(2x+78)$$
$$48x+72=-2x-78$$
$$48x+72-72=-2x-78-72$$
$$48x=-2x-150$$
$$48x+2x=-2x-150+2x$$
$$50x=-150$$
$$\frac{50x}{50}=-\frac{150}{50}$$
$$x=-3$$

Check:
$$2.4(2x+3)=-0.1(2x+78)$$
$$2.4[2(-3)+3]\stackrel{?}{=}-0.1[2(-3)+78]$$
$$2.4(-6+3)\stackrel{?}{=}-0.1(-6+78)$$
$$2.4(-3)\stackrel{?}{=}-0.1(72)$$
$$-7.2=-7.2\quad\text{True}$$

The solution set is $\{-3\}$.

48.
$$6(4n+4)=8(3+3n)$$
$$24n+24=24+24n$$
$$24n+24-24=24+24n-24$$
$$24n=24n$$
$$24n-24n=24n-24n$$
$$0=0$$

Since 0 = 0 is a true statement for every value of n, the solution set is the set of all real numbers. The solution set is $\{n|n \text{ is a real number}\}$.

50.
$$4(x+2)+4=4x-8$$
$$4x+8+4=4x-8$$
$$4x+12=4x-8$$
$$4x+12-4x=4x-8-4x$$
$$12=-8\quad\text{False}$$

Since $12 = -8$ is a false statement, the original equation has no solution. The solution set is $\varnothing$.

52.
$$5(x-4)+x=6(x-2)-8$$
$$5x-20+x=6x-12-8$$
$$6x-20=6x-20$$
$$6x-20+20=6x-20+20$$
$$6x=6x$$
$$6x-6x=6x-6x$$
$$0=0$$

Since 0 = 0 is a true statement for every value of x, the solution set is the set of all real numbers. The solution set is $\{x|x \text{ is a real number}\}$.

54.
$$9(x-2)=8(x-3)+x$$
$$9x-18=8x-24+x$$
$$9x-18=9x-24$$
$$9x-18-9x=9x-24-9x$$
$$-18=-24\quad\text{False}$$

Since $-18 = -24$ is a false statement, the original equation has no solution. The solution set is $\varnothing$.

56.
$$\frac{a}{2}+\frac{7}{4}=5$$
$$4\left(\frac{a}{2}+\frac{7}{4}\right)=4(5)$$
$$4\left(\frac{a}{2}\right)+4\left(\frac{7}{4}\right)=20$$
$$2a+7=20$$
$$2a+7-7=20-7$$
$$2a=13$$
$$\frac{2a}{2}=\frac{13}{2}$$
$$a=\frac{13}{2}$$
The solution set is $\left\{\frac{13}{2}\right\}$.

58.
$$4x-7=2x-7$$
$$4x-7+7=2x-7+7$$
$$4x=2x$$
$$4x-2x=2x-2x$$
$$2x=0$$
$$\frac{2x}{2}=\frac{0}{2}$$
$$x=0$$
The solution set is $\{0\}$.

60.
$$3x+2(x+4)=5(x+1)+3$$
$$3x+2x+8=5x+5+3$$
$$5x+8=5x+8$$
$$5x+8-5x=5x+8-5x$$
$$8=8 \quad \text{True}$$
The solution set is $\{x|x \text{ is a real number}\}$.

62.
$$-(w+0.2)=0.3(4-w)$$
$$-1w-0.2=1.2-0.3w$$
$$-1w-0.2+0.2=1.2-0.3w+0.2$$
$$-1w=1.4-0.3w$$
$$-1w+0.3w=1.4-0.3w+0.3w$$
$$-0.7w=1.4$$
$$\frac{-0.7w}{-0.7}=\frac{1.4}{-0.7}$$
$$w=-2$$
The solution set is $\{-2\}$.

64.
$$\frac{1}{3}(8+2c)=\frac{1}{5}(3c-5)$$
$$15\left[\frac{1}{3}(8+2c)\right]=15\left[\frac{1}{5}(3c-5)\right]$$
$$5(8+2c)=3(3c-5)$$
$$40+10c=9c-15$$
$$40+10c-10c=9c-15-10c$$
$$40=-1c-15$$
$$40+15=-1c-15+15$$
$$55=-1c$$
$$\frac{55}{-1}=\frac{-1c}{-1}$$
$$-55=c$$
The solution set is $\{-55\}$.

66.
$$9c-3(6-5c)=c-2(3c+9)$$
$$9c-18+15c=c-6c-18$$
$$24c-18=-5c-18$$
$$24c-18+18=-5c-18+18$$
$$24c=-5c$$
$$24c+5c=-5c+5c$$
$$29c=0$$
$$\frac{29c}{29}=\frac{0}{29}$$
$$c=0$$
The solution set is $\{0\}$.

68.
$$10x-2(x+4)=8(x-2)+6$$
$$10x-2x-8=8x-16+6$$
$$8x-8=8x-10$$
$$8x-8-8x=8x-10-8x$$
$$-8=-10 \quad \text{False}$$
The solution set is $\varnothing$.

70.
$$\frac{n+1}{8}-\frac{2-n}{3}=\frac{5}{6}$$
$$24\left(\frac{n+1}{8}-\frac{2-n}{3}\right)=24\left(\frac{5}{6}\right)$$
$$24\left(\frac{n+1}{8}\right)-24\left(\frac{2-n}{3}\right)=4\cdot 5$$
$$3(n+1)-8(2-n)=20$$
$$3n+3-16+8n=20$$
$$11n-13=20$$
$$11n-13+13=20+13$$
$$11n=33$$
$$\frac{11n}{11}=\frac{33}{11}$$
$$n=3$$
The solution set is $\{3\}$.

72. $10y-18-4y=12y-13$
$6y-18=12y-13$
$6y-18+18=12y-13+18$
$6y=12y+5$
$6y-12y=12y+5-12y$
$-6y=5$
$\frac{-6y}{-6}=\frac{5}{-6}$
$y=-\frac{5}{6}$

The solution set is $\left\{-\frac{5}{6}\right\}$.

74. $-4(2x-3)-(10x+7)-2=-(12x-5)-(4x+9)-1$
$-8x+12-10x-7-2=-12x+5-4x-9-1$
$-18x+3=-16x-5$
$-18x+3-3=-16x-5-3$
$-18x=-16x-8$
$-18x+16x=-16x-8+16x$
$-2x=-8$
$\frac{-2x}{-2}=\frac{-8}{-2}$
$x=4$

The solution set is $\{4\}$.

76. $\frac{1}{5}(2y-1)-2=\frac{1}{2}(3y-5)+3$
$10\left[\frac{1}{5}(2y-1)-2\right]=10\left[\frac{1}{2}(3y-5)+3\right]$
$10\left[\frac{1}{5}(2y-1)\right]-10(2)=10\left[\frac{1}{2}(3y-5)\right]+10(3)$
$2(2y-1)-20=5(3y-5)+30$
$4y-2-20=15y-25+30$
$4y-22=15y+5$
$4y-22+22=15y+5+22$
$4y=15y+27$
$4y-15y=15y+27-15y$
$-11y=27$
$\frac{-11y}{-11}=\frac{27}{-11}$
$y=-\frac{27}{11}$

The solution set is $\left\{-\frac{27}{11}\right\}$.

78. $3[8-4(n-2)]+5n=-20+2[5(1-n)-6n]$
$3[8-4n+8]+5n=-20+2[5-5n-6n]$
$3[-4n+16]+5n=-20+2[5-11n]$
$-12n+48+5n=-20+10-22n$
$-7n+48=-10-22n$
$-7n+48-48=-10-22n-48$
$-7n=-22n-58$
$-7n+22n=-22n-58+22n$
$15n=-58$
$\frac{15n}{15}=\frac{-58}{15}$
$n=-\frac{58}{15}$
The solution set is $\left\{-\frac{58}{15}\right\}$.

80. The sum of 8 and a number is written as $8 + x$.

82. The difference of 8 and a number is written as $8 - x$.

84. Two more than three times a number is written as $3x + 2$.

86. $-3(x-4)=10$
$-3x+12=10$
$-3x+12-12=10-12$
$-3x=-2$
$\frac{-3x}{-3}=\frac{-2}{-3}$
$x=\frac{2}{3}$

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

90. answers may vary

92. answers may vary

94. $-7.6y-10=-1.1y+12$
$-7.6y-10+10=-1.1y+12+10$
$-7.6y=-1.1y+22$
The equations are equivalent when $K = 22$.

96. $\frac{x}{6}+4=\frac{x}{3}$
$6\left(\frac{x}{6}+4\right)=6\left(\frac{x}{3}\right)$
$6\left(\frac{x}{6}\right)+6(4)=2x$
$x+24=2x$
The equations are equivalent when $K = 24$.

98. answers may vary

100. $2.86z-8.1258=-3.75$
$2.86z-8.1258+8.1258=-3.75+8.1258$
$2.86z=4.3758$
$\frac{2.86z}{2.86}=\frac{4.3758}{2.86}$
$z=1.53$
Check: $2.86z-8.1258=-3.75$
$2.86(1.53)-8.1258 \stackrel{?}{=} -3.75$
$4.3758-8.1258 \stackrel{?}{=} -3.75$
$-3.75=-3.75$ True
The solution set is $\{1.53\}$.

102. $7x^2+2x-3=6x(x+4)+x^2$
$7x^2+2x-3=6x^2+24x+x^2$
$7x^2+2x-3=7x^2+24x$
$7x^2+2x-3-7x^2=7x^2+24x-7x^2$
$2x-3=24x$
$2x-3-2x=24x-2x$
$-3=22x$
$\frac{-3}{22}=\frac{22x}{22}$
$x=-\frac{3}{22}$

Check: $7x^2+2x-3=6x(x+4)+x^2$

$$7\left(-\frac{3}{22}\right)^2+2\left(-\frac{3}{22}\right)-3 \stackrel{?}{=} 6\left(-\frac{3}{22}\right)\left[\left(-\frac{3}{22}\right)+4\right]+\left(-\frac{3}{22}\right)^2$$

$$\frac{63}{484}-\frac{6}{22}-3 \stackrel{?}{=} \frac{-18}{22}\left[\left(-\frac{3}{22}\right)+4\right]+\frac{9}{484}$$

$$\frac{63}{484}-\frac{6}{22}-3 \stackrel{?}{=} \frac{54}{484}-\frac{72}{22}+\frac{9}{484}$$

$$\frac{63}{484}-\frac{132}{484}-\frac{1452}{484} \stackrel{?}{=} \frac{54}{484}-\frac{1584}{484}+\frac{9}{484}$$

$$-\frac{1521}{484}=-\frac{1521}{484} \quad \text{True}$$

The solution set is $\left\{-\frac{3}{22}\right\}$.

Section 2.2 Practice Exercises

1. a. x is the first even integer, $x + 2$ is the next consecutive even integer, and $x + 4$ is the third consecutive even integer. The sum of three consecutive even integers is $(x) + (x + 2) + (x + 4) = 3x + 6$.

b. The perimeter of a triangle is the sum of the lengths of the sides.
$(x)+(2x+1)+(4x)=x+2x+1+4x=7x+1$

2. Let x = number of athletes from Australia, then $x + 120$ was the number of athletes from the United States, and $2x - 271$ was the number of athletes from Great Britain.
Sum: $x+(x+120)+(2x-271)=x+x+2x+120-271$
$=4x-151$

3. Let x be the first number. The other two numbers are $3x$ and $x + 50$.
$x+3x+x+50=235$
$5x+50=235$
$5x=185$
$x=37$
$3x = 3(37) = 111$
$x + 50 = (37) + 50 = 87$
The numbers are 37, 87, and 111.

4. Let x be the original price of the home.
$x-0.06x=83,660$
$0.94x=83,660$
$x=89,000$
The original price of the home was \$89,000.

5. Let x be the width of the rectangle. The length of the rectangle is $2x + 5$. The perimeter is the sum of the lengths of the sides.
$(x)+(2x+5)+(x)+(2x+5)=106$
$6x+10=106$
$6x=96$
$x=16$
$2x + 5 = 2(16) + 5 = 37$
The length is 37 m; the width is 16 m.

6. Let x be the first integer. Then $x + 1$ is the next consecutive integer and $x + 2$ is the next consecutive integer after that.

$$(x)+(x+1)+(x+2)=378$$
$$3x+3=378$$
$$3x=375$$
$$x=125$$

$x + 1 = 126$
$x + 2 = 127$
The three consecutive integers whose sum is 378 are 125, 126, and 127.

Vocabulary, Readiness & Video Check 2.2

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)	$s, s + 2, s + 4$

13. distributive property

14. The original application asks you to find three numbers. The solution $x = 45$ only gives you the first number. You need to INTERPRET this result.

Exercise Set 2.2

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

4. Let x be the first integer. Then $x + 2$ and $x + 4$ are the next two consecutive odd integers.
$(x) + (x + 2) + (x + 4) = 3x + 6$

6. y quarters have a value of $25y$ cents. $7y$ dimes have a value of $10(7y)$ cents, and $(2y - 1)$ nickels have a value of $5(2y - 1)$ cents.

$$\begin{aligned} 25y + 10(7y) + 5(2y - 1) &= 25y + 70y + 10y - 5 \\ &= 105y - 5 \end{aligned}$$

The total amount of money is $(105y - 5)$ cents.

8. Each of the five vertical fences has a dimension of $3x - 15$. Each of the four horizontal fences has a dimension of x.

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

The total amount of fencing needed so that the land can be divided into 4 rectangles of equal dimensions is

$19x - 75$.

10. The length of the unknown vertical side is $18 - 10 = 8$. The length of the unknown horizontal side is

$x + 14 - (x + 8) = x + 14 - x - 8 = 6$.

$18 + (x + 8) + 10 + 6 + 8 + (x + 14) = 2x + 64$

The perimeter is $2x + 64$.

12. Let x be the number.

$$\begin{aligned} 2(x+3) &= 5x - 1 - 4x \\ 2x + 6 &= 5x - 1 - 4x \\ 2x + 6 &= x - 1 \\ 2x &= x - 7 \\ x &= -7 \end{aligned}$$

The number is -7.

14. Let x be the first number. The other two numbers are $x - 6$ and $2x$.

$$\begin{aligned} (x) + (x - 6) + (2x) &= 306 \\ 4x - 6 &= 306 \\ 4x &= 312 \\ x &= 78 \end{aligned}$$

$x - 6 = (78) - 6 = 72$

$2x = 2(78) = 156$

The three numbers are 72, 78, and 156.

16. Let x be the number of acres of land that is federally owned in Nevada. Then x is 90% of 70.

$x = 0.90(70) = 63$

Let $70 - x$ be the number of acres of land that is not federally owned in Nevada.

$70 - (63) = 7$

7 million acres of land in Nevada is not federally owned.

18. Let x be the number of tornadoes in the United States in April 2012. Then x is 21.9% of 939.

$x = 0.219(939) \approx 206$

There were 206 tornadoes in the United States in April 2012.

20. Let x be the number of people employed in the restaurant industry. Then x is 9% of 145 million.

$x = 0.09(145 \text{ million}) \approx 13.1 \text{ million}$

There were 13.1 million people employed in the restaurant industry in the United States in 2013.

22. From the circle graph, the most common time spent on e-mail per day is 15 minutes to 60 minutes.

24. Let x be the number of employees who use e-mail between 2 and 3 hours per day. Then x is 10% of 250.

$x = 0.10(250) = 25$

25 employees use e-mail between 2 and 3 hours per day.

26. Let x be the payroll for the Boston Bruins. Then $x - 3{,}005{,}000$ was the payroll for the New York Rangers.

$$\begin{aligned} x + x - 3{,}005{,}000 &= 129{,}675{,}000 \\ 2x - 3{,}005{,}000 &= 129{,}675{,}000 \\ 2x &= 132{,}680{,}000 \\ x &= 66{,}340{,}000 \\ x - 3{,}005{,}000 &= 66{,}340{,}000 - 3{,}005{,}000 \\ &= 63{,}335{,}000 \end{aligned}$$

The payroll for the Bruins was \$66,340,000 and the payroll for the Rangers was \$63,335,000.

28. The perimeter is the sum of the lengths of the sides.

$$\begin{aligned} (x) + (4x) + (2x + 1) &= 130.5 \\ 7x + 1 &= 130.5 \\ 7x &= 129.5 \\ x &= 18.5 \end{aligned}$$

$4x = 4(18.5) = 74$

$2x + 1 = 2(18.5) + 1 = 37 + 1 = 38$

The dimensions are 18.5 m, 74 m, and 38 m.

30. See Practice Exercise 2.

$$\begin{aligned} 4x - 151 &= 1505 \\ 4x &= 1656 \\ x &= 414 \end{aligned}$$

$x + 120 = 534$

$2x - 271 = 557$

The number of athletes from each country was: United States: 534; Australia: 414; Great Britain: 557.

32. $(x)+(3x)+(x+10)=180$
$5x+10=180$
$5x=170$
$x=34$
$3x = 3(34) = 102$
$x + 10 = (34) + 10 = 44$
The angles have measures of 34°, 44°, and 102°.

34. $(2x)+(3.5x)+(3x+7)=75$
$8.5x+7=75$
$8.5x=68$
$x=8$
$2x = 2(8) = 16$
$3.5x = 3.5(8) = 28$
$3x + 7 = 3(8) + 7 = 24 + 7 = 31$
The sides have lengths of 16 cm, 28 cm, and 31 cm.

36. $(7.3x)+(9.2x-3)+(7.3x)+(9.2x-3)=324$
$33x-6=324$
$33x=330$
$x=10$
$7.3x = 7.3(10) = 73$
$9.2x - 3 = 9.2(10) - 3 = 92 - 3 = 89$
The sides have lengths of 73 ft, 73 ft, 89 ft, and 89 ft.

38. $x+(2x-2)+(3x-10)=294$
$x+2x-2+3x-10=294$
$6x-12=294$
$6x=306$
$x=51$
$2x - 2 = 2(51) - 2 = 100$
$3x - 10 = 3(51) - 10 = 143$

Year	Percent Increase in Tablet Users Worldwide since 2013	Predicted Percent Increase
2014	x	51%
2015	$2x - 2$	100%
2016	$3x - 10$	143%
Total	294%	

40. Let x be the decline in the number of jobs in utilities (in thousands). Then $2x + 1$ is the decline in the number of jobs in manufacturing and $2x - 24$ is the decline in the number of jobs in agriculture.
$x+(2x+1)+(2x-24)=157$
$x+2x+1+2x-24=157$
$5x-23=157$
$5x=180$
$x=36$
$2x + 1 = 2(36) + 1 = 73$
$2x - 24 = 2(36) - 24 = 48$
The predicted declines in the number of jobs are: utilities: 36 thousand; manufacturing: 73 thousand; agriculture: 48 thousand.

42. Let x be the number of seats in a B737-200 aircraft. Then the number of seats in a B767-300ER is $x + 88$, and the number of seats in a F-100 is $x - 32$.
$x+(x+88)+(x-32)=413$
$3x+56=413$
$3x=357$
$x=119$
$x + 88 = 119 + 88 = 207$
$x - 32 = 119 - 32 = 87$
The B737-200 has 119 seats, the B767-300ER has 207 seats, and the F-100 has 87 seats.

44. Let x be the price of the textbook before tax.
$x+0.09x=158.60$
$1.09x=158.60$
$x=145.50$
The human anatomy book costs $145.50 before tax.

46. Let x be the population in 2012. This population is decreased by 0.2% to get the 2013 population.
$x-0.002x=127.3$
$0.998x=127.3$
$x\approx 127.6$
The population of Japan in 2012 was 127.6 million.

48. Let x be the first integer. Then $x + 2$ and $x + 4$ are the next two consecutive odd integers.
$x+(x+2)+(x+4)=327$
$3x+6=327$
$3x=321$
$x=107$
$x + 2 = (107) + 2 = 109$
$x + 4 = (107) + 4 = 111$
The three consecutive odd integers are 107, 109 and 111.

50. Let $x°$ be the measure of the first and second angles of a triangle. Then, the third angle measures $(3x - 10)°$.

$$x + x + (3x - 10) = 180$$
$$5x - 10 = 180$$
$$5x = 190$$
$$x = 38$$

$3x - 10 = 3(38) - 10 = 114 - 10 = 104$

The angles measure 38°, 38°, and 104°.

52. Let x be the length of one side of a frame in the shape of a regular pentagon. Then $x + 7$ is the length of one side of the square frame.

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

$x + 7 = (28) + 7 = 35$

The length of one side of a frame in the shape of a regular pentagon is 28 inches. The length of one side of the square frame is 35 inches.

54. Let x be the size of the workforce prior to layoffs.

$$0.15x = 11{,}000$$
$$x = 73{,}333$$

Prior to layoffs, Dana's workforce was 73,333 people.

56. Let x be Alabama's average SAT score. Then $x + 1$ is Louisiana's average SAT score and $x + 2$ is Michigan's average SAT score.

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

$x + 1 = (526) + 1 = 527$

$x + 2 = (526) + 2 = 528$

Alabama's average SAT score is 526.
Louisiana's average SAT score is 527.
Michigan's average SAT score is 528.

58. Let $x°$ be the measure of the first angle. Then its complement measures $(2x + 30)°$.

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

$2x + 30 = 2(20) + 30 = 40 + 30 = 70$

The angles measure 20° and 70°.

60. a. Let x be Singapore's penetration rate. Then $x + 20.7$ is Hong Kong's penetration rate and $x - 7.2$ is U.K.'s penetration rate.

$$x + (x + 20.7) + (x - 7.2) = 390.6$$
$$3x + 13.5 = 390.6$$
$$3x = 377.1$$
$$x = 125.7$$

$x + 20.7 = 125.7 + 20.7 = 146.4$

$x - 7.2 = 125.7 - 7.2 = 118.5$

Singapore's penetration rate is 125.7. Hong Kong's penetration rate is 146.4. U.K.'s penetration rate is 118.5.

b. answers may vary

62. Let x be the number of medals won by the Netherlands. Then Australia won $(x + 1)$ medals and Italy won $(x + 2)$ medals.

$$x + (x + 1) + (x + 2) = 21$$
$$x + x + 1 + x + 2 = 21$$
$$3x + 3 = 21$$
$$3x = 18$$
$$x = 6$$

$x + 1 = 6 + 1 = 7$

$x + 2 = 6 + 2 = 8$

The Netherlands won 6 medals, Australia won 7 medals, and Italy won 8 medals.

64. $$ab + 6bc = (0)(-1) + 6(-1)(9)$$
$$= 0 - 54$$
$$= -54$$

66. $$2n^2 + 3m^2 = 2(-2)^2 + 3(7)^2$$
$$= 2(4) + 3(49)$$
$$= 8 + 147$$
$$= 155$$

68. $\frac{1}{3}lwh = \frac{1}{3}(37.8)(5.6)(7.9) = 557.424$

70. answers may vary

72. Let $x°$ be the measure of an angle. Then its complement measures $(90 - x)°$ and its supplement measures $(180 - x)°$.

$$180 - x = 2(90 - x) + 50$$
$$180 - x = 180 - 2x + 50$$
$$180 - x = 230 - 2x$$
$$180 + x = 230$$
$$x = 50$$

The angle measures 50°.

74. $y = -88x + 2105$
$y = -88(15) + 2105$
$y = -1320 + 2105$
$y = 785$
The average number of cigarettes smoked by an American adult in 2015 was predicted to be 785.

76. The average number of cigarettes smoked daily in 2015 was predicted to be $\frac{785}{365} \approx 2$.
This does not represent the average number of cigarettes smoked by an American smoker, because it is the average for *all* Americans, both smokers and non-smokers.

78. Let x be the first odd integer. Then $x + 2$ is the next consecutive odd integer.
$7x = 5(x+2) + 54$
$7x = 5x + 10 + 54$
$7x = 5x + 64$
$2x = 64$
$x = 32$
No such odd integers exist.

80. $R = C$
$60x = 50x + 5000$
$10x = 5000$
$x = 500$
$50x + 5000 = 50(500) + 5000$
$= 25,000 + 5000$
$= 30,000$
500 computer boards must be sold to break even. It costs \$30,000 to produce the 500 boards.

82. The company makes a profit if it makes and sells more products than the break-even number.

Section 2.3 Practice Exercises

1. $I = Prt$
$\frac{I}{rt} = \frac{Prt}{rt}$
$\frac{I}{rt} = P$

2. $2y + 5x = 10$
$2y + 5x - 5x = 10 - 5x$
$2y = 10 - 5x$
$\frac{2y}{2} = \frac{10 - 5x}{2}$
$y = \frac{10 - 5x}{2}$ or $y = 5 - \frac{5}{2}x$

3. $A = \frac{1}{2}(B + b)h$
$2A = 2\left[\frac{1}{2}(B + b)h\right]$
$2A = (B + b)h$
$2A = Bh + bh$
$2A - bh = Bh$
$B = \frac{2A - bh}{h}$ or $B = \frac{2A}{h} - b$

4. Use $A = P\left(1 + \frac{r}{n}\right)^{nt}$ with $P = 5000$, $r = 4\% = 0.04$, $n = 12$, and $t = 2$.
$A = 5000\left(1 + \frac{0.04}{12}\right)^{12 \cdot 2}$
$A = 5000(1.0033333)^{24}$
$A \approx 5000(1.083142959)$
$A \approx \$5415.71$

5. Use $d = rt$, where $d = 192$ and $t = 7.5$.
$d = rt$
$192 = 7.5t$
$\frac{192}{7.5} = \frac{7.5t}{7.5}$
$25.6 = t$
The time is 25.6 hours or 25 hours 0.6(60) minutes or 25 hours, 36 minutes.

Vocabulary, Readiness & Video Check 2.3

1. $2x + y = 5$
$y = 5 - 2x$

2. $7x - y = 3$
$-y = 3 - 7x$
$y = -3 + 7x$ or $y = 7x - 3$

3. $a - 5b = 8$
$a = 5b + 8$

4. $7r + s = 10$
$s = 10 - 7r$

5. $5j + k - h = 6$
$5j + k = h + 6$
$k = h - 5j + 6$

6. $w - 4y + z = 0$
$w + z = 4y$
$z = 4y - w$

7. That the specified variable will equal some expression and that this expression should not contain the specified variable.

8. The only way to check the solution is in the formula used. If the wrong formula is used, a wrong answer may seem to check correctly.

Exercise Set 2.3

2. $W = gh$

$\frac{W}{h} = \frac{gh}{h}$

$\frac{W}{h} = g$

4. $V = lwh$

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

$\frac{V}{lh} = w$

6. $a^2 + b^2 = c^2$

$b^2 = c^2 - a^2$

8. $2x + 3y = 17$

$3y = 17 - 2x$

$y = \frac{17 - 2x}{3}$ or $y = \frac{17}{3} - \frac{2}{3}x$

10. $P = 2l + 2w$

$P - 2l = 2w$

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

12. $A = P(1 + rt)$

$A = P + Prt$

$A - P = Prt$

$\frac{A - P}{Pr} = t$

14. $-9x - 5y = 18$

$-5y = 18 + 9x$

$y = \frac{18 + 9x}{-5}$ or $y = -\frac{18}{5} - \frac{9}{5}x$

16. $S = 2\pi r^2 + 2\pi rh$

$S - 2\pi r^2 = 2\pi rh$

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

18. $A = \pi r^2$

$\frac{A}{r^2} = \frac{\pi r^2}{r^2}$

$\frac{A}{r^2} = \pi$

20. $F = \frac{9}{5}C + 32$

$5F = 5\left[\frac{9}{5}C + 32\right]$

$5F = 9C + 160$

$5F - 160 = 9C$

$\frac{5F - 160}{9} = C$ or $C = \frac{5}{9}(F - 32)$

22. Use $A = P\left(1 + \frac{r}{n}\right)^{nt}$ with $P = 5000$, $r = 6\% = 0.06$, and $t = 15$.

$n = 1$: $A = 5000\left(1 + \frac{0.06}{1}\right)^{1 \cdot 15}$

$A = 5000(1.06)^{15}$

$A \approx \$11,982.79$

$n = 2$: $A = 5000\left(1 + \frac{0.06}{2}\right)^{2 \cdot 15}$

$A = 5000(1.03)^{30}$

$A \approx \$12,136.31$

$n = 4$: $A = 5000\left(1 + \frac{0.06}{4}\right)^{4 \cdot 15}$

$A = 0500(1.015)^{60}$

$A \approx \$12,216.10$

$n = 12$: $A = 5000\left(1 + \frac{0.06}{12}\right)^{12 \cdot 15}$

$A = 5000(1.005)^{180}$

$A \approx \$12,270.47$

$n = 365$: $A = 5000\left(1 + \frac{0.06}{365}\right)^{365 \cdot 15}$

$A \approx \$12,297.11$

24. Use $A = P\left(1+\frac{r}{n}\right)^{nt}$ with $P = 25{,}000$, $r = 5\% = 0.05$, and $t = 2$.

a. semiannually: $n = 2$:

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

b. quarterly: $n = 4$: $A = 25{,}000\left(1+\frac{0.05}{4}\right)^{4\cdot 2}$

$$A = 25{,}000(1.0125)^8$$
$$A \approx \$27{,}612.15$$

c. monthly: $n = 12$: $A = 25{,}000\left(1+\frac{0.05}{12}\right)^{12\cdot 2}$

$$A \approx \$27{,}623.53$$

26. Roundtrip distance = 154 + 154 = 308 miles

$$d = r \cdot t$$
$$308 = r\left(5\frac{1}{2}\right)$$
$$\frac{308}{5\frac{1}{2}} = r$$
$$r = 56$$
$$r = 56 \text{ mph}$$

Their average speed was 56 mph.

28. $F = \frac{9}{5}C + 32$

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

−15°C is 5°F.

30. $A = l \cdot w$

$$A = 18 \cdot 12$$
$$A = 216 \text{ sq ft}$$
$$\text{Packages} = \frac{216}{50} = 4.32$$

Buy 5 packages of tiles.

32. $A = P\left(1+\frac{r}{n}\right)^{nt}$ with $P = 1000$, $r = 5.5\% = 0.055$, $n = 2$, and $t = 3$.

$$A = 1000\left(1+\frac{0.055}{2}\right)^{2\cdot 3}$$
$$A = 1000(1+0.0275)^6$$
$$A \approx \$1176.77$$

Each will have $1176.77. Four people will have $4707.07. They will have enough money.

34. $A = l \cdot w$

$$A = 21 \cdot 8$$
$$A = 168 \text{ sq ft}$$

Three coats = $3 \cdot 168 = 504$ sq ft

$$\text{Gallons} = \frac{504}{300} = 1.68$$

Buy 2 gallons of paint.

36. Radius of satellite orbit $= 22{,}248 + 4000$
$= 26{,}248$ mi

$C = 2\pi r = 2 \cdot \pi \cdot 26{,}248 \approx 164{,}921$ mi

38. If diameter = 4.6, radius = 2.3.

$$V = \pi r^2 h$$
$$V = \pi(2.3)^2(18.3)$$
$$V = 96.807\pi$$
$$V \approx 304.13 \text{ cubic meters}$$

40. $8 \text{ miles} \times 5280 \ \frac{\text{ft}}{\text{mile}} = 42{,}240$ ft

$7.5 \text{ hours} \times 60 \ \frac{\text{minutes}}{\text{hour}} \times 60 \ \frac{\text{seconds}}{\text{minute}}$
$= 27{,}000$ seconds

$$D = r \cdot t$$
$$42{,}240 = r \cdot 27{,}000$$
$$\frac{42{,}240}{27{,}000} = r$$
$$1.564 \approx r$$

The rate that the drill can be retrieved is approximately 1.6 ft/sec.

42. $V = \frac{4}{3}\pi r^3$

$$V = \frac{4}{3}(3.14)(20.6)^3$$
$$V \approx 36{,}599.07$$

Eartha's volume is approximately 36,599 cubic feet.

44. Use $d = rt$, with $d = 135$ and $r = 60$.

$d = rt$

$135 = 60t$

$2.25 = t$ or $t = 2$ hr, $0.25(60) = 15$ min

It takes 2.25 hours or 2 hours 15 minutes.

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

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

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

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

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

$C = 120 + 81 + 8 = 209$

209 calories

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

$120 = 4(21) + 9f + 4(5)$

$120 = 84 + 9f + 20$

$120 = 104 + 9f$

$16 = 9f$

$\frac{16}{9} = f$

1.8 grams of fat

52. {2, 3}

54. $x - 3 \geq -7$

$x \geq -4$

{−3, −2, −1, 0, 1, 2, 3}

56. answers may vary

	Planet	AU from Sun
58.	Saturn	$\frac{886.1}{92.9} = 9.538$
60.	Uranus	$\frac{1783}{92.9} = 19.193$
62.	Neptune	$\frac{2793}{92.9} = 30.065$
64.	Pluto	$\frac{3670}{92.9} = 39.505$

66. answers may vary

68. answers may vary

70. Two of the 8 sectors are yellow.

$P(\text{yellow}) = \frac{2}{8} = \frac{1}{4}$

72. Three of the 8 sectors are blue.

$P(\text{blue}) = \frac{3}{8}$

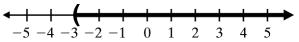
74. Three of the sectors are black or yellow.

$P(\text{black or yellow}) = \frac{3}{8}$

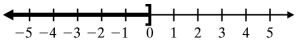
76. Six of the sectors are yellow, blue, or black.

$P(\text{yellow, blue, or black}) = \frac{6}{8} = \frac{3}{4}$

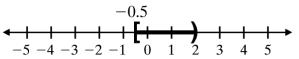
Section 2.4 Practice Exercises

1. 

$\{x|x > -3\}$ is $(-3, \infty)$.

2. 

$\{x|x \leq 0\}$ is $(-\infty, 0]$.

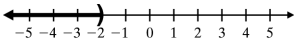
3. 

$\{x|-0.5 \leq x < 2\}$ is $[-0.5, 2)$.

4. $x + 3 < 1$

$x + 3 - 3 < 1 - 3$

$x < -2$



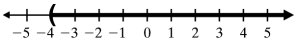
$\{x|x < -2\}$ is $(-\infty, -2)$.

5. $3x - 4 < 4x$

$3x - 4 - 3x < 4x - 3x$

$-4 < x$

$x > -4$



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

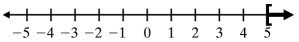
6. $5x - 1 \geq 4x + 4$

$5x - 1 + 1 \geq 4x + 4 + 1$

$5x \geq 4x + 5$

$5x - 4x \geq 4x + 5 - 4x$

$x \geq 5$

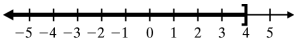


$\{x|x \geq 5\}$ is $[5, \infty)$.

7. $\frac{1}{6}x \le \frac{2}{3}$

$6 \cdot \frac{1}{6}x \le 6 \cdot \frac{2}{3}$

$x \le 4$

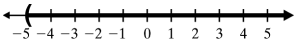


$\{x|x \le 4\}$ is $(-\infty, 4]$.

8. $-1.1x < 5.5$

$\frac{-1.1x}{-1.1} > \frac{5.5}{-1.1}$

$x > -5$



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

9. $-(2x-6) \le 4(2x-4)+2$

$-2x+6 \le 8x-16+2$

$-2x+6 \le 8x-14$

$-2x+6-6 \le 8x-14-6$

$-2x \le 8x-20$

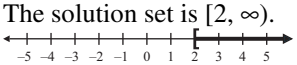
$-2x-8x \le 8x-20-8x$

$-10x \le -20$

$\frac{-10x}{-10} \ge \frac{-20}{-10}$

$x \ge 2$

The solution set is $[2, \infty)$.



10. $\frac{3}{4}(x+2) \ge x-6$

$4\left[\frac{3}{4}(x+2)\right] \ge 4(x-6)$

$3(x+2) \ge 4x-24$

$3x+6 \ge 4x-24$

$3x+6-6 \ge 4x-24-6$

$3x \ge 4x-30$

$3x-4x \ge 4x-30-4x$

$-x \ge -30$

$\frac{-x}{-1} \le \frac{-30}{-1}$

$x \le 30$

The solution set is $(-\infty, 30]$.

11. $5(x-3) < 5x+2$

$5x-15 < 5x+2$

$5x-15-5x < 5x+2-5x$

$-15 < 2$ True

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

12. Let x be the amount of sales.

$1000 + 0.15x \ge 4000$

$0.15x \ge 3000$

$x \ge 20,000$

The minimum amount of sales needed is \$20,000.

13. $c > -13.5t + 440$

$100 > -13.5t + 440$

$-340 > -13.5t$

$25.2 < t$

2000 + 25 = 2025

Consumption will be less than 100 billion per year after the year 2025.

Vocabulary, Readiness & Video Check 2.4

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 $\{x|x \ge -0.4\}$ 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 $\{x|x \le -0.4\}$ written in interval notation is $(-\infty, -0.4]$.

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

9. $2x > -15$ no

10. $-2x \le 15$ yes

11. $-2x < -15$ yes

12. $-x \ge 23$ yes

13. The graph of Example 1 is shaded from $-\infty$ to, but not including, -3, as indicated by a parenthesis. To write interval notation, write down what is shaded for the inequality from left to right. A parenthesis is always used with $-\infty$, so from the graph, the interval notation is $(-\infty, -3)$.

14. we can add the same number to (or subtract the same number from) both sides of a linear inequality in one variable and have an equivalent inequality; addition property of equality

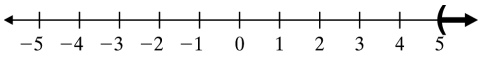
15. If you multiply or divide both sides of an inequality by the same nonzero negative number, you must reverse the direction of the inequality symbol.

16. We multiply both sides of the inequality by 28 to rid the inequality of fractions.

17. maximum, or less

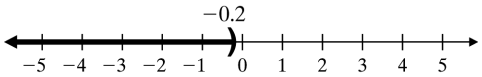
Exercise Set 2.4

2.



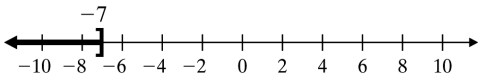
$\{x|x > 5\}$ is $(5, \infty)$.

4.



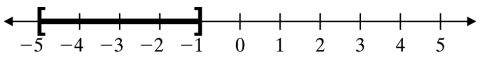
$\{x|x < -0.2\}$ is $(-\infty, -0.2)$.

6.



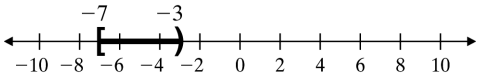
$\{x|-7 \geq x\}$ is $(-\infty, -7]$.

8.



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

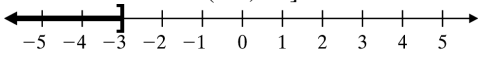
10.



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

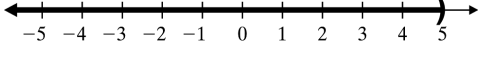
12.
$$x + 2 \leq -1$$
$$x + 2 - 2 \leq -1 - 2$$
$$x \leq -3$$

The solution set is $(-\infty, -3]$.



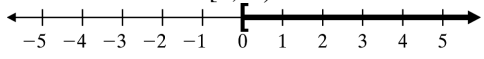
14.
$$11x < 10x + 5$$
$$11x - 10x < 10x + 5 - 10x$$
$$x < 5$$

The solution set is $(-\infty, 5)$.



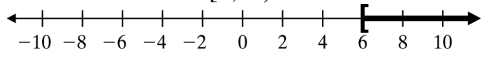
16.
$$7x - 1 \geq 6x - 1$$
$$7x - 1 + 1 \geq 6x - 1 + 1$$
$$7x \geq 6x$$
$$7x - 6x \geq 6x - 6x$$
$$x \geq 0$$

The solution set is $[0, \infty)$.



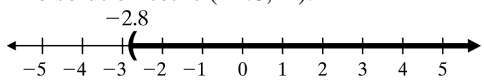
18.
$$\frac{5}{6}x \geq 5$$
$$\frac{6}{5}\left(\frac{5}{6}x\right) \geq \frac{6}{5}(5)$$
$$x \geq 6$$

The solution set is $[6, \infty)$.



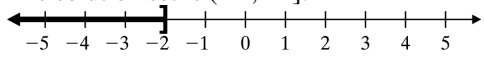
20.
$$4x > -11.2$$
$$\frac{4x}{4} > \frac{-11.2}{4}$$
$$x > -2.8$$

The solution set is $(-2.8, \infty)$.



22.
$$-4x \geq 8$$
$$\frac{-4x}{-4} \leq \frac{8}{-4}$$
$$x \leq -2$$

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



24.
$$8 - 5x \leq 23$$
$$8 - 5x - 8 \leq 23 - 8$$
$$-5x \leq 15$$
$$\frac{-5x}{-5} \geq \frac{15}{-5}$$
$$x \geq -3$$

The solution set is $[-3, \infty)$.

26.
$$20 + x < 6x - 15$$
$$20 + x - 20 < 6x - 15 - 20$$
$$x < 6x - 35$$
$$x - 6x < 6x - 35 - 6x$$
$$-5x < -35$$
$$\frac{-5x}{-5} > \frac{-35}{-5}$$
$$x > 7$$

The solution set is $(7, \infty)$.

28.
$$\begin{aligned} 6(2-3x) &\ge 12 \\ 12-18x &\ge 12 \\ 12-18x-12 &\ge 12-12 \\ -18x &\ge 0 \\ \frac{-18x}{-18} &\le \frac{0}{-18} \\ x &\le 0 \end{aligned}$$
The solution set is $(-\infty, 0]$.

30.
$$\begin{aligned} 5(x+4) &\le 4(2x+3) \\ 5x+20 &\le 8x+12 \\ 5x+20-20 &\le 8x+12-20 \\ 5x &\le 8x-8 \\ 5x-8x &\le 8x-8-8x \\ -3x &\le -8 \\ \frac{-3x}{-3} &\ge \frac{-8}{-3} \\ x &\ge \frac{8}{3} \end{aligned}$$
The solution set is $\left[\frac{8}{3}, \infty\right)$.

32.
$$\begin{aligned} \frac{1-2x}{3}+\frac{3x+7}{7} &> 1 \\ 21\left[\frac{1-2x}{3}+\frac{3x+7}{7}\right] &> 21(1) \\ 21\left(\frac{1-2x}{3}\right)+21\left(\frac{3x+7}{7}\right) &> 21 \\ 7(1-2x)+3(3x+7) &> 21 \\ 7-14x+9x+21 &> 21 \\ -5x+28 &> 21 \\ -5x+28-28 &> 21-28 \\ -5x &> -7 \\ \frac{-5x}{-5} &< \frac{-7}{-5} \\ x &< \frac{7}{5} \end{aligned}$$
The solution set is $\left(-\infty, \frac{7}{5}\right)$.

34.
$$\begin{aligned} -2(4x+2) &> -5[1+2(x-1)] \\ -8x-4 &> -5[1+2x-2] \\ -8x-4 &> -5[2x-1] \\ -8x-4 &> -10x+5 \\ -8x-4+4 &> -10x+5+4 \\ -8x &> -10x+9 \\ -8x+10x &> -10x+9+10x \\ 2x &> 9 \\ x &> \frac{9}{2} \end{aligned}$$
The solution set is $\left(\frac{9}{2}, \infty\right)$.

36.
$$\begin{aligned} x-9 &< -12 \\ x-9+9 &< -12+9 \\ x &< -3 \end{aligned}$$
The solution set is $(-\infty, -3)$.

38.
$$\begin{aligned} -x &> -2 \\ \frac{-x}{-1} &< \frac{-2}{-1} \\ x &< 2 \end{aligned}$$
The solution set is $(-\infty, 2)$.

40.
$$\begin{aligned} -6x &\le 4.2 \\ \frac{-6x}{-6} &\ge \frac{4.2}{-6} \\ x &\ge -0.7 \end{aligned}$$
The solution set is $[-0.7, \infty)$.

42.
$$\begin{aligned} \frac{3}{4}-\frac{2}{3} &\ge \frac{x}{6} \\ 12\left[\frac{3}{4}-\frac{2}{3}\right] &\ge 12\left(\frac{x}{6}\right) \\ 12\left(\frac{3}{4}\right)-12\left(\frac{2}{3}\right) &\ge 2x \\ 9-8 &\ge 2x \\ 1 &\ge 2x \\ \frac{1}{2} &\ge \frac{2x}{2} \\ \frac{1}{2} &\ge x \end{aligned}$$
The solution set is $\left(-\infty, \frac{1}{2}\right]$.

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

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

48. $0.7x-x>0.45$
$-0.3x>0.45$
$\frac{-0.3x}{-0.3}<\frac{0.45}{-0.3}$
$x<-1.5$
The solution set is $(-\infty,-1.5)$.

50. $7(2x+3)+4x\le 7+5(3x-4)+x$
$14x+21+4x\le 7+15x-20+x$
$18x+21\le 16x-13$
$18x+21-21\le 16x-13-21$
$18x\le 16x-34$
$18x-16x\le 16x-34-16x$
$2x\le -34$
$\frac{2x}{2}\le\frac{-34}{2}$
$x\le -17$
The solution set is $(-\infty,-17]$.

52. $13y-(9y+2)\le 5(y-6)+10$
$13y-9y-2\le 5y-30+10$
$4y-2\le 5y-20$
$4y-2+2\le 5y-20+2$
$4y\le 5y-18$
$4y-5y\le 5y-18-5y$
$-1y\le -18$
$\frac{-1y}{-1}\ge\frac{-18}{-1}$
$y\ge 18$
The solution set is $[18,\infty)$.

54. $\frac{2}{3}(x+3)<\frac{1}{6}(2x-8)+2$
$6\left[\frac{2}{3}(x+3)\right]<6\left[\frac{1}{6}(2x-8)+2\right]$
$4(x+3)<6\left[\frac{1}{6}(2x-8)\right]+6(2)$
$4x+12<1(2x-8)+12$
$4x+12<2x-8+12$
$4x+12<2x+4$
$4x+12-12<2x+4-12$
$4x<2x-8$
$4x-2x<2x-8-2x$
$2x<-8$
$\frac{2x}{2}<\frac{-8}{2}$
$x<-4$
The solution set is $(-\infty,-4)$.

56. $0.2(8x-2)<1.2(x-3)$
$10[0.2(8x-2)]<10[1.2(x-3)]$
$2(8x-2)<12(x-3)$
$16x-4<12x-36$
$16x-4+4<12x-36+4$
$16x<12x-32$
$16x-12x<12x-32-12x$
$4x<-32$
$\frac{4x}{4}<\frac{-32}{4}$
$x<-8$
The solution set is $(-\infty,-8)$.

58.
$$\frac{7}{12}x-\frac{1}{3}\le\frac{3}{8}x-\frac{5}{6}$$
$$24\left(\frac{7}{12}x-\frac{1}{3}\right)\le 24\left(\frac{3}{8}x-\frac{5}{6}\right)$$
$$24\left(\frac{7}{12}x\right)-24\left(\frac{1}{3}\right)\le 24\left(\frac{3}{8}x\right)-24\left(\frac{5}{6}\right)$$
$$14x-8\le 9x-20$$
$$14x-8+8\le 9x-20+8$$
$$14x\le 9x-12$$
$$14x-9x\le 9x-12-9x$$
$$5x\le -12$$
$$\frac{5x}{5}\le\frac{-12}{5}$$
$$x\le -\frac{12}{5}$$
The solution set is $\left(-\infty, -\frac{12}{5}\right]$.

60.
$$\frac{3-4x}{6}-\frac{1-2x}{12}\le -2$$
$$12\left(\frac{3-4x}{6}-\frac{1-2x}{12}\right)\le 12(-2)$$
$$12\left(\frac{3-4x}{6}\right)-12\left(\frac{1-2x}{12}\right)\le -24$$
$$2(3-4x)-(1-2x)\le -24$$
$$6-8x-1+2x\le -24$$
$$5-6x\le -24$$
$$5-5-6x\le -24-5$$
$$-6x\le -29$$
$$\frac{-6x}{-6}\ge\frac{-29}{-6}$$
$$x\ge\frac{29}{6}$$
The solution set is $\left[\frac{29}{6}, \infty\right)$.

62.
$$\frac{x-4}{2}-\frac{x-2}{3}>\frac{5}{6}$$
$$6\left(\frac{x-4}{2}-\frac{x-2}{3}\right)>6\left(\frac{5}{6}\right)$$
$$6\left(\frac{x-4}{2}\right)-6\left(\frac{x-2}{3}\right)>6\left(\frac{5}{6}\right)$$
$$3(x-4)-2(x-2)>5$$
$$3x-12-2x+4>5$$
$$x-8>5$$
$$x-8+8>5+8$$
$$x>13$$
The solution set is $(13, \infty)$.

64.
$$\frac{3x+2}{18}-\frac{1+2x}{6}\le -\frac{1}{2}$$
$$18\left(\frac{3x+2}{18}-\frac{1+2x}{6}\right)\le 18\left(-\frac{1}{2}\right)$$
$$18\left(\frac{3x+2}{18}\right)-18\left(\frac{1+2x}{6}\right)\le 18\left(-\frac{1}{2}\right)$$
$$3x+2-3(1+2x)\le -9$$
$$3x+2-3-6x\le -9$$
$$-3x-1\le -9$$
$$-3x-1+1\le -9+1$$
$$-3x\le -8$$
$$\frac{-3x}{-3}\ge\frac{-8}{-3}$$
$$x\ge\frac{8}{3}$$
The solution set is $\left[\frac{8}{3}, \infty\right)$.

66. a. Let x be Holden's time on his last trial.
$$\frac{6.85+7.04+6.92+x}{4}<7$$
$$4\left(\frac{6.85+7.04+6.92+x}{4}\right)<4(7)$$
$$6.85+7.04+6.92+x<28$$
$$20.81+x-20.81<28-20.81$$
$$x<7.19$$
The solution is $\{x|x<7.19\}$.

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

68. a. Let x be the number of additional ounces (after the first ounce).
$$90+x\cdot 20\le 300$$
$$90+20x\le 300$$
$$20x\le 210$$
$$x\le 10.5$$
The solution is $\{x|x\le 10\}$.

b. Eleven ounces or less can be mailed for \$3.00. (The first ounce plus 10 additional ounces.)

70. a. Let x be the number of additional half hours.
$$100+60x\le 400$$
$$60x\le 300$$
$$x\le 5$$
The solution is $\{x|x\le 5\}$.

b. With \$4.00, you can park for 3 hours or less. (First half hour, plus 5 additional half hours.)

72. a. Let x be the number of daily miles. Then the daily charge for plan B is $\$(24 + 0.15x)$. Plan A is more economical when the daily charge for Plan B is more than \$36.

$$24 + 0.15x > 36$$
$$0.15x > 12$$
$$x > 80$$

The solution is $\{x|x > 80\}$.

b. Plan A is more economical for more than 80 daily miles.

74. Stibnite melts at temperatures of 977°F or greater. Use $C = \frac{5}{9}(F - 32)$. Replace F with 977.

$$C = \frac{5}{9}(F - 32)$$
$$C = \frac{5}{9}(977 - 32)$$
$$C = \frac{5}{9}(945)$$
$$C = 525$$

977°F = 525°C

So stibnite melts at temperatures of 525°C or greater. The solution set is $\{C|C \geq 525°\}$.

76. a.
$$c < -13.5t + 440$$
$$50 < -13.5t + 440$$
$$-390 > -13.5t$$
$$28.9 < t$$

2000 + 29 = 2029

In the year 2029 and after, cigarette consumption will be less than 50 billion per year.

b. answers may vary

78. Consumption of skim milk is decreasing over time; answers may vary.

80. 2020 is 20 years after 2000, so 2020 corresponds to $t = 20$.

$s = -0.25t + 28.7$
$s = -0.25(20) + 28.7$
$s = -5 + 28.7$
$s = 23.7$

The average consumption of skim milk is expected to be 23.7 pounds per person per year in 2020.

82. answers may vary

84. answers may vary

86. answers may vary

88. The integers that are both greater than 1 and less than 5 are $\{2, 3, 4\}$.

90. The integers that are both greater than or equal to −2 and greater than or equal to 2 are $\{2, 3, 4, 5, ...\}$.

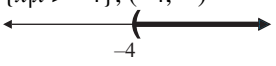
92.
$$2x - 6 = 4$$
$$2x - 6 + 6 = 4 + 6$$
$$2x = 10$$
$$\frac{2x}{2} = \frac{10}{2}$$
$$x = 5$$

The solution set is $\{5\}$.

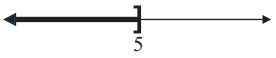
94.
$$-x + 7 = 5x - 6$$
$$-x + 7 - 7 = 5x - 6 - 7$$
$$-x = 5x - 13$$
$$-x - 5x = 5x - 13 - 5x$$
$$-6x = -13$$
$$\frac{-6x}{-6} = \frac{-13}{-6}$$
$$x = \frac{13}{6}$$

The solution set is $\left\{\frac{13}{6}\right\}$.

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

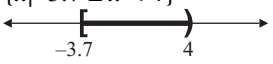


98.



$(-\infty, 5]$

100. $\{x|-3.7 \leq x < 4\}$



102. To solve $3x > -14$, both sides must be divided by 3, so the inequality symbol is not reversed.

104. To solve $-3x < -14$, both sides must be divided by −3, so the inequality symbol must be reversed.

106. answers may vary

108.
$$2x - 3 < 5$$
$$2x < 8$$
$$x < 4$$

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

110. answers may vary

112. answers may vary

114. answers may vary

Integrated Review

1. $-4x = 20$
$x = -5$
The solution set is $\{-5\}$.

2. $-4x < 20$
$x > -5$
The solution set is $(-5, \infty)$.

3. $\frac{3}{4}x \geq 2$
$3x \geq 8$
$x \geq \frac{8}{3}$
The solution set is $\left[\frac{8}{3}, \infty\right)$.

4. $5x + 3 \geq 2 + 4x$
$x + 3 \geq 2$
$x \geq -1$
The solution set is $[-1, \infty)$.

5. $6(y-4) = 3(y-8)$
$6y - 24 = 3y - 24$
$6y = 3y$
$3y = 0$
$y = 0$
The solution set is $\{0\}$.

6. $-4x \leq \frac{2}{5}$
$x \geq -\frac{1}{10}$
The solution set is $\left[-\frac{1}{10}, \infty\right)$.

7. $-3x \geq \frac{1}{2}$
$x \leq -\frac{1}{6}$
The solution set is $\left(-\infty, -\frac{1}{6}\right]$.

8. $5(y+4) = 4(y+5)$
$5y + 20 = 4y + 20$
$5y = 4y$
$y = 0$
The solution set is $\{0\}$.

9. $7x < 7(x-2)$
$7x < 7x - 14$
$0 < -14$
False; the solution set is $\varnothing$.

10. $\frac{-5x+11}{2} \leq 7$
$-5x + 11 \leq 14$
$-5x \leq 3$
$x \geq -\frac{3}{5}$
The solution set is $\left[-\frac{3}{5}, \infty\right)$.

11. $-5x + 1.5 = -19.5$
$-5x = -21$
$x = \frac{21}{5} = 4.2$
The solution set is $\{4.2\}$.

12. $-5x + 4 = -26$
$-5x = -30$
$x = 6$
The solution set is $\{6\}$.

13. $5 + 2x - x = -x + 3 - 14$
$5 + x = -x - 11$
$x = -x - 16$
$2x = -16$
$x = -8$
The solution set is $\{-8\}$.

14. $12x + 14 < 11x - 2$
$12x < 11x - 16$
$x < -16$
The solution set is $(-\infty, -16)$.

15. $$\frac{x}{5}-\frac{x}{4}=\frac{x-2}{2}$$
$$20\left[\frac{x}{5}-\frac{x}{4}\right]=20\left(\frac{x-2}{2}\right)$$
$$20\left(\frac{x}{5}\right)-20\left(\frac{x}{4}\right)=10(x-2)$$
$$4x-5x=10x-20$$
$$-x=10x-20$$
$$-11x=-20$$
$$x=\frac{20}{11}$$
The solution set is $\left\{\frac{20}{11}\right\}$.

16. $12x-12=8(x-1)$
$12x-12=8x-8$
$12x=8x+4$
$4x=4$
$x=1$
The solution set is $\{1\}$.

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

18. $-3x-4.7=11.8$
$-3x=16.5$
$x=-5.5$
The solution set is $\{-5.5\}$.

19. $-2(b-4)-(3b-1)=5b+3$
$-2b+8-3b+1=5b+3$
$-5b+9=5b+3$
$-5b=5b-6$
$-10b=-6$
$$b=\frac{-6}{-10}=\frac{3}{5}$$
The solution set is $\left\{\frac{3}{5}\right\}$.

20. $8(x+3)<7(x+5)+x$
$8x+24<7x+35+x$
$8x+24<8x+35$
$24<35$ True
The solution set is $(-\infty, \infty)$.

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

22. $4(x-6)-x=8(x-3)-5x$
$4x-24-x=8x-24-5x$
$3x-24=3x-24$
$-24=-24$ True
The solution set is $\{x|x \text{ is a real number}\}$.

23. $$\frac{x+3}{12}+\frac{x-5}{15}<\frac{2}{3}$$
$$60\left[\frac{x+3}{12}+\frac{x-5}{15}\right]<60\left(\frac{2}{3}\right)$$
$$60\left(\frac{x+3}{12}\right)+60\left(\frac{x-5}{15}\right)<40$$
$5(x+3)+4(x-5)<40$
$5x+15+4x-20<40$
$9x-5<40$
$9x<45$
$x<5$
The solution set is $(-\infty, 5)$.

24. $$\frac{y}{3}+\frac{y}{5}=\frac{y+3}{10}$$
$$30\left[\frac{y}{3}+\frac{y}{5}\right]=30\left[\frac{y+3}{10}\right]$$
$$30\left(\frac{y}{3}\right)+30\left(\frac{y}{5}\right)=3(y+3)$$
$10y+6y=3y+9$
$16y=3y+9$
$13y=9$
$$y=\frac{9}{13}$$
The solution set is $\left\{\frac{9}{13}\right\}$.

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

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

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

28. $\frac{1}{3}(x-10)-4x>\frac{5}{6}(2x+1)-1$
$6\left[\frac{1}{3}(x-10)-4x\right]>6\left[\frac{5}{6}(2x+1)-1\right]$
$6\left[\frac{1}{3}(x-10)\right]-6(4x)>6\left[\frac{5}{6}(2x+1)\right]-6(1)$
$2(x-10)-24x>5(2x+1)-6$
$2x-20-24x>10x+5-6$
$-22x-20>10x-1$
$-22x>10x+19$
$-32x>19$
$x<-\frac{19}{32}$
The solution set is $\left(-\infty, -\frac{19}{32}\right)$.

Section 2.5 Practice Exercises

1. The numbers 3, 4, and 5 are in both sets. The intersection is $\{3, 4, 5\}$.

2. $x+5<9$ *and* $3x-1<2$
$x<4$ *and* $3x<3$
$x<4$ *and* $x<1$
The solution set is
$(-\infty, 4)\cap(-\infty, 1) = (-\infty, 1)$.

3. $4x\ge 0$ *and* $2x+4\le 2$
$x\ge 0$ *and* $2x\le -2$
$x\ge 0$ *and* $x\le -1$
There is no number greater than or equal to 0 and less than or equal to -1. The solution set is $\varnothing$.

4. $5<1-x<9$
$5-1<1-x-1<9-1$
$4<-x<8$
$-4>x>-8$
The solution set is $(-8, -4)$.

5. $-2<\frac{3}{4}x+2\le 5$
$-2-2<\frac{3}{4}x+2-2\le 5-2$
$-4<\frac{3}{4}x\le 3$
$4(-4)<4\left(\frac{3}{4}x\right)\le 4(3)$
$-16<3x\le 12$
$\frac{-16}{3}<\frac{3x}{3}\le\frac{12}{3}$
$-\frac{16}{3}<x\le 4$
The solution set is $\left(-\frac{16}{3}, 4\right]$.

6. The numbers that are in either set are $\{1, 2, 3, 4, 5, 6\}$. This set is the union.

7. $3x-2\ge 10$ *or* $x-6\le -4$
$3x\ge 12$ *or* $x\le 2$
$x\ge 4$ *or* $x\le 2$
The solution set is $(-\infty, 2]\cup[4, \infty)$.

8. $x-7 \le -1 \quad or \quad 2x-6 \ge 2$
$x \le 6 \quad or \quad 2x \ge 8$
$x \le 6 \quad or \quad x \ge 4$
The solution set is $(-\infty, \infty)$.

Vocabulary, Readiness & Video Check 2.5

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

9. For an element to be in the intersection of sets A and B, the element must be in set A and in set B.

10. Graph the two inequality solutions, each on its own number line, so you can see their intersection. Graph this intersection on the third number line—this intersection is the solution set.

11. For an element to be in the union of sets A and B, the element must be in set A or in set B.

12. Graph the two inequality solutions, each on its own number line, so you can see their union. Graph this union on the third number line—this union is the solution set.

Exercise Set 2.5

2. $C \cap D = \{2, 3, 4, 5\} \cap \{4, 5, 6, 7\} = \{4, 5\}$

4. $A \cup D = \{x \mid x \text{ is an even integer}\} \cup \{4, 5, 6, 7\}$
$= \{x \mid x \text{ is an even integer or } x = 5 \text{ or } x = 7\}$

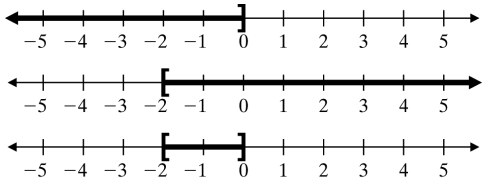
6. $A \cap B = \{x \mid x \text{ is an even integer}\} \cap \{x \mid x \text{ is an odd integer}\}$
$= \varnothing$

8. $B \cup D = \{x \mid x \text{ is an odd integer}\} \cup \{4, 5, 6, 7\}$
$= \{x \mid x \text{ is an odd integer or } x = 4 \text{ or } x = 6\}$

10. $B \cap C = \{x \mid x \text{ is an odd integer}\} \cap \{2, 3, 4, 5\}$
$= \{3, 5\}$

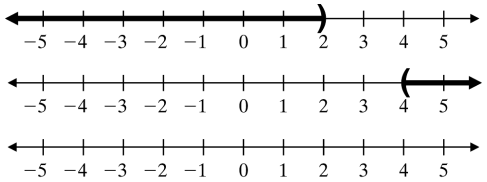
12. $A \cup C = \{x \mid x \text{ is an even integer}\} \cup \{2, 3, 4, 5\}$
$= \{x \mid x \text{ is an even integer or } x = 3 \text{ or } x = 5\}$

14.



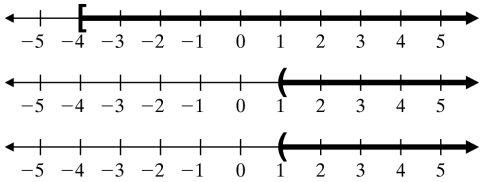
The solution set is $[-2, 0]$.

16.



The solution set is $\varnothing$.

18.



The solution set is $(1, \infty)$.

20. $x+2 \geq 3$ *and* $5x-1 \geq 9$

$x \geq 1$ *and* $5x \geq 10$

$x \geq 1$ *and* $x \geq 2$

The solution set is $[2, \infty)$.

22. $2x+4 > 0$ *and* $4x > 0$

$2x > -4$ *and* $x > 0$

$x > -2$ *and* $x > 0$

The solution set is $(0, \infty)$.

24. $-7x \leq -21$ *and* $x-20 \leq -15$

$x \geq 3$ *and* $x \leq 5$

The solution set is $[3, 5]$.

26. $-2 \leq x+3 \leq 0$

$-2-3 \leq x+3-3 \leq 0-3$

$-5 \leq x \leq -3$

The solution set is $[-5, -3]$.

28. $1 < 4+2x < 7$

$1-4 < 4+2x-4 < 7-4$

$-3 < 2x < 3$

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

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

The solution set is $\left(-\frac{3}{2}, \frac{3}{2}\right)$.

30. $-2 < \frac{1}{2}x - 5 < 1$

$-2+5 < \frac{1}{2}x - 5 + 5 < 1+5$

$3 < \frac{1}{2}x < 6$

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

$6 < x < 12$

The solution set is $(6, 12)$.

32. $-4 \leq \frac{-2x+5}{3} \leq 1$

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

$-12 \leq -2x+5 \leq 3$

$-12-5 \leq -2x+5-5 \leq 3-5$

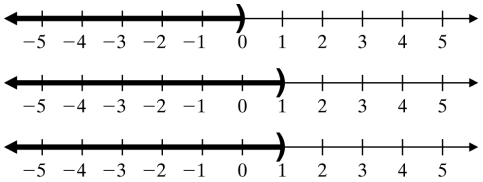
$-17 \leq -2x \leq -2$

$\frac{-17}{-2} \geq \frac{-2x}{-2} \geq \frac{-2}{-2}$

$\frac{17}{2} \geq x \geq 1$

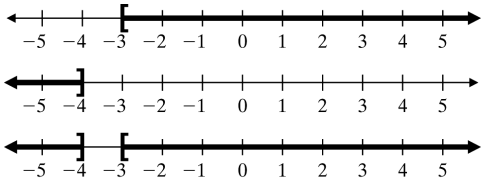
The solution set is $\left[1, \frac{17}{2}\right]$.

34.



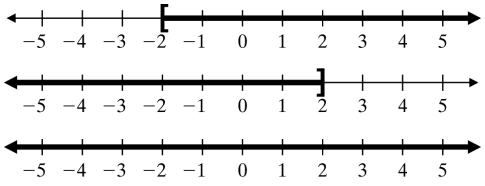
The solution set is $(-\infty, 1)$.

36.



The solution set is $(-\infty, -4] \cup [-3, \infty)$.

38.



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

40. $-5x \le 10 \quad or \quad 3x - 5 \ge 1$
$x \ge -2 \quad or \quad 3x \ge 6$
$x \ge -2 \quad or \quad x \ge 2$
The solution set is $[-2, \infty)$.

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

44. $5(x-1) \le -5 \quad or \quad 5 - x \le 11$
$5x - 5 \le -5 \quad or \quad -x \le 6$
$5x \le 0 \quad or \quad x \ge -6$
$x \le 0 \quad or \quad x \ge -6$
The solution set is $(-\infty, \infty)$.

46. $x < \frac{5}{7} \quad and \quad x < 1$
The solution set is
$\left(-\infty, \frac{5}{7}\right) \cap (-\infty, 1) = \left(-\infty, \frac{5}{7}\right)$.

48. $x < \frac{5}{7}$ *or* $x < 1$
The solution set is $\left(-\infty, \frac{5}{7}\right)$ or
$(-\infty, 1) = (-\infty, 1)$.

50. $3 < 5x + 1 < 11$
$3 - 1 < 5x + 1 - 1 < 11 - 1$
$2 < 5x < 10$
$\frac{2}{5} < \frac{5x}{5} < \frac{10}{5}$
$\frac{2}{5} < x < 2$
The solution set is $\left(\frac{2}{5}, 2\right)$.

52. $\frac{2}{3} < x + \frac{1}{2} < 4$
$6\left(\frac{2}{3}\right) < 6\left(x + \frac{1}{2}\right) < 6(4)$
$4 < 6(x) + 6\left(\frac{1}{2}\right) < 24$
$4 < 6x + 3 < 24$
$4 - 3 < 6x + 3 - 3 < 24 - 3$
$1 < 6x < 21$
$\frac{1}{6} < \frac{6x}{6} < \frac{21}{6}$
$\frac{1}{6} < x < \frac{7}{2}$
The solution set is $\left(\frac{1}{6}, \frac{7}{2}\right)$.

54. $2x - 1 \ge 3 \quad and \quad -x > 2$
$2x \ge 4 \quad and \quad x < -2$
$x \ge 2 \quad and \quad x < -2$
The solution set is $[2, \infty) \cap (-\infty, -2) = \varnothing$.

56. $\frac{3}{8}x + 1 \le 0 \quad or \quad -2x < -4$
$\frac{3}{8}x \le -1 \quad or \quad x > 2$
$\frac{8}{3}\left(\frac{3}{8}x\right) \le \frac{8}{3}(-1) \quad or \quad x > 2$
$x \le -\frac{8}{3} \quad or \quad x > 2$
The solution set is $\left(-\infty, -\frac{8}{3}\right] \cup (2, \infty)$.

58. $-2 < \frac{-2x - 1}{3} < 2$
$3(-2) < 3\left(\frac{-2x - 1}{3}\right) < 3(2)$
$-6 < -2x - 1 < 6$
$-6 + 1 < -2x - 1 + 1 < 6 + 1$
$-5 < -2x < 7$
$\frac{-5}{-2} > \frac{-2x}{-2} > \frac{7}{-2}$
$\frac{5}{2} > x > -\frac{7}{2}$
The solution set is $\left(-\frac{7}{2}, \frac{5}{2}\right)$.

60. $-5 < 2(x+4) \le 8$
$-5 < 2x+8 \le 8$
$-5-8 < 2x+8-8 \le 8-8$
$-13 < 2x \le 0$
$\frac{-13}{2} < \frac{2x}{2} \le \frac{0}{2}$
$-\frac{13}{2} < x \le 0$
The solution set is $\left(-\frac{13}{2}, 0\right]$.

62. $5x \le 0$ *and* $-x+5 < 8$
$x \le 0$ *and* $-x < 3$
$x \le 0$ *and* $x > -3$
The solution set is $(-\infty, 0] \cap (-3, \infty) = (-3, 0]$.

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

66. $-2x < -6$ *and* $1-x > -2$
$x > 3$ *and* $-x > -3$
$x > 3$ *and* $x < 3$
The solution set is $(3, \infty) \cap (-\infty, 3) = \varnothing$.

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

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

72. $-0.7 < 0.4x + 0.8 < 0.5$
$10(-0.7) < 10(0.4x+0.8) < 10(0.5)$
$-7 < 10(0.4x) + 10(0.8) < 5$
$-7 < 4x+8 < 5$
$-7-8 < 4x+8-8 < 5-8$
$-15 < 4x < -3$
$\frac{-15}{4} < \frac{4x}{4} < \frac{-3}{4}$
$-3.75 < x < -0.75$
The solution set is $(-3.75, -0.75)$.

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

76. $|-4| - (-4) + |-20| = 4 + 4 + 20 = 8 + 20 = 28$

78. $|x| = 5$ when $x = 5$ or $x = -5$.
The solution set is $\{-5, 5\}$.

80. There are no values of x such that $|x| = -2$, so the solution set is $\varnothing$.

82. From the graph, we see that the number of single-family housing starts that are less than 1000 or the number of single-family housing completions greater than 1500 are for the years 2004, 2005, 2006, 2008, 2009, 2010, 2011, and 2012.

84. answers may vary

86. $2x - 3 < 3x + 1 < 4x - 5$
$2x-3 < 3x+1$ *and* $3x+1 < 4x-5$
$2x < 3x+4$ *and* $3x < 4x-6$
$-x < 4$ *and* $-x < -6$
$x > -4$ *and* $x > 6$
The solution set is $(-4, \infty) \cap (6, \infty) = (6, \infty)$.

88. $-3(x-2) \le 3-2x \le 10-3x$

$-3(x-2) \le 3-2x$ *and* $3-2x \le 10-3x$

$-3x+6 \le 3-2x$ *and* $-2x \le 7-3x$

$-3x \le -3-2x$ *and* $x \le 7$

$-x \le -3$ *and* $x \le 7$

$x \ge 3$ *and* $x \le 7$

The solution set is $[3, \infty) \cap (-\infty, 7] = [3, 7]$.

90. $-10 \le C \le 18$

$$-10 \le \frac{5}{9}(F-32) \le 18$$

$$\frac{9}{5}(-10) \le \frac{9}{5}\left[\frac{5}{9}(F-32)\right] \le \frac{9}{5}(18)$$

$$-18 \le F-32 \le 32.4$$

$$-18+32 \le F-32+32 \le 32.4+32$$

$$14 \le F \le 64.4$$

The temperatures ranged from 14°F to 64.4°F.

92. Let x be her final exam score.

$$80 \le \frac{80+90+82+75+2x}{6} \le 89$$

$$6(80) \le 6\left(\frac{80+90+82+75+2x}{6}\right) \le 6(89)$$

$$480 \le 80+90+82+75+2x \le 534$$

$$480 \le 327+2x \le 534$$

$$480-327 \le 327+2x-327 \le 534-327$$

$$153 \le 2x \le 207$$

$$\frac{153}{2} \le \frac{2x}{2} \le \frac{207}{2}$$

$$76.5 \le x \le 103.5$$

To earn a B in the course, her final exam grade must be between 76.5 and 100 (assuming she can't earn extra credit.)

Section 2.6 Practice Exercises

1. $|q| = 5$

$q = 5$ or $q = -5$

The solution set is $\{-5, 5\}$.

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 ∅.

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 ∅.

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, Readiness & Video Check 2.6

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. $\varnothing$

6. If a is negative, $|X|=a$ has no solution. (Also, if a is 0, we solve $X=0$.)

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

22. $|2x-5|=|2x+5|$
$2x-5=-(2x+5)$ or $2x-5=2x+5$
$2x-5=-2x-5$ or $-5=5$
$4x=0$ or false
$x=0$
The only solution is 0.

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

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

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

30. $|4m+5|=5$
$4m+5=5$ or $4m+5=-5$
$4m=0$ or $4m=-10$
$m=0$ or $m=-\frac{10}{4}$
$m=0$ or $m=-\frac{5}{2}$

32. $|7z|+1=22$

$|7z|=21$

$7z=21 \quad \text{or} \quad 7z=-21$

$z=3 \quad \text{or} \quad z=-3$

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

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

$|x+4|=5$

$x+4=5 \quad \text{or} \quad x+4=-5$

$x=1 \quad \text{or} \quad x=-9$

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

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

42. $|5x-2|=0$

$5x-2=0$

$5x=2$

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

44. $|2+3m|-9=-7$

$|2+3m|=2$

$2+3m=2 \quad \text{or} \quad 2+3m=-2$

$3m=0 \quad \text{or} \quad 3m=-4$

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

46. $|8-6c|=1$

$8-6c=1 \quad \text{or} \quad 8-6c=-1$

$-6c=-7 \quad \text{or} \quad -6c=-9$

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

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

48. $|3x+5|=|-4|$

$|3x+5|=4$

$3x+5=4 \quad \text{or} \quad 3x+5=-4$

$3x=-1 \quad \text{or} \quad 3x=-9$

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

50. $|3+6n|=|4n+11|$

$3+6n=4n+11 \quad \text{or} \quad 3+6n=-(4n+11)$

$2n=8 \quad \text{or} \quad 3+6n=-4n-11$

$n=4 \quad \text{or} \quad 10n=-14$

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

52. $|4-5y|=-|-3|$

$|4-5y|=-3$

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

54. $|4n+5|=|4n+3|$

$4n+5=-(4n+3) \quad \text{or} \quad 4n+5=4n+3$

$4n+5=-4n-3 \quad \text{or} \quad 5=3$

$8n=-8 \quad \text{or} \quad \text{false}$

$n=-1$

The only solution is -1.

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

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

$1+3n=16 \quad \text{or} \quad 1+3n=-16$

$3n=15 \quad \text{or} \quad 3n=-17$

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

58. $8+|4m|=24$

$|4m|=16$

$4m=16 \quad \text{or} \quad 4m=-16$

$m=4 \quad \text{or} \quad m=-4$

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

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

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

$5x+2=12 \quad \text{or} \quad 5x+2=-12$

$5x=10 \quad \text{or} \quad 5x=-14$

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

62. $|5z-1| = |7-z|$

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

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

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

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

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

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

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

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

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

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

66. $|8-y| = |y+2|$

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

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

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

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

70. From the circle graph, mozzarella cheese had the highest U.S. production in 2012.

72. In 2012, cream cheese accounted for 7% of the total cheese production.
7% of 10,890,000,000 is
0.07(10,890,000,000) = 762,300,000
762,300,000 pounds of cream cheese was produced in the United States in 2012.

74. answers may vary

76. $|y| < 0$ has no solutions.

78. Since absolute value is never negative, the solution set is $\varnothing$.

80. All numbers whose distance from 0 is 2 units is written as $|x| = 2$.

82. answers may vary

84. $|x-7| = 2$

86. answers may vary

88. $|2x-1| = 4$

90. $|ax+b| = c$

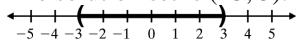
a. one solution if $c = 0$

b. no solutions if c is a negative number

c. two solutions if c is a positive number

Section 2.7 Practice Exercises

1. $|x| < 3$
The solution set of this inequality contains all numbers whose distance from 0 is less than 3.
The solution set is (–3, 3).



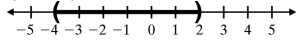
2. $|b+1| < 3$

$-3 < b+1 < 3$

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

$-4 < b < 2$

(–4, 2)



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

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

$|3x-2| \le 4$

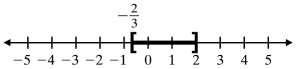
$-4 \le 3x-2 \le 4$

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

$-2 \le 3x \le 6$

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

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



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

$$\frac{3(x-2)}{5} = 0$$
$$5\left[\frac{3(x-2)}{5}\right] = 5(0)$$
$$3(x-2) = 0$$
$$3x - 6 = 0$$
$$3x = 6$$
$$x = 2$$

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

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

$$y+4 \le -6 \quad \text{or} \quad y+4 \ge 6$$
$$y+4-4 \le -6-4 \quad \text{or} \quad y+4-4 \ge 6-4$$
$$y \le -10 \quad \text{or} \quad y \ge 2$$

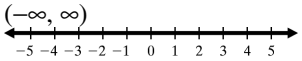
$(-\infty, -10] \cup [2, \infty)$

7. $|4x+3|+5 > 3$

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

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

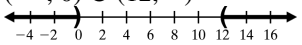
$(-\infty, \infty)$



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

$$\left|\frac{x}{2}-3\right|-5+5 > -2+5$$
$$\left|\frac{x}{2}-3\right| > 3$$
$$\frac{x}{2}-3 < -3 \quad \text{or} \quad \frac{x}{2}-3 > 3$$
$$2\left(\frac{x}{2}-3\right) < 2(-3) \quad \text{or} \quad 2\left(\frac{x}{2}-3\right) > 2(3)$$
$$x-6 < -6 \quad \text{or} \quad x-6 > 6$$
$$x < 0 \quad \text{or} \quad x > 12$$

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



Vocabulary, Readiness & Video Check 2.7

1. D

2. E

3. C

4. B

5. A

6. The left side of the inequality is an absolute value, which must be nonnegative—it must be 0 or positive. Therefore, there is no value of x that can make the value of this absolute value be less than the negative value on the right side of the inequality.

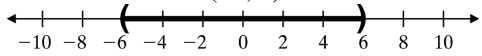
7. The solution set involves "or" and "or" means "union."

Exercise Set 2.7

2. $|x| < 6$

$-6 < x < 6$

The solution set is $(-6, 6)$.

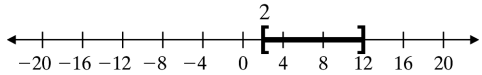


4. $|y-7| \le 5$

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

$2 \le y \le 12$

The solution set is $[2, 12]$.

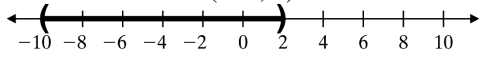


6. $|x+4| < 6$

$-6 < x+4 < 6$

$-10 < x < 2$

The solution set is $(-10, 2)$.



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

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

$-15 \le 5x \le 21$

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

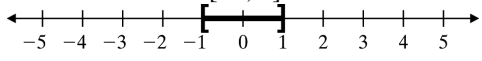
The solution set is $\left[-3, \frac{21}{5}\right]$.

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

$|x| \le 1$

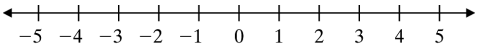
$-1 \le x \le 1$

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

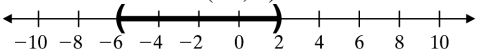
$|z+2|<4$

$-4<z+2<4$

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

$-6<z<2$

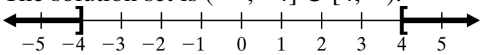
The solution set is $(-6, 2)$.



16. $|y| \geq 4$

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

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

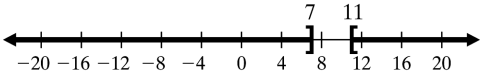


18. $|x - 9| \geq 2$

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

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

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

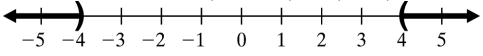


20. $|x|-1>3$

$|x|>4$

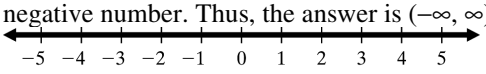
$x<-4$ or $x>4$

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

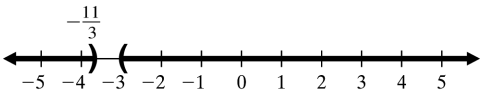
$|10+3x|>1$

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

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

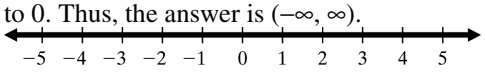
$x<-\frac{11}{3}$ or $x>-3$

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



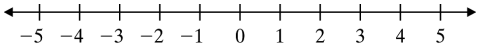
26. $|x| \geq 0$

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



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

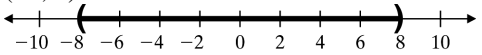
The absolute value of an expression is never negative, so no solution exists. The solution set is $\varnothing$.



30. $|z| < 8$

$-8 < z < 8$

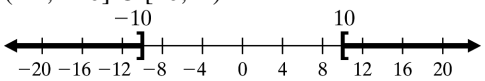
$(-8, 8)$



32. $|x| \geq 10$

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

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

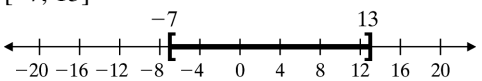


34. $|-3 + x| \leq 10$

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

$-7 \leq x \leq 13$

$[-7, 13]$



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 $\frac{0.3x}{0.3} \geq -\frac{0.9}{0.3}$

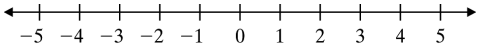
$x \leq -\frac{11}{3}$ or $x \geq -3$

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

38. $8+|x|<1$

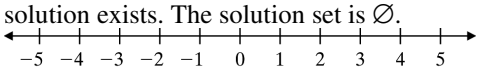
$|x|<-7$

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



40. $|x| \le -7$

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



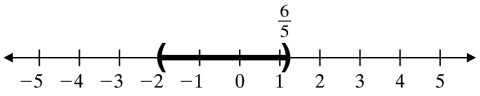
42. $|5x + 2| < 8$

$-8 < 5x + 2 < 8$

$-10 < 5x < 6$

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

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



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

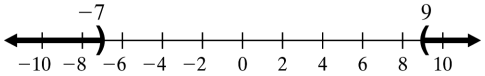
$|-1 + x| - 6 + 6 > 2 + 6$

$|-1 + x| > 8$

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

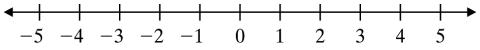
$x < -7$ or $x > 9$

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



46. $|x| < 0$

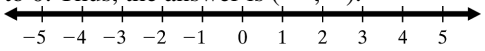
An absolute value is never negative, so no solution exists. The solution set is $\varnothing$.



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

$|x| \ge -1$

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



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

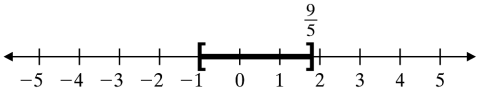
$|5x - 2| \le 7$

$-7 \le 5x - 2 \le 7$

$-5 \le 5x \le 9$

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

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



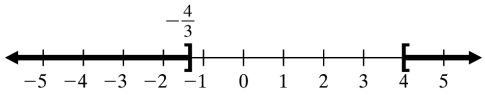
52. $\left|\frac{3}{4}x - 1\right| \ge 2$

$\frac{3}{4}x - 1 \le -2$ or $\frac{3}{4}x - 1 \ge 2$

$\frac{3}{4}x \le -1$ or $\frac{3}{4}x \ge 3$

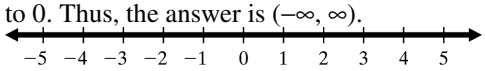
$x \le -\frac{4}{3}$ or $x \ge 4$

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



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

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



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

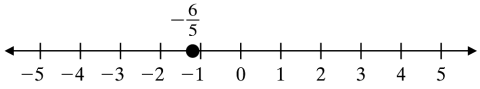
$\frac{5x+6}{2} = 0$

$5x + 6 = 0$

$5x = -6$

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

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



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

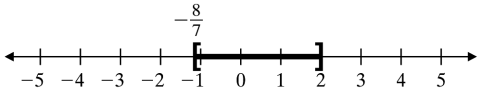
$|7x - 3| \le 11$

$-11 \le 7x - 3 \le 11$

$-8 \le 7x \le 14$

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

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



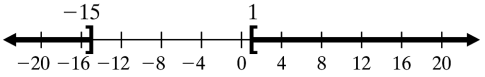
60. $\left|\frac{7+x}{2}\right| \ge 4$

$\frac{7+x}{2} \le -4$ or $\frac{7+x}{2} \ge 4$

$7+x \le -8$ or $7+x \ge 8$

$x \le -15$ or $x \ge 1$

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



62. $-9+\left|3+4x\right| < -4$

$-9+\left|3+4x\right|+9 < -4+9$

$\left|3+4x\right| < 5$

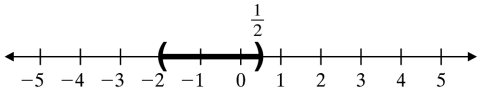
$-5 < 3+4x < 5$

$-8 < 4x < 2$

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

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

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



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

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

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

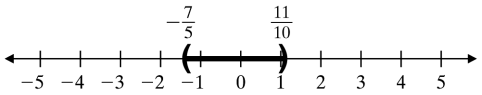
$-25 < 3+20x < 25$

$-28 < 20x < 22$

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

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

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



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. $|x+4| \ge 20$

$x+4 \le -20$ or $x+4 \ge 20$

$x \le -24$ or $x \ge 16$

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

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

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

74. $8+\left|5x-3\right| \ge 11$

$\left|5x-3\right| \ge 3$

$5x-3 \le -3$ or $5x-3 \ge 3$

$5x \le 0$ or $5x \ge 6$

$x \le 0$ or $x \ge \frac{6}{5}$

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

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

$\left|5x-3\right| = 2$

$5x-3 = -2$ 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.
$$\left|0.2-\frac{51}{256}\right| = \left|\frac{2}{10}-\frac{51}{256}\right|$$
$$= \left|\frac{256}{1280}-\frac{255}{1280}\right|$$
$$= \left|\frac{1}{1280}\right|$$
$$= \frac{1}{1280}$$
$$= 0.00078125$$

The absolute error is $\frac{1}{1280}$ or 0.00078125.

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.
$$4(x-5) = 2x-14$$
$$4x-20 = 2x-14$$
$$4x = 2x+6$$
$$2x = 6$$
$$x = 3$$

The solution set is $\{3\}$.

2.
$$x+7 = -2(x+8)$$
$$x+7 = -2x-16$$
$$x = -2x-23$$
$$3x = -23$$
$$x = -\frac{23}{3}$$

The solution set is $\left\{-\frac{23}{3}\right\}$.

3. $3(2y-1) = -8(6+y)$
$6y-3 = -48-8y$
$6y = -45-8y$
$14y = -45$
$y = -\frac{45}{14}$
The solution set is $\left\{-\frac{45}{14}\right\}$.

4. $-(z+12) = 5(2z-1)$
$-z-12 = 10z-5$
$-z = 10z+7$
$-11z = 7$
$z = -\frac{7}{11}$
The solution set is $\left\{-\frac{7}{11}\right\}$.

5. $n-(8+4n) = 2(3n-4)$
$n-8-4n = 6n-8$
$-8-3n = 6n-8$
$-3n = 6n$
$-9n = 0$
$n = 0$
The solution set is $\{0\}$.

6. $4(9v+2) = 6(1+6v)-10$
$36v+8 = 6+36v-10$
$36v+8 = 36v-4$
$8 = -4$
False; the solution set is $\varnothing$.

7. $0.3(x-2) = 1.2$
$10[0.3(x-2)] = 10(1.2)$
$3(x-2) = 12$
$3x-6 = 12$
$3x = 18$
$x = 6$
The solution set is $\{6\}$.

8. $1.5 = 0.2(c-0.3)$
$10(1.5) = 10[0.2(c-0.3)]$
$15 = 2(c-0.3)$
$15 = 2c-0.6$
$15.6 = 2c$
$7.8 = c$
The solution set is $\{7.8\}$.

9. $-4(2-3x) = 2(3x-4)+6x$
$-8+12x = 6x-8+6x$
$-8+12x = 12x-8$
$-8 = -8$ True
The solution set is $\{x|x \text{ is a real number}\}$.

10. $6(m-1)+3(2-m) = 0$
$6m-6+6-3m = 0$
$3m = 0$
$m = 0$
The solution set is $\{0\}$.

11. $6-3(2g+4)-4g = 5(1-2g)$
$6-6g-12-4g = 5-10g$
$-6-10g = 5-10g$
$-6 = 5$ False
The solution set is $\varnothing$.

12. $20-5(p+1)+3p = -(2p-15)$
$20-5p-5+3p = -2p+15$
$15-2p = -2p+15$
$15 = 15$ True
The solution set is $\{p|p \text{ is a real number}\}$.

13. $\frac{x}{3}-4 = x-2$
$3\left(\frac{x}{3}-4\right) = 3(x-2)$
$x-12 = 3x-6$
$x = 3x+6$
$-2x = 6$
$x = -3$
The solution set is $\{-3\}$.

14. $\frac{9}{4}y = \frac{2}{3}y$
$12\left(\frac{9}{4}y\right) = 12\left(\frac{2}{3}y\right)$
$27y = 8y$
$19y = 0$
$y = 0$
The solution set is $\{0\}$.

15. $\dfrac{3n}{8}-1=3+\dfrac{n}{6}$

$24\left(\dfrac{3n}{8}-1\right)=24\left(3+\dfrac{n}{6}\right)$

$24\left(\dfrac{3n}{8}\right)-24(1)=24(3)+24\left(\dfrac{n}{6}\right)$

$9n-24=72+4n$

$9n=96+4n$

$5n=96$

$n=\dfrac{96}{5}$

The solution set is $\left\{\dfrac{96}{5}\right\}$.

16. $\dfrac{z}{6}+1=\dfrac{z}{2}+2$

$6\left(\dfrac{z}{6}+1\right)=6\left(\dfrac{z}{2}+2\right)$

$6\left(\dfrac{z}{6}\right)+6(1)=6\left(\dfrac{z}{2}\right)+6(2)$

$z+6=3z+12$

$z=3z+6$

$-2z=6$

$z=-3$

The solution set is $\{-3\}$.

17. $\dfrac{y}{4}-\dfrac{y}{2}=-8$

$4\left(\dfrac{y}{4}-\dfrac{y}{2}\right)=4(-8)$

$4\left(\dfrac{y}{4}\right)-4\left(\dfrac{y}{2}\right)=-32$

$y-2y=-32$

$-y=-32$

$y=32$

The solution set is $\{32\}$.

18. $\dfrac{2x}{3}-\dfrac{8}{3}=x$

$3\left(\dfrac{2x}{3}-\dfrac{8}{3}\right)=3(x)$

$3\left(\dfrac{2x}{3}\right)-3\left(\dfrac{8}{3}\right)=3x$

$2x-8=3x$

$-8=x$

The solution set is $\{-8\}$.

19. $\dfrac{b-2}{3}=\dfrac{b+2}{5}$

$15\left(\dfrac{b-2}{3}\right)=15\left(\dfrac{b+2}{5}\right)$

$5(b-2)=3(b+2)$

$5b-10=3b+6$

$5b=3b+16$

$2b=16$

$b=8$

The solution set is $\{8\}$.

20. $\dfrac{2t-1}{3}=\dfrac{3t+2}{15}$

$15\left(\dfrac{2t-1}{3}\right)=15\left(\dfrac{3t+2}{15}\right)$

$5(2t-1)=3t+2$

$10t-5=3t+2$

$10t=3t+7$

$7t=7$

$t=1$

The solution set is $\{1\}$.

21. $\dfrac{2(t+1)}{3}=\dfrac{2(t-1)}{3}$

$3\left[\dfrac{2(t+1)}{3}\right]=3\left[\dfrac{2(t-1)}{3}\right]$

$2(t+1)=2(t-1)$

$2t+2=2t-2$

$2=-2$ False

The solution set is $\varnothing$.

22. $\dfrac{3a-3}{6}=\dfrac{4a+1}{15}+2$

$30\left(\dfrac{3a-3}{6}\right)=30\left(\dfrac{4a+1}{15}+2\right)$

$5(3a-3)=30\left(\dfrac{4a+1}{15}\right)+30(2)$

$15a-15=2(4a+1)+60$

$15a-15=8a+2+60$

$15a-15=8a+62$

$15a=8a+77$

$7a=77$

$a=11$

The solution set is $\{11\}$.

23. Let x be the number.

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

The number is –7.

24. Let x be the first number and $x + 5$ be the second number.

$$\begin{aligned} x+(x+5) &= 285 \\ 2x+5 &= 285 \\ 2x &= 280 \\ x &= 140 \end{aligned}$$

$x + 5 = (140) + 5 = 145$

The two numbers are 140 and 145.

25. 40% of 130 = 40% · 130 = 0.40 · 130 = 52

26. 1.5% of 8 = 1.5% · 8 = 0.015 · 8 = 0.12

27. Let x be the median earnings of young adults with associate degrees in 2012.

$$\begin{aligned} x+0.26x &= 44,800 \\ 1.26x &= 44,800 \\ x &\approx 35,556 \end{aligned}$$

The median earnings of young adults with associate degrees in 2012 was $35,556.

28. Four consecutive integers are x, $x + 1$, $x + 2$, and $x + 3$.

$$\begin{aligned} (x+1)+(x+2)+(x+3)-2x &= 16 \\ 3x+6-2x &= 16 \\ x+6 &= 16 \\ x &= 10 \end{aligned}$$

$x + 1 = (10) + 1 = 11$
$x + 2 = (10) + 2 = 12$
$x + 3 = (10) + 3 = 13$

The integers are 10, 11, 12, and 13.

29. Let x be the first odd integer and $x + 2$ is the next consecutive odd integer.

$$\begin{aligned} 5(x) &= 3(x+2)+54 \\ 5x &= 3x+6+54 \\ 5x &= 3x+60 \\ 2x &= 60 \\ x &= 30 \end{aligned}$$

Since x is not odd, no such integers exist.

30. Let x be the width of a playing field and $2x - 5$ is the length of this field.

$$\begin{aligned} x+(2x-5)+x+(2x-5) &= 230 \\ 6x-10 &= 230 \\ 6x &= 240 \\ x &= 40 \end{aligned}$$

$2x – 5 = 2(40) – 5 = 80 – 5 = 75$

The playing field has a width of 40 m and a length of 75 m.

31. Let x be the number of miles driven per day. Then $0.12(x – 100)$ represents the cost of driving more than 100 miles per day.

$$\begin{aligned} 2[19.95+0.12(x-100)] &= 46.86 \\ 2(19.95)+2[0.12(x-100)] &= 46.86 \\ 39.90+0.24(x-100) &= 46.86 \\ 39.90+0.24x-24 &= 46.86 \\ 15.90+0.24x &= 46.86 \\ 0.24x &= 30.96 \\ x &= 129 \end{aligned}$$

Therefore in two days, Mr. Woo drives 258 miles.

32. Recall that

$$\begin{aligned} R &= C \\ 16.5x &= 4.5x+3000 \\ 12.0x &= 3000 \\ x &= 250 \end{aligned}$$

250 calculators need to be sold to break even.

33.

$$\begin{aligned} V &= LWH \\ \frac{V}{LH} &= \frac{LWH}{LH} \\ \frac{V}{LH} &= W \end{aligned}$$

34.

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

35.

$$\begin{aligned} 5x-4y &= -12 \\ -4y &= -5x-12 \\ 4y &= 5x+12 \\ y &= \frac{5x+12}{4} \end{aligned}$$

36.

$$\begin{aligned} 5x-4y &= -12 \\ 5x &= 4y-12 \\ x &= \frac{4y-12}{5} \end{aligned}$$

37. $y - y_1 = m(x - x_1)$

$$\frac{y - y_1}{x - x_1} = \frac{m(x - x_1)}{x - x_1}$$

$$\frac{y - y_1}{x - x_1} = m$$

38. $y - y_1 = m(x - x_1)$

$y - y_1 = mx - mx_1$

$y - y_1 + mx_1 = mx$

$$\frac{y - y_1 + mx_1}{m} = \frac{mx}{m}$$

$$\frac{y - y_1 + mx_1}{m} = x$$

39. $E = I(R + r)$

$E = IR + Ir$

$E - IR = Ir$

$$\frac{E - IR}{I} = \frac{Ir}{I}$$

$$\frac{E - IR}{I} = r$$

40. $S = vt + gt^2$

$S - vt = gt^2$

$$\frac{S - vt}{t^2} = \frac{gt^2}{t^2}$$

$$\frac{S - vt}{t^2} = g$$

41. $T = gr + gvt$

$T = g(r + vt)$

$$\frac{T}{r + vt} = \frac{g(r + vt)}{r + vt}$$

$$\frac{T}{r + vt} = g$$

42. $I = Prt + P$

$I = P(rt + 1)$

$$\frac{I}{rt + 1} = \frac{P(rt + 1)}{rt + 1}$$

$$\frac{I}{rt + 1} = P$$

43. Use $A = P\left(1 + \frac{r}{n}\right)^{nt}$ with $P = 3000$, $r = 3\% = 0.03$, and $t = 7$.

a. $n = 2$: $A = 3000\left(1 + \frac{0.03}{2}\right)^{2 \cdot 7}$

$A = 3000(1.015)^{14}$

$A \approx \$3695.27$

b. $n = 52$: $A = 3000\left(1 + \frac{0.03}{52}\right)^{52 \cdot 7}$

$A \approx \$3700.81$

44. Recall that $C = \frac{5}{9}(F - 32)$. Replace F with 90.

$C = \frac{5}{9}(90 - 32)$

$C = \frac{5}{9}(58)$

$C = 32.\overline{2}$

$90°\text{F} = 32\frac{2}{9}°\text{C}$

45. Let x be the original width of the photograph and $x + 2$ be the original length of the photograph. Then $x + 4$ and $x + 6$ are the new dimensions of width and length, respectively.

$(x + 4)(x + 6) = x(x + 2) + 88$

$x^2 + 6x + 4x + 24 = x^2 + 2x + 88$

$x^2 + 10x + 24 = x^2 + 2x + 88$

$10x + 24 = 2x + 88$

$10x = 2x + 64$

$8x = 64$

$x = 8$

$x + 2 = (8) + 2 = 10$

The original width was 8 in. and original length was 10 in.

46. $A = l \cdot w$

$A = 18 \cdot 21$

$A = 378$ sq ft

$$\text{Packages} = \frac{378}{24} = 15.75$$

Buy 16 packages of tiles.

47. $3(x-5) > -(x+3)$
$3x-15 > -x-3$
$3x > -x+12$
$4x > 12$
$x > 3$
The solution set is (3, ∞).

48. $-2(x+7) \geq 3(x+2)$
$-2x-14 \geq 3x+6$
$-2x \geq 3x+20$
$-5x \geq 20$
$x \leq -4$
The solution set is (−∞, −4].

49. $4x-(5+2x) < 3x-1$
$4x-5-2x < 3x-1$
$2x-5 < 3x-1$
$2x < 3x+4$
$-x < 4$
$x > -4$
The solution set is (−4, ∞).

50. $3(x-8) < 7x+2(5-x)$
$3x-24 < 7x+10-2x$
$3x-24 < 5x+10$
$3x < 5x+34$
$-2x < 34$
$x > -17$
The solution set is (−17, ∞).

51. $24 \geq 6x-2(3x-5)+2x$
$24 \geq 6x-6x+10+2x$
$24 \geq 10+2x$
$14 \geq 2x$
$7 \geq x$
$x \leq 7$
The solution set is (−∞, 7].

52. $\frac{x}{3}+\frac{1}{2} > \frac{2}{3}$
$6\left(\frac{x}{3}+\frac{1}{2}\right) > 6\left(\frac{2}{3}\right)$
$2x+3 > 4$
$2x > 1$
$x > \frac{1}{2}$
The solution set is $\left(\frac{1}{2}, \infty\right)$.

53. $x+\frac{3}{4} < -\frac{x}{2}+\frac{9}{4}$
$4\left(x+\frac{3}{4}\right) < 4\left(-\frac{x}{2}+\frac{9}{4}\right)$
$4(x)+4\left(\frac{3}{4}\right) < 4\left(-\frac{x}{2}\right)+4\left(\frac{9}{4}\right)$
$4x+3 < -2x+9$
$4x < -2x+6$
$6x < 6$
$x < 1$
The solution set is (−∞, 1).

54. $\frac{x-5}{2} \leq \frac{3}{8}(2x+6)$
$8\left(\frac{x-5}{2}\right) \leq 8\left[\frac{3}{8}(2x+6)\right]$
$4(x-5) \leq 3(2x+6)$
$4x-20 \leq 6x+18$
$4x \leq 6x+38$
$-2x \leq 38$
$x \geq -19$
The solution set is [−19, ∞).

55. Let x be the number of pounds of laundry. The cost to do it at the laundromat is $0.5(10) + 0.4(x - 10)$. It is more economical to use the housekeeper when the cost at the laundromat exceeds \$15.
$0.5(10)+0.4(x-10) > 15$
$5+0.4x-4 > 15$
$0.4x+1 > 15$
$0.4x > 14$
$x > 35$
It is more economical to use the housekeeper for more than 35 pounds of laundry per week.

56. Let x be the score from the eighth judge.
$\frac{9.5+9.7+9.9+9.7+9.7+9.6+9.5+x}{8} \geq 9.65$
$\frac{67.6+x}{8} \geq 9.65$
$8\left(\frac{67.6+x}{8}\right) \geq 8(9.65)$
$67.6+x \geq 77.2$
$x \geq 9.6$
To win the silver medal, Nana must score at least 9.6 points from the judge.

57. $1 \le 4x - 7 \le 3$
$8 \le 4x \le 10$
$2 \le x \le \frac{10}{4}$
$2 \le x \le \frac{5}{2}$
The solution set is $\left[2, \frac{5}{2}\right]$.

58. $-2 \le 8 + 5x < -1$
$-10 \le 5x < -9$
$-2 \le x < -\frac{9}{5}$
The solution set is $\left[-2, -\frac{9}{5}\right)$.

59. $-3 < 4(2x - 1) < 12$
$-3 < 8x - 4 < 12$
$1 < 8x < 16$
$\frac{1}{8} < x < 2$
The solution set $\left(\frac{1}{8}, 2\right)$.

60. $-6 < x - (3 - 4x) < -3$
$-6 < x - 3 + 4x < -3$
$-6 < 5x - 3 < -3$
$-3 < 5x < 0$
$-\frac{3}{5} < x < 0$
The solution set is $\left(-\frac{3}{5}, 0\right)$.

61. $\frac{1}{6} < \frac{4x - 3}{3} \le \frac{4}{5}$
$\frac{1}{2} < 4x - 3 \le \frac{12}{5}$
$\frac{1}{2} + 3 < 4x \le \frac{12}{5} + 3$
$\frac{7}{2} < 4x \le \frac{27}{5}$
$\frac{7}{8} < x \le \frac{27}{20}$
The solution set is $\left(\frac{7}{8}, \frac{27}{20}\right]$.

62. $x \le 2$ *and* $x > -5$
The solution set is $(-\infty, 2] \cap (-5, \infty) = (-5, 2]$.

63. $3x - 5 > 6$ *or* $-x < -5$
$3x > 11$ *or* $x > 5$
$x > \frac{11}{3}$ *or* $x > 5$
The solution set is $\left(\frac{11}{3}, \infty\right)$.

64. $-2x \ge 4$ *or* $2x \ge 4$
$\frac{-2x}{-2} \le \frac{4}{-2}$ *or* $\frac{2x}{2} \ge \frac{4}{2}$
$x \le -2$ *or* $x \ge 2$
The solution set is $(-\infty, -2] \cup [2, \infty)$.

65. $500 \le F \le 1000$
$500 \le \frac{9}{5}C + 32 \le 1000$
$468 \le \frac{9}{5}C \le 968$
$2340 \le 9C \le 4840$
$260 \le C \le 537\frac{7}{9}$
$260° \le C \le 538°$

66. Let x be the amount of money she must save each summer.
$4000 \le 500 + 2x \le 8000$
$3500 \le 2x \le 7500$
$1750 \le x \le 3750$
Carol must earn between \$1750 and \$3750 each of the next two summers to buy the car.

67. $|2x + 9| = 9$
$2x + 9 = 9$ or $2x + 9 = -9$
$2x = 0$ or $2x = -18$
$x = 0$ or $x = -9$
The solution set is $\{0, -9\}$.

68. $|-3x + 4| = 7$
$-3x + 4 = 7$ or $-3x + 4 = -7$
$-3x = 3$ or $-3x = -11$
$x = -1$ or $x = \frac{11}{3}$
The solution set is $\left\{-1, \frac{11}{3}\right\}$.

69. $|3x-2|+6=10$

$|3x-2|=4$

$3x-2=4$ or $3x-2=-4$

$3x=6$ or $3x=-2$

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

The solution set is $\left\{2, -\frac{2}{3}\right\}$.

70. $5+|6x+1|=5$

$|6x+1|=0$

$6x+1=0$

$6x=-1$

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

The solution set is $\left\{-\frac{1}{6}\right\}$.

71. $-5=|4x-3|$

The absolute value of a number is always nonnegative. Therefore it can never equal –5. The solution set is $\varnothing$.

72. $|5-6x|+8=3$

$|5-6x|=-5$

The absolute value of a number is always nonnegative. Therefore it can never equal –5. The solution set is $\varnothing$.

73. $\left|\frac{3x-7}{4}\right|=2$

$\frac{3x-7}{4}=2$ or $\frac{3x-7}{4}=-2$

$3x-7=8$ or $3x-7=-8$

$3x=15$ or $3x=-1$

$x=5$ or $x=-\frac{1}{3}$

The solution set is $\left\{-\frac{1}{3}, 5\right\}$.

74. $\left|\frac{2x-5}{3}\right|=1$

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

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

$2x=8$ or $2x=2$

$x=4$ or $x=1$

The solution set is $\{1, 4\}$.

75. $|6x+1|=|15+4x|$

$6x+1=15+4x$ or $6x+1=-(15+4x)$

$6x=14+4x$ or $6x+1=-15-4x$

$2x=14$ or $6x=-16-4x$

$x=7$ or $10x=-16$

$x=7$ or $x=-\frac{16}{10}=-\frac{8}{5}$

The solution set is $\left\{7, -\frac{8}{5}\right\}$.

76. $|3x-7|=|5x-7|$

$3x-7=5x-7$ or $3x-7=-(5x-7)$

$3x=5x+0$ or $3x-7=-5x+7$

$3x=5x$ or $3x=-5x+14$

$0=2x$ or $8x=14$

$0=x$ or $x=\frac{14}{8}=\frac{7}{4}$

The solution set is $\left\{0, \frac{7}{4}\right\}$.

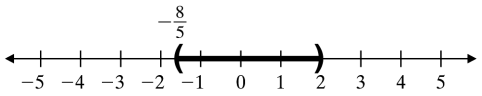
77. $|5x-1|<9$

$-9<5x-1<9$

$-8<5x<10$

$-\frac{8}{5}<x<2$

The solution set is $\left(-\frac{8}{5}, 2\right)$.



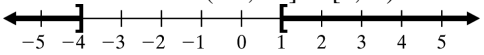
78. $|6+4x|\geq 10$

$6+4x\leq -10$ or $6+4x\geq 10$

$4x\leq -16$ or $4x\geq 4$

$x\leq -4$ or $x\geq 1$

The solution set is $(-\infty, -4]\cup[1, \infty)$.



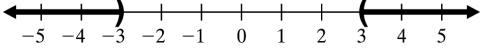
79. $|3x|-8>1$

$|3x|>9$

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

$x<-3$ or $x>3$

The solution set is $(-\infty, -3)\cup(3, \infty)$.



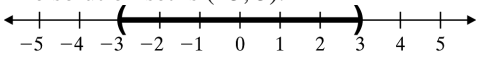
80. $9+|5x|<24$

$|5x|<15$

$-15<5x<15$

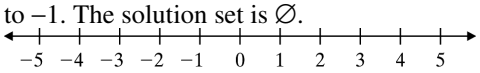
$-3<x<3$

The solution set is (–3, 3).



81. $|6x-5|\le -1$

The absolute value of a number is never negative. Thus it will never be less than or equal to –1. The solution set is ∅.



82. $\left|3x+\frac{2}{5}\right|\ge 4$

$3x+\frac{2}{5}\ge 4$ or $3x+\frac{2}{5}\le -4$

$5\left(3x+\frac{2}{5}\right)\ge 5(4)$ or $5\left(3x+\frac{2}{5}\right)\le 5(-4)$

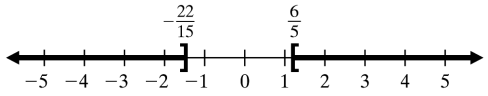
$15x+2\ge 20$ or $15x+2\le -20$

$15x\ge 18$ or $15x\le -22$

$x\ge \frac{18}{15}$ or $x\le -\frac{22}{15}$

$x\ge \frac{6}{5}$ or $x\le -\frac{22}{15}$

The solution set is $\left(-\infty, -\frac{22}{5}\right]\cup\left[\frac{6}{5}, \infty\right)$.



83. $\left|\frac{x}{3}+6\right|-8>-5$

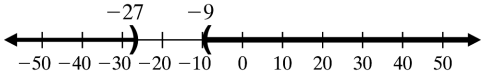
$\left|\frac{x}{3}+6\right|>3$

$\frac{x}{3}+6<-3$ or $\frac{x}{3}+6>3$

$\frac{x}{3}<-9$ or $\frac{x}{3}>-3$

$x<-27$ or $x>-9$

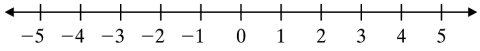
The solution set is $(-\infty, -27)\cup(-9, \infty)$.



84. $\left|\frac{4(x-1)}{7}\right|+10<2$

$\left|\frac{4(x-1)}{7}\right|<-8$

The absolute value of a number is never negative. Thus it will never be less than –8. The solution set is ∅.



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

$30\left(\frac{x-2}{5}+\frac{x+2}{2}\right)=30\left(\frac{x+4}{3}\right)$

$30\left(\frac{x-2}{5}\right)+30\left(\frac{x+2}{2}\right)=10(x+4)$

$6(x-2)+15(x+2)=10x+40$

$6x-12+15x+30=10x+40$

$21x+18=10x+40$

$21x=10x+22$

$11x=22$

$x=2$

The solution set is {2}.

86. $\frac{2z-3}{4}-\frac{4-z}{2}=\frac{z+1}{3}$

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

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

$3(2z-3)-6(4-z)=4z+4$

$6z-9-24+6z=4z+4$

$12z-33=4z+4$

$12z=4z+37$

$8z=37$

$z=\frac{37}{8}$

The solution set is $\left\{\frac{37}{8}\right\}$.

87. Let x be the number of tourists in France. Then $x + 9$ is the number of tourists in the United States, and $x + 44$ is the number of tourists in China.

$$x + (x+9) + (x+44) = 332$$
$$3x + 53 = 332$$
$$3x = 279$$
$$x = 93$$

$x + 9 = (93) + 9 = 102$
$x + 44 = (93) + 44 = 137$
In 2020, France will have 93 million tourists, the United States will have 102 million tourists, and China will have 137 million tourists.

88.
$$A = \frac{h}{2}(B+b)$$
$$2A = h(B+b)$$
$$2A = hB + hb$$
$$2A - hb = hB$$
$$\frac{2A - hb}{h} = B$$

89.
$$V = \frac{1}{3}\pi r^2 h$$
$$3V = \pi r^2 h$$
$$\frac{3V}{\pi r^2} = h$$

90. Volume of Box $= l \cdot w \cdot h$
$= 8 \cdot 5 \cdot 3$
$= 120$ cubic inches

Volume of cylinder $= \pi r^2 h$
$= \pi \cdot 3^2 \cdot 6$
$= 54\pi$
≈ 169.65 cubic inches
The cylinder is larger and holds more ice cream.

91.
$$D = r \cdot t$$
$$130 = r \cdot 2.25$$
$$57.\overline{7} = r$$
His average speed was 58 mph.

92.
$$48 + x \geq 5(2x+4) - 2x$$
$$48 + x \geq 10x + 20 - 2x$$
$$48 + x \geq 8x + 20$$
$$x \geq 8x - 28$$
$$-7x \geq -28$$
$$x \leq 4$$
The solution set is $(-\infty, 4]$.

93.
$$\frac{3(x-2)}{5} > -\frac{5(x-2)}{3}$$
$$15\left[\frac{3(x-2)}{5}\right] > 15\left[-\frac{5(x-2)}{3}\right]$$
$$9(x-2) > -25(x-2)$$
$$9x - 18 > -25x + 50$$
$$9x > -25x + 68$$
$$34x > 68$$
$$x > 2$$
The solution set is $(2, \infty)$.

94.
$$0 \leq \frac{2(3x+4)}{5} \leq 3$$
$$0 \leq 2(3x+4) \leq 15$$
$$0 \leq 6x + 8 \leq 15$$
$$-8 \leq 6x \leq 7$$
$$-\frac{8}{6} \leq x \leq \frac{7}{6}$$
$$-\frac{4}{3} \leq x \leq \frac{7}{6}$$
The solution set is $\left[-\frac{4}{3}, \frac{7}{6}\right]$.

95. $x \leq 2$ *or* $x > -5$
The solution set is $(-\infty, 2] \cup (-5, \infty) = (-\infty, \infty)$.

96.
$$-2x \leq 6 \quad \textit{and} \quad -2x + 3 < -7$$
$$x \geq -3 \quad \textit{and} \quad -2x < -10$$
$$x \geq -3 \quad \textit{and} \quad x > 5$$
The solution set is $[-3, \infty) \cap (5, \infty) = (5, \infty)$.

97.
$$|7x| - 26 = -5$$
$$|7x| = 21$$
$$7x = 21 \quad \text{or} \quad 7x = -21$$
$$x = 3 \quad \text{or} \quad x = -3$$
The solution set is $\{-3, 3\}$.

98.
$$\left|\frac{9 - 2x}{5}\right| = -3$$
The absolute value of a number is never negative. Thus it will never be equal to -3. The solution set is $\varnothing$.

99. $|x-3| = |7+2x|$

$x-3 = 7+2x$ or $x-3 = -(7+2x)$

$x = 10+2x$ or $x-3 = -7-2x$

$-x = 10$ or $x = -4-2x$

$x = -10$ or $3x = -4$

$x = -10$ or $x = -\frac{4}{3}$

The solution set is $\left\{-10, -\frac{4}{3}\right\}$.

100. $|6x-5| \geq -1$

The absolute value of a number is always nonnegative. Thus it will always be greater than -1. The solution set is all real numbers or $(-\infty, \infty)$.

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

$-1 < \frac{4x-3}{5} < 1$

$-5 < 4x-3 < 5$

$-2 < 4x < 8$

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

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

The solution set is $\left(-\frac{1}{2}, 2\right)$.

Chapter 2 Test

1. $8x+14 = 5x+44$

$8x+14-5x = 5x+44-5x$

$3x+14 = 44$

$3x+14-14 = 44-14$

$3x = 30$

$\frac{3x}{3} = \frac{30}{3}$

$x = 10$

The solution set is $\{10\}$.

2. $9(x+2) = 5[11-2(2-x)+3]$

$9x+18 = 5[11-4+2x+3]$

$9x+18 = 5[2x+10]$

$9x+18 = 10x+50$

$9x = 10x+32$

$-x = 32$

$x = -32$

The solution set is $\{-32\}$.

3. $3(y-4)+y = 2(6+2y)$

$3y-12+y = 12+4y$

$4y-12 = 12+4y$

$-12 = 12$ False

The solution set is $\varnothing$.

4. $7n-6+n = 2(4n-3)$

$8n-6 = 8n-6$

$-6 = -6$ True

The solution set is $\{n|n \text{ is a real number}\}$.

5. $\frac{7w}{4}+5 = \frac{3w}{10}+1$

$20\left(\frac{7w}{4}+5\right) = 20\left(\frac{3w}{10}+1\right)$

$20\left(\frac{7w}{4}\right)+20(5) = 20\left(\frac{3w}{10}\right)+20(1)$

$35w+100 = 6w+20$

$35w+100-6w = 6w+20-6w$

$29w+100 = 20$

$29w+100-100 = 20-100$

$29w = -80$

$\frac{29w}{29} = \frac{-80}{29}$

$w = -\frac{80}{29}$

The solution set is $\left\{-\frac{80}{29}\right\}$.

6. $\frac{z+7}{9}+1 = \frac{2z+1}{6}$

$18\left(\frac{z+7}{9}+1\right) = 18\left(\frac{2z+1}{6}\right)$

$18\left(\frac{z+7}{9}\right)+18(1) = 3(2z+1)$

$2(z+7)+18 = 6z+3$

$2z+14+18 = 6z+3$

$2z+32 = 6z+3$

$2z = 6z-29$

$-4z = -29$

$z = \frac{29}{4}$

The solution set is $\left\{\frac{29}{4}\right\}$.

7. $|6x-5|-3=-2$

$|6x-5|=1$

$6x-5=1$ or $6x-5=-1$

$6x=6$ or $6x=4$

$x=1$ or $x=\frac{4}{6}=\frac{2}{3}$

The solution set is $\left\{1, \frac{2}{3}\right\}$.

8. $|8-2t|=-6$

Since the absolute value is never negative, the solution set is $\varnothing$.

9. $|2x-3|=|4x+5|$

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

$2x-3=4x+5$ or $2x-3=-4x-5$

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

$-2x=8$ or $6x=-2$

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

The solution set is $\left\{-4, -\frac{1}{3}\right\}$.

10. $|x-5|=|x+2|$

$x-5=x+2$ or $x-5=-(x+2)$

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

False or $x=-x+3$

False or $2x=3$

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

The solution set is $\left\{\frac{3}{2}\right\}$.

11. $3x-4y=8$

$-4y=-3x+8$

$4y=3x-8$

$y=\frac{3x-8}{4}$

12. $S=gt^2+gvt$

$S=g(t^2+vt)$

$\frac{S}{t^2+vt}=g$

13. $F=\frac{9}{5}C+32$

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

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

14. $3(2x-7)-4x>-(x+6)$

$6x-21-4x>-x-6$

$2x-21>-x-6$

$2x>-x+15$

$3x>15$

$x>5$

The solution set is $(5, \infty)$.

15. $\frac{3x-2}{3}-\frac{5x+1}{4}\geq 0$

$12\left(\frac{3x-2}{3}-\frac{5x+1}{4}\right)\geq 12(0)$

$12\left(\frac{3x-2}{3}\right)-12\left(\frac{5x+1}{4}\right)\geq 0$

$4(3x-2)-3(5x+1)\geq 0$

$12x-8-15x-3\geq 0$

$-3x-11\geq 0$

$-3x\geq 11$

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

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

16. $-3<2(x-3)\leq 4$

$-3<2x-6\leq 4$

$3<2x\leq 10$

$\frac{3}{2}<x\leq 5$

The solution set is $\left(\frac{3}{2}, 5\right]$.

17. $|3x+1|>5$

$3x+1<-5$ or $3x+1>5$

$3x<-6$ or $3x>4$

$x<-2$ or $x>\frac{4}{3}$

The solution set is $(-\infty, -2)\cup\left(\frac{4}{3}, \infty\right)$.

18. $|x-5|-4<-2$
$|x-5|<2$
$-2<x-5<2$
$3<x<7$
The solution set is (3, 7).

19. $x \ge 5$ *and* $x \ge 4$
The solution set is $[5, \infty) \cap [4, \infty) = [5, \infty)$.

20. $x \ge 5$ *or* $x \ge 4$
The solution set is $[5, \infty) \cup [4, \infty) = [4, \infty)$.

21. $-1 \le \dfrac{2x-5}{3} < 2$
$3(-1) \le 3\left(\dfrac{2x-5}{3}\right) < 3(2)$
$-3 \le 2x-5 < 6$
$-3+5 \le 2x < 6+5$
$2 \le 2x < 11$
$\dfrac{2}{2} \le \dfrac{2x}{2} < \dfrac{11}{2}$
$1 \le x < \dfrac{11}{2}$
The solution set is $\left[1, \dfrac{11}{2}\right)$.

22. $6x+1>5x+4$ *or* $1-x>-4$
$6x>5x+3$ *or* $-x>-5$
$x>3$ *or* $x<5$
The solution set is $(3, \infty) \cup (-\infty, 5) = (-\infty, \infty)$.

23. 12% of 80 = 0.12 · 80 = 9.6

24. Let x be the number of new vehicles sold by Ford in 2011. The number of new vehicles sold by Ford in 2012 is x increased by 12.12%.
$x+0.1212x = 5,668,000$
$1.1212x = 5,668,000$
$x \approx 5,055,000$
Ford sold 5,055,000 new vehicles in 2011.

25. Recall that $C = 2\pi r$. Here $C = 78.5$.
$78.5 = 2\pi r$
$r = \dfrac{78.5}{2\pi} = \dfrac{39.25}{\pi}$
Also recall that $A = \pi r^2$.
$A = \pi\left(\dfrac{39.25}{\pi}\right)^2 = \dfrac{39.25^2}{\pi} \approx \dfrac{39.25^2}{3.14} \approx 491$
The area of the pen is about 491 square feet. Each dog requires at least 60 square feet of space, and $\dfrac{491}{60} \approx 8.18$. At most 8 dogs could be kept in the pen.

26. Let x be the number of people employed as interpreters or translators in 2010. The number of people expected to be employed in these fields in 2020 is x increased by 42%.
$x+0.42x = 83,000$
$1.42x = 83,000$
$x \approx 58,000$
There were 58,000 people employed as interpreters or translators in 2010.

27. Use $A = P\left(1+\dfrac{r}{n}\right)^{nt}$ where $P = 2500$, $r = 3.5\% = 0.035$, $t = 10$, and $n = 4$.
$A = 2500\left(1+\dfrac{0.035}{4}\right)^{4\cdot 10}$
$A = 2500(1.00875)^{40}$
$A \approx \$3542.27$

28. Let x be the amount of money international travelers spent in New York. Then $x + 4$ is the amount of money international travelers spent in California and $2x - 1$ is the amount of money international travelers spent in Florida.
$x+(x+4)+(2x-1) = 39$
$4x+3 = 39$
$4x = 36$
$x = 9$
$x + 4 = (9) + 4 = 13$
$2x - 1 = 2(9) - 1 = 18 - 1 = 17$
International travelers spent \$9 billion in New York, \$13 billion in California, and \$17 billion in Florida.

Cumulative Review Chapters 1–2

1. $\{x|x$ is a natural number greater than 100$\}$
$= \{101, 102, 103, ...\}$

2. a. $\{x|x$ is an integer between −3 and 5$\}$
$= \{-2, -1, 0, 1, 2, 3, 4\}$

b. $\{x|x$ is a whole number between 3 and 5$\}$
$= \{4\}$

3. The sum of x and 5 is 20 is written as $x + 5 = 20$.

4. If 19 is subtracted from x, the difference is the product of 4 and x is written as $x - 19 = 4x$.

5. The quotient of z and 9 amounts to 9 plus z is written as $\frac{z}{9} = 9 + z$.

6. a. Because -3 is to the right of -5, $-3 > -5$.

b. Because $\frac{-12}{-4} = 3$, $3 = 3$.

c. Because 0 is to the right of -2, $0 > -2$.

7. The opposite of 8 is -8.

8. The opposite of 0 is 0.

9. The opposite of $-\frac{1}{5}$ is $\frac{1}{5}$.

10. The opposite of -7.3 is 7.3.

11. $-3 + (-11) = -14$

12. $-20.2 + 7.8 = -12.4$

13. $-10 + 15 = 5$

14. $-\frac{1}{2} + \frac{7}{2} = \frac{-1+7}{2} = \frac{6}{2} = 3$

15. $-\frac{2}{3} + \frac{3}{7}$

$-\frac{2}{3} \cdot \frac{7}{7} + \frac{3}{7} \cdot \frac{3}{3}$

$-\frac{14}{21} + \frac{9}{21} = \frac{-14+9}{21} = -\frac{5}{21}$

16. $1.7 - 8.9 = 1.7 + (-8.9) = -7.2$

17. $\frac{20}{-4} = -5$

18. $\frac{30}{0}$ = undefined

19. $\frac{0}{-8} = 0$

20. $-\frac{3}{4} \div \frac{9}{4} = -\frac{3}{4} \cdot \frac{4}{9} = -\frac{3}{9} = -\frac{1}{3}$

21. $\frac{-10}{-80} = \frac{1}{8}$

22. $-\frac{3}{4}\left(-\frac{4}{7}\right) = \frac{3}{7}$

23. $3 + 2 \cdot 30 = 3 + 60 = 63$

24. $\frac{\sqrt{9+40} - 2^2}{20 \div 2 \cdot 2} = \frac{\sqrt{49} - 4}{10 \cdot 2} = \frac{7-4}{20} = \frac{3}{20}$

25. $3x - 5x + 4 = -2x + 4$

26. $-3(4 + y) + \frac{1}{3}(6 - 12y) = -12 - 3y + 2 - 4y$

$= -7y - 10$

27. $y + 3y = 4y$

28. $6 + 2(7x - 1) + 4 = 6 + 14x - 2 + 4 = 14x + 8$

29. $\frac{x^7}{x^4} = x^{7-4} = x^3$

30. $\frac{a^{-2} \cdot b^{-8}}{b^{-7}} = a^{-2} \cdot b^{-8-(-7)}$

$= a^{-2} \cdot b^{-8+7}$

$= a^{-2} \cdot b^{-1}$

$= \frac{1}{a^2 b}$

31. $\frac{20x^6}{4x^5} = 5x^{6-5} = 5x$

32. $\frac{(-3)^9 z^7 \cdot z^2}{(-3)^{11} z^{-11}} = \frac{(-3)^9 z^9}{(-3)^{11} z^{-11}}$

$= (-3)^{9-11} z^{9-(-11)}$

$= (-3)^{-2} z^{9+11}$

$= (-3)^{-2} z^{20}$

$= \frac{z^{20}}{(-3)^2}$

$= \frac{z^{20}}{9}$

33. $\left(\dfrac{3x^2y}{y^{-9}z}\right)^{-2} = \left(\dfrac{3x^2y^{10}}{z}\right)^{-2}$
$= \dfrac{3^{-2}x^{-4}y^{-20}}{z^{-2}}$
$= \dfrac{z^2}{3^2x^4y^{20}}$
$= \dfrac{z^2}{9x^4y^{20}}$

34. $(-4a^{-3}b^{-4})(3a^{-2}b)^2 = (-4a^{-3}b^{-4})(3^2a^{-4}b^2)$
$= (-4)(3^2)\cdot a^{-3}a^{-4}b^{-4}b^2$
$= (-4)(9)a^{-7}b^{-2}$
$= \dfrac{-36}{a^7b^2}$

35. $\left(\dfrac{3a^2}{2x^{-1}}\right)^3\left(\dfrac{x^{-3}}{4a^{-2}}\right)^{-1} = \left(\dfrac{3^3a^6}{2^3x^{-3}}\right)\left(\dfrac{x^3}{4^{-1}a^2}\right)$
$= \dfrac{27a^6x^3}{8(4^{-1})a^2x^{-3}}$
$= \dfrac{4\cdot 27a^4x^6}{8}$
$= \dfrac{27a^4x^6}{2}$

36. $11.2 = 1.2 - 5x$
$10 = -5x$
$-2 = x$
The solution set is $\{-2\}$.

37. $2x + 5 = 9$
$2x = 4$
$x = 2$
The solution set is $\{2\}$.

38. $2x + 1.5 = -0.2 + 1.6x$
$10(2x + 1.5) = 10(-0.2 + 1.6x)$
$20x + 15 = -2 + 16x$
$20x = -17 + 16x$
$4x = -17$
$x = -4.25$
The solution set is $\{-4.25\}$.

39. $6x - 4 = 2 + 6(x - 1)$
$6x - 4 = 2 + 6x - 6$
$6x - 4 = 6x - 4$
$-4 = -4$ True
The solution set is $\{x | x \text{ is a real number}\}$.

40. a. The sum of three consecutive integers if x is the first consecutive integer is written as $x + (x + 1) + (x + 2) = 3x + 3$.

b. The perimeter of a square with side length $3x + 1$ is written as $4(3x + 1) = 12x + 4$.

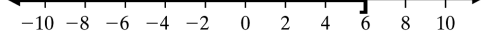
41. Let x be the original price of a particular computer model. The selling price is x decreased by 8%.
$x - 0.08x = 2162$
$0.92x = 2162$
$x = 2350$
The original price was \$2350.

42. Let x be the first number and $3x + 2$ be the second number.
$(3x + 2) - x = 24$
$2x + 2 = 24$
$2x = 22$
$x = 11$
$3x + 2 = 3(11) + 2 = 33 + 2 = 35$
The two numbers are 11 and 35.

43. $V = lwh$
$\dfrac{V}{lw} = \dfrac{lwh}{lw}$
$\dfrac{V}{lw} = h$

44. $7x - 4y = 10$
$7x = 4y + 10$
$x = \dfrac{4y + 10}{7}$

45. $\dfrac{1}{4}x \le \dfrac{3}{2}$
$4\left(\dfrac{1}{4}x\right) \le 4\left(\dfrac{3}{2}\right)$
$x \le 6$
The solution set is $(-\infty, 6]$.



46. $2(7x-1)-5x > -(-7x)+4$
$14x-2-5x > 7x+4$
$9x-2 > 7x+4$
$9x > 7x+6$
$2x > 6$
$x > 3$
The solution set is $(3, \infty)$.

47. $-2x-5 < -3 \quad or \quad 6x < 0$
$-2x < 2 \quad or \quad x < 0$
$x > -1 \quad or \quad x < 0$
The solution set is $(-1, \infty) \cup (-\infty, 0) = (-\infty, \infty)$.

48. $4(x+1)-3 < 4x+1$
$4x+4-3 < 4x+1$
$4x+1 < 4x+1$
$1 < 1$ False
The solution set is $\varnothing$.

49. $|p| = 2$
$p = 2$ or $p = -2$
The solution set is $\{-2, 2\}$.

50. $|x+3| = |7-x|$
$x+3 = 7-x$ or $x+3 = -(7-x)$
$x = 4-x$ or $x+3 = -7+x$
$2x = 4$ or $3 = -7$
$x = 2$ or False
The solution set is $\{2\}$.