Chapter 5

Lesson 5.1

1. The formula for an equation in slope-intercept form is $y = mx + b$, where m = slope and b = the y-intercept.

2. **Step 1:** Begin by writing the formula for slope-intercept form $y = mx + b$.
   Step 2: Substitute the given slope for m.
   Step 3: Use the ordered pair you are given (x, y), substitute these values for the variables x and y in the equation.
   Step 4: Solve for b (the y–intercept of the graph).
   Step 5: Rewrite the original equation in step 1, substituting the slope for m and the y–intercept for b.

3. You will need to find the slope of the line first.

4. $m = 7$ and y-intercept = –2, so the equation is $y = 7x - 2$

5. $m = -5$ and y-intercept = 6, so the equation is $y = -5x + 6$

6. $m = -2$ and y-intercept = 7, so the equation is $y = -2x + 7$

7. $m = \frac{2}{3}$ and y-intercept = $\frac{4}{5}$, so the equation is $y = -\frac{1}{4}x + \frac{4}{5}$

8. $m = -\frac{1}{4}$ and contains (4, –1)

   Then $-1 = -\frac{1}{4}(4) + b$

   $-1 = -1 + b$
   $b = 0$

   So $y = -\frac{1}{4}$ + 0 or $y = -\frac{1}{4}$

9. $m = \frac{2}{3}$ and contains $\left(\frac{1}{2}, 1\right)$

$$1 = \frac{2}{3}\left(\frac{1}{2}\right) + b$$

$$1 = \frac{1}{3} + b$$

$$b = 1 - \frac{1}{3} = \frac{2}{3}$$

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

10. $m = –1$ and contains $\left(\frac{4}{5}, 0\right)$

$$0 = -1\left(\frac{4}{5}\right) + b$$

$$0 = -\frac{4}{5} + b$$

$$b = \frac{4}{5}$$

$$y = -x + \frac{4}{5}$$

11. (2, 6) and (5, 0)

$$m = \frac{6-0}{2-5} = \frac{6}{-3} = -2$$

$0 = –2(5) + b$

$b = 10$

$y = –2x + 10$

12. (5, –2) and (8, 4)

$$m = \frac{4-(-2)}{8-5} = \frac{6}{3} = 2$$

$–2 = 2(5) + b$

$b = –2 –10 = –12$

$y = 2x – 12$

13. (3, 5) and (–3, 0)

$$m = \frac{5-0}{3-(-3)} = \frac{5}{6}$$

$$0 = \frac{5}{6}(-3) + b$$

$$b = \frac{15}{6} = \frac{5}{2}$$

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

14. $m = -\frac{2}{3}$ and contains (2, –2)

$$-2 = -\frac{2}{3}(2) + \text{b}$$

$$b = -2 + \frac{4}{3} = \frac{-6+4}{3} = -\frac{2}{3}$$

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

15. $m = -3$ and contains (3, –5)

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

$-5 = -9 + b$

$b = 4$

$y = -3x + 4$

16. (10, 15) and (12, 20)

$$m = \frac{20-15}{12-10} = \frac{5}{2}$$

$$15 = \frac{5}{2}(10) + b$$

$$b = \ b = 15 - \frac{25}{2} = \frac{30-25}{2} = \frac{5}{2}$$

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

17. The graph passes through (0, 3) and (3, 0). Since the y-intercept is (0, 3), then b = 3.

$$m = \frac{3-0}{0-3} = \frac{3}{-3} = -1$$

$y = -x + 3$

18. The y-intercept is (0, 4), so $b = 4$. The red triangle shows that the slope is –1 because for each time you go down one, you go to the right one.
So, $y = -x + 4$

19. The y-intercept is (0, –2), so $b = -2$. The red triangle shows that the slope is $\frac{1}{2}$ because for each time you go up one, you go to the right two.
So, $y = \frac{1}{2}x - 2$

20. The y-intercept is (0, –6), so $b = -6$. The line also passes through (1, –2)
$m = \frac{-2-(-6)}{1-0} = \frac{4}{1} = 4$
So, $y = 4x - 6$

21. $m = 5$ and $f(0) = -3$
$f(0) = -3$ represents the y-intercept
So, $y = 5x - 3$

22. $m = -2$ and $f(0) = 5$
$f(0) = 5$ represents the y-intercept
So, $y = -2x + 5$

23. $m = -7$ and $f(2) = -1$
$f(2) = -1$ represents the point (2, –1)
So, $-1 = -7(2) + b$
$b = -1 + 14 = 13$
$y = -7x + 13$

24. $m = \frac{1}{3}$ and $f(-1) = \frac{2}{3}$
$f(-1) = \frac{2}{3}$ represents the point $(-1, \frac{2}{3})$
So, $\frac{2}{3} = \frac{1}{3}(-1) + b$
$b = \frac{2}{3} + \frac{1}{3} = \frac{3}{3} = 1$
$y = \frac{1}{3}x + 1$

25. $m = 4.2$ and $f(-3) = 7.1$

So, $7.1 = 4.2(-3) + b$

$b = 7.1 - 12.6 = -5.5$

$y = 4.2x - 5.5$

26. $f\left(\frac{1}{4}\right) = \frac{3}{4},\ f(0) = \frac{5}{4}$

$\left(\frac{1}{4}, \frac{3}{4}\right)$ and $\left(0, \frac{5}{4}\right)$

$b = \frac{5}{4}$

$$m = \frac{\frac{5}{4} - \frac{3}{4}}{0 - \frac{1}{4}} = \frac{\frac{2}{4}}{-\frac{1}{4}} = \frac{2}{4}\left(-\frac{4}{1}\right) = -2$$

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

27. $f(1.5) = -3,\ f(-1) = 2$

(1.5, –3) and (–1, 2)

$$m = \frac{2-(-3)}{-1-1.5} = \frac{5}{-2.5} = -2$$

$2 = -2(-1) + b$

$b = 2 - 2 = 0$

$y = -2x + 0$ or $y = -2x$

28. $f(-1) = 1$ and $f(1) = -1$

(–1, 1) and (1, –1)

$$m = \frac{1-(-1)}{-1-1} = \frac{2}{-2} = -1$$

$-1 = (-1)(1) + b$

$b = -1 + 1 = 0$

$y = -1x + 0$ or $y = -x$

29. The initial amount is \$1500 and the payments are \$350 per month, m. Then the equation is $y = 350m + 1500$.

1 year = 12 months, so y = 350(12) + 1500 = \$5700

He will spend \$5700 in one year.

30. We are given two points on the line, namely (3, 10) and (11, 14). So, the slope of the line is $m=\frac{14-10}{11-3}=\frac{4}{8}=\frac{1}{2}$.

$10 = \frac{1}{2}(3) + b$

$b=10-\frac{3}{2}=\frac{20-3}{2}=\frac{17}{2}$

$y=\frac{17}{2}x+\frac{1}{2}$

The height of the plant when it was planted can be found when $x = 0$.

$y=\frac{17}{2}(0)+\frac{1}{2}=\frac{1}{2}$

The plant was a half-inch tall when planted.

31. Two points on the line are (160, 5) and (40, 2). We can find the slope of the line that passes through these two points.

$m=\frac{2-5}{40-160}=\frac{-3}{-120}=\frac{1}{40}$

Then we can determine the equation of the line.

$2 = \frac{1}{40}(40) + b$

$b = 2 – 1 = 1$

$y = \frac{1}{40}x – 1$

When $x = 140$, then the length of the spring will be $y = \frac{1}{40}(140) – 1 = 3.5 – 1 =$ 2.5 inches.

32. We are given the points (100, 265) and (120, 275), where the first coordinate is the weight, w, and the second coordinate is the distance, d.

We can find the slope of the line $m=\frac{275-265}{120-100}=\frac{10}{20}=\frac{1}{2}$.

Then we can find b:

$265 = \frac{1}{2}(100) + b$

$265 = 50 + b$

$b = 265 – 50 = 215$

The equation is $d=\frac{1}{2}w+215$.

When $w = 150$, then $d=\frac{1}{2}(150)+215=75+215=290$ feet.

33. Let x = a number. Then $\frac{1}{3}x = x - 7$

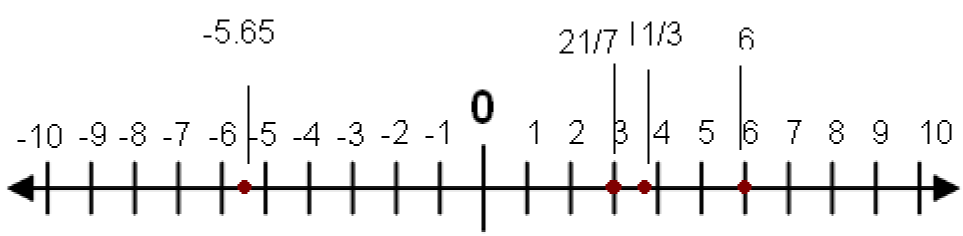
34. The formula for the perimeter of a square is $P = 4s$, where s = the length of one side. So $67 = 4s$ → $s = 16.75$ cm.

35. Let x = the number of games they lost. Then the number of games they won is x + 2 and the number of games they tied is x – 3.
So, we can find the number of games they lost by
$17 = x + (x + 2) + (x – 3)$
$17 = 3x – 1$
$18 = 3x$
$x = 6$
They lost 6 games, which means they won 6 + 2 = 8 games and tied 6 – 3 = 3 games.

36. $\frac{(30 - 4 + 4 \div 2) \div (21 \div 3)}{2} = \frac{(28) \div (7)}{2} = \frac{4}{2} = 2$

37. The opposite of 16.76 is –16.76.

38.



39. [(–4 + 4.5) + (18 – |–13|) + (–3.3)] = (0.5) + (31) + (–3.3) = 28.2

Lesson 5.2

1. $y - y_1 = m(x - x_1)$

2. There are multiple possible answers. One possible answer is that instead of needing to find the *y*-intercept, you can use any point with the point-slope formula.

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

   $y + 4 = \frac{1}{3}x + 0$ OR $y + 4 = \frac{1}{3}x$

4. $m = -\frac{1}{10}$ and passes through (10, 2)

   $y - 2 = -\frac{1}{10}(x - 10)$ OR $y - 2 = -\frac{1}{10}x + 1$

5. $m = -75$ and passes through (0, 125)
   $y - 125 = -75(x - 0)$ OR $y - 125 = -75x$

6. $m = 10$ and passes through (8, –2)
   $y + 2 = 10(x - 8)$ OR $y + 2 = 10x - 80$

7. passes through points (–2, 3) and (–1, –2)
   We must first find the slope of the line.
   $m = \frac{-2-3}{-1-(-2)} = \frac{-5}{1} = -5$
   Then we can select either point to write our equation.
   $y + 2 = -5(x + 1)$ OR $y + 2 = -5x - 5$

8. passes through points (0, 0) and (1, 2)
   We must first find the slope of the line.
   $m = \frac{2-0}{1-0} = \frac{2}{1} = 2$
   Then we can select either point to write our equation.
   $y - 0 = 2(x - 0)$ OR $y = 2x$

9. passes through points (10, 12) and (5, 25)
We must first find the slope of the line.
$m = \frac{25-12}{5-10} = \frac{13}{-5} = -\frac{13}{5}$
Then we can select either point to write our equation.
$y - 12 = -\frac{13}{5}(x - 10)$ OR $y - 12 = -\frac{13}{5}x + 26$

10. passes through points (2, 3) and (0, 3)
We must first find the slope of the line. You may notice that the *y*-coordinates are the same. That means this is a horizontal line, so the slope should be zero.
$m = \frac{3-3}{0-2} = \frac{0}{-2} = 0$
Because the slope is zero, the y-coordinate will always be the same. Therefore, the equations of the line is y = 0. Here is the result by following the same process.
Selecting either point to write our equation gives
$y - 3 = 0(x - 0)$
$y - 3 = 0$
$y = 3$

11. $m = \frac{3}{5}$ and y-intercept = –3
We know one point on the line is (0, –3) because those are the coordinates of the *y*-intercept. Using the point-slope form, $y + 3 = \frac{3}{5}(x - 0)$ OR $y + 3 = \frac{3}{5}x$.

12. $m = -6$ and *y*-intercept = 0.5.
Therefore, one point on the line is (0, 0.5).
$y - 0.5 = -6(x - 0)$ OR $y - 0.5 = -6x$

13. passes through (–4, –2) and (8, 12)
We must first find the slope of the line.
$m = \frac{12-(-2)}{8-(-4)} = \frac{14}{12} = \frac{7}{6}$
Then we can select either point to write our equation.
$y + 2 = \frac{7}{6}(x + 4)$ OR $y + 2 = \frac{7}{6}x + \frac{14}{3}$

14. $y - 2 = 3(x - 1)$
$y - 2 = 3x - 3$
$y = 3x - 1$

15. $y+4=\frac{-2}{3}(x+6)$

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

$y=-\frac{2}{3}x-8$

16. 0 = x + 5
Since there is no y in this equation, it cannot be written in slope-intercept form as usual. Solving for x gives x = –5.

17. $y=\frac{1}{4}(x-24)\Rightarrow y=\frac{1}{4}x-6$

18. $m=-\frac{1}{5}$ and $f(0) = 7$. This tells us one point on the function is (0, 7).

$y-7=-\frac{1}{5}(x-0)$

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

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

$f(x)=-\frac{1}{5}x+7$

19. m = –12 and $f(–2)$ = 5
One point on the function is (–2, 5).
So y – 5 = –12(x + 2)
y – 5 = –12x – 24

20. $f(–7)$ = 5 means (–7, 5) and $f(3)$ = –4 means (3, –4)
So, we can find the slope by $m=\frac{-4-5}{3-(-7)}=\frac{-9}{10}=-\frac{9}{10}$
Now we can use either point to find the equation of the line in point-slope form:
$y-5=-\frac{9}{10}\left[x-(-7)\right]$ OR $y-5=-\frac{9}{10}x-\frac{63}{10}$

21. $f(6)$ = 0 means (6, 0) and $f(0)$ = 6 means (0, 6)
So, we can find the slope by $m=\frac{6-0}{0-6}=\frac{6}{-6}=-1$
Now we can use either point to find the equation of the line in point-slope form:
$y-0=-1(x-6)$ OR $y=-x+6$

22. $m = 3$ and $f(2) = -9$

Since we know the slope and a point, we can just substitute the values into the point-slope formula.

$y - (-9) = 3(x - 2)$

$y + 9 = 3x - 6$

23. $m = -\frac{9}{5}$ and $f(0) = 32$

$y - 32 = -\frac{9}{5}\ (x - 0)$

$y - 32 = -\frac{9}{5}x$

24. $m = 25$ and $f(0) = 250$

$y - 250 = 25(x - 0)$

$y - 250 = 25x$

25. $f(32) = 0$ means (32, 0) and $f(77) = 25$ means (77, 25)

So, we can find the slope by $m = \frac{25-0}{77-32} = \frac{25}{45} = \frac{5}{9}$

Now we can use either point to find the equation of the line in point-slope form:

$y - 32 = \frac{5}{9}\left(x - 0\right)$ OR $y - 32 = \frac{5}{9}x$

26. If we let the independent variable, x, be the weight and the dependent variable, y, be the length of the spring, then we have:

(100, 20) and (300, 25)

So, we can find the slope by $m = \frac{25-20}{300-100} = \frac{5}{200} = \frac{1}{40}$.

$y - 20 = \frac{1}{40}\left(x - 100\right)$ OR $y - 32 = \frac{1}{40}x - \frac{5}{2}$

To find the length of the spring when it is not stretch means to find the value of y when $x = 0$ (when there is no weight on the spring).

$$y - 32 + 32 = \left(\frac{1}{40}x - \frac{5}{2}\right) + 32$$

So, $y = \frac{1}{40}x + \frac{59}{2}$

$$y = \frac{1}{40}(0) + \frac{59}{2} = \frac{59}{2} = 29.5 \text{ cm}$$

27. Let t = time in minutes and d = depth in feet. At the time he decides to go up (t = 0), the depth is -400 feet, so one point is (0, -400). He raises up to -50 feet and it take 20 minutes, which gives us (20, -50).
We can now find the slope of the line the submarine took:

$$m = \frac{-400-(-50)}{0-20} = \frac{-350}{-20} = 17.5$$

$$d + 400 = 17.5(t-0)$$

$$d + 400 = 17.5t$$

To find the depth after 5 minutes, we need to find d when t = 5.
Then d = 17.5(5) – 400 = –312.5.
The submarine was at a depth of –312.5 feet.

28. Since she makes \$6 for each sale, it represents the slope.
We know one point on the line is (200, 2500). Therefore we can find the equation of the line.

$$y - 2500 = 6(x - 200) \text{ OR } y - 2500 = 6x - 1200$$

To find the base salary, we need to find the value of y when x = 0.
y – 2500 = 6(0) – 1200
y = – 1,200 + 2,500 = 1,300
Anne's base salary is \$1,300.

29. 4(j + 2) = 400 translates to 4 times the sum of a number, j, and 2 equals 400.

30. $0.45 \cdot 0.25 - 24 \div \frac{1}{4} = 0.1125 - 24 \div \frac{1}{4} = 0.1125 - 6 = -5.8875$

31. $C(F) = \frac{F-32}{1.8}$, so $C(35) = \frac{35-32}{1.8} = \frac{3}{1.8} \approx 1.67^\circ \text{C}$

32. $\frac{\text{120 meters}}{\text{3 minutes}} = 40 \text{ meters/minute}$

33. What percent of 87.4 is 106?
Let x = the decimal percent

x (87.4) = 106 $\quad \frac{x(87.4)}{87.4} = \frac{106}{87.4}$

$$x \approx 1.2128$$

1.2128(100) = 121.28%

34. orig = \$25.00 and new = \$40.63
amount of change = 40.63 – 25 = 15.63
percent change = $\frac{15.63}{25}(100) = 62.52\%$

35. $606 = 0.045(w - 4000) + 0.07w$

$606 = 0.045w - 180 + 0.07w$

$606 = 0.115w - 180$

$$\frac{426}{0.115} = \frac{0.115w}{0.115}$$

$w \approx 3704.35$

Lesson 5.3

1. $Ax + By = C$, where A, B, and C are integers and A and B are not both zero.

2. "Clear the fractions" means to change the coefficients to integers. To do so, one needs to multiply both sides by a common denominator, usually the lowest common denominator.

3. standard form: $Ax + By = C$

   slope-intercept form: $y = \frac{-Ax + C}{B}$ OR $-\frac{A}{B}x + \frac{C}{B}$

   Therefore, the slope is $-\frac{A}{B}$ and the y-intercept is $\frac{C}{B}$.

4. $y = 3x - 8$

   $-3x + y = -8$ OR $3x - y = 8$

5. $y = -x - 6$

   $x - y = -8$

6. $y = \frac{5}{3}x - 4$

   $3(y) = \left(\frac{5}{3}x - 4\right)3$

   $3y = 5x - 12$

   $-5x + 3y = -12$ OR $5x - 3y = 12$

7. $0.3x + 0.7y = 15$

   To change this to standard form, we must make the coefficients integers. To do this, we need to multiply both sides by 10 since each number is to the tenths place.

   $10(0.3x + 0.7y) = 15(10)$

   $3x + 7y = 150$

8. $5 = \frac{1}{6}x - y$

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

   $30 = x - 6y$

   $x - 6y = 30$

9. $y - 7 = -5(x - 12)$

$y - 7 = -5x + 60$

$\underline{5x + 7 \;\; + 5x + 7}$

$5x + y = 67$

10. $2y = 6x + 9$

$-6x + 2y = 9$ OR $6x - 2y = -9$

11. $y = \frac{9}{4}x + \frac{1}{4}$

$4(y) = \left(\frac{9}{4}x + \frac{1}{4}\right)4$

$4y = 9x + 1$

$-9x + 4y = 1$ OR $9x - 4y = -1$

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

$15\left(y + \frac{3}{5}\right) = \left[\frac{2}{3}(x - 2)\right]15$

$15y + 9 = 10x - 20$

$-10x + 15y - 29$ OR $10x - 15y = 29$

13. $3y + 5 = 4(x - 9)$

$3y + 5 = 4x - 36$

$4x + 3y = -41$

14. $5x - 2y = 15$

First, put the equation in slope-intercept form.

$-2y = -5x + 15$

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

Now that the equation is in slope-intercept form, we know that the slope is $\frac{5}{2}$ and the y-intercept is $-\frac{15}{2}$.

15. $3x + 6y = 25$

$$\frac{6y}{6} = \frac{-3x+25}{6}$$

$$y = -\frac{1}{2} + \frac{25}{6}$$

slope = $-\frac{1}{2}$ and *y*-intercept = $\frac{25}{6}$

16. $x – 8y = 12$

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

$$y = \frac{1}{8}x - \frac{3}{2}$$

slope = $\frac{1}{8}$ and *y*-intercept = $-\frac{3}{2}$

17. $3x – 7y = 20$

$$\frac{-7y}{-7} = \frac{-3x+20}{-7}$$

$$y = \frac{3}{7}x - \frac{20}{7}$$

slope = $\frac{3}{7}$ and *y*-intercept = $-\frac{20}{7}$

18. $9x – 9y = 4$

$$\frac{-9y}{-9} = \frac{-9x+4}{-9}$$

$$y = x - \frac{4}{9}$$

slope = 1 and *y*-intercept = $-\frac{4}{9}$

19. $6x + y = 3$

$y = –6x + 3$

slope = –6 and *y*-intercept = 3

20. $x – y = 9$

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

$$y = x - 9$$

slope = 1 and *y*-intercept = –9

21. $8x + 3y = 15$

$$\frac{3y}{3} = \frac{-8x+15}{-3}$$

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

slope = $\frac{8}{3}$ and y-intercept = –5

22. $4x + 9y = 1$

$$\frac{9y}{9} = \frac{-4x+1}{9}$$

$$y = -\frac{4}{9}x + \frac{1}{9}$$

slope = $-\frac{4}{9}$ and y-intercept = $\frac{1}{9}$

23. slope = –1 through point (–3, 5)

The point-slope formula is $y - y_1 = m(x - x_1)$, so $y - 5 = -1(x + 3)$.

$y - 5 = -x - 3$

$+x +5 \quad +x +5$

Standard Form is $x + y = 2$.

24. slope = $-\frac{1}{4}$ through point (4, 0)

$y - y_1 = m(x - x_1) \rightarrow y - 0 = -\frac{1}{4}(x - 4)$

$$y = -\frac{1}{4}(x - 4)$$

$$y = -\frac{1}{4}x + 1$$

$$-\frac{1}{4}x + y = 1$$

25. Line through (5, –2) and (–5, 4)

We need to find the slope first. The formula is $m = \frac{y_2 - y_1}{x_2 - x_1}$.

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{4-(-2)}{-5-5} = \frac{6}{-10} = -\frac{3}{5}$$

Then, we can choose any point to substitute into the point-slope formula.

$y - y_1 = m(x - x_1) \rightarrow y + 2 = -\frac{3}{5}\ (x - 5)$

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

$-2 \ +\frac{3}{5}x \quad -2+\frac{3}{5}x$

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

Standard Form is $3x + 5y = 5$.

26. Line through (–3, –2) and (5, 1)

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{5-(-3)}{1-(-2)} = \frac{8}{3}$$

$y - 1 = \frac{8}{3}x - 1$

$+1 \ -\frac{8}{3}x \quad +1 \ -\frac{8}{3}x$

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

Standard Form is $8x - 3y = -3$.

27. Line through (1, –1) and (5, 2)

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{2-(-1)}{5-1} = \frac{3}{4}$$

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

$-1 \ -\frac{3}{4}x \quad -1 \ -\frac{3}{4}x$

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

Standard Form is $3x - 4y = -8$.

28. Let t = the number of pounds of tomatoes and c = the number of pounds of corn.
$1.29t + 3.25c = 11.61$
If $t = 6$, then $1.29(6) + 3.25c = 11.61$
$7.74 + 3.25c = 11.61$
$3.25c = 11.61 – 7.74$
$\frac{3.25c}{3.25} = \frac{3.87}{3.25}$
$c \approx 1.19$ pounds of corn

29. Let f = the number of fried fish plates and b = the number baked fish plates.
$7.50f + 8.25b = 2{,}336.25$
If $f = 130$, then $7.50(130) + 8.25b = 2{,}336.25$
$975 + 8.25b = 2{,}336.25$
$8.25b = 2{,}336.25 – 975$
$\frac{8.25b}{8.25} = \frac{1{,}361.25}{8.25}$
$b = 165$ baked fish plates

30. Let j_1 = the number of hours at the job making \$6 per hour and let j_2 = the number of hours at the the job making \$10.

Then we can write $6\,j_1 + 10\,j_2 = 366$.

We need to find the value of j_1 when $j_2 = 15$
$6\,j_1 + 10(15) = 366$
$6\,j_1 = 366 – 150$
$\frac{6\,j_1}{6} = \frac{216}{6}$
$j_1 = 36$
Andrew needs to work 36 hours at his \$6 job to meet his goal.

31. First, we need to write the percents as decimals to get the right values, so 5% = 0.05 and 7% = 0.07. We can assume that the accounts are simple interest. Let a_1 = the amount of money invested in the 5% account and a_2 = the amount of money invested in the 7% account.
Then our equation is $0.05\,a_1 + 0.07\,a_2 = 400$.
To put the equation in standard form, we need to multiply through by 100.
$100(0.05a_1 + 0.07a_2) = 100(400)$

$5a_1 + 7a_2 = 40{,}000$

$5(5{,}000) + 7a_2 = 40{,}000$
$25{,}000 + 7a_2 = 40{,}000$
$7a_2 = 40{,}000 – 25{,}000$
$\frac{7a_2}{7} = \frac{15{,}000}{7}$
$a_2 = 2{,}142.86$
Anne will need to invest no more than $2,142.86 in the 7% account.

32. $y – 2 = 6(x – 3)$
$y – 2 = 6x – 18$
$y = 6x – 16$

33. $\frac{p-2}{7} = \frac{p+1}{6}$
$6(p – 2) = 7(p + 1)$
$6p – 12 = 7p + 7$
$–19 = p$

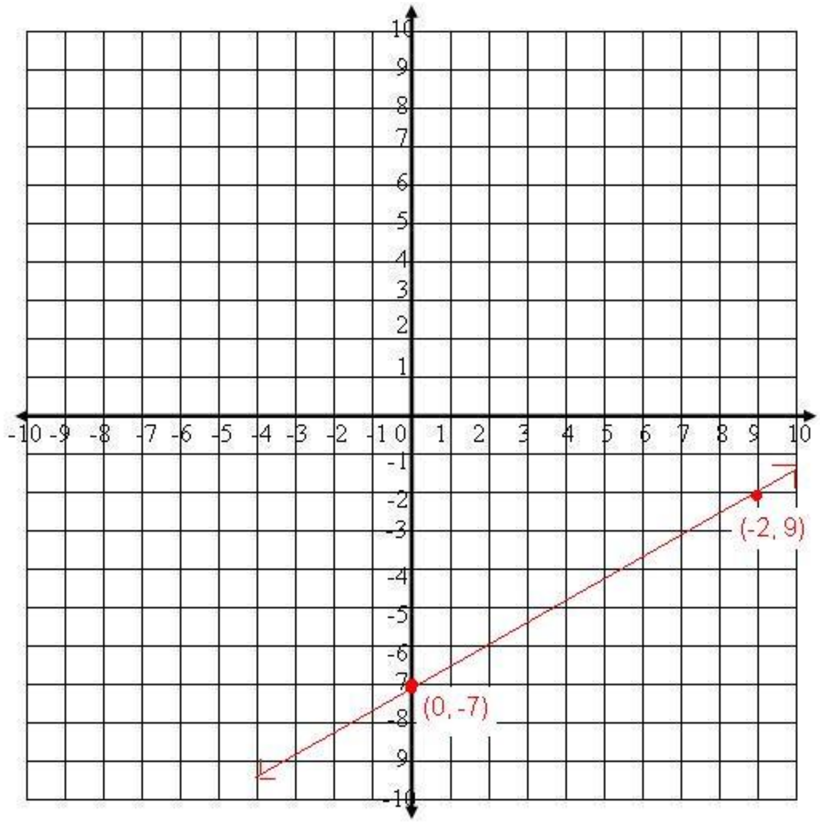
34. The graph of $x = 1.5$ is a vertical line that passes through $x = 1.5$. It is parallel to the y-axis.

35. $5(4) + 3(–3) = 9$
$20 – 9 = 9$
$11 \neq 9$
It is not a solution to the equation.

36. One point is quadrant III is (–3, –4). All coordinates in quadrant III are negative.

37. $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{6-6}{16-6} = \frac{0}{15} = 0$

38.



Lesson 5.4

1. parallel lines – lines that have the same slope

2. perpendicular lines – lines that intersect at 90° angles.

3. The product of the slopes of perpendicular lines is –1.

4. A family of lines is a set of lines that have something in common with each other.

5. a. parallel = –5

   b. perpendicular = $\frac{1}{5}$

6. $2x + 8y = 9$

   $8y = -2x + 9$

   $y = -\frac{1}{4}x + \frac{9}{8}$

   a. parallel = $-\frac{1}{4}$

   b. perpendicular = 4

7. $x = 8$

   a. parallel = any vertical line ($x = -2$, $x = 0$, $x = 5$, etc)

   b. perpendicular = any horizontal line ($y = 1$, $y = 0$, $y = -7$, etc)

8. $y = -4.75$

   a. parallel = any horizontal line ($y = 1$, $y = 0$, $y = -7$, etc)

   b. perpendicular = any vertical line ($x = -2$, $x = 0$, $x = 5$, etc)

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

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

   $y = \frac{1}{5}x + \frac{3}{5} + \frac{10}{5}$

   $y = \frac{1}{5}x + \frac{13}{5}$

   a. parallel = $\frac{1}{5}$

   b. perpendicular = –5

10. $m_a = \frac{6-4}{2-(-1)} = \frac{2}{3}$; $m_b = \frac{1-(-3)}{8-2} = \frac{4}{6} = \frac{2}{3}$; lines are parallel

11. $m_a = \frac{0-(-3)}{-8-4} = \frac{3}{-12} = -\frac{1}{4}$; $m_b = \frac{6-(-1)}{-2-(-1)} = \frac{7}{-1} = -7$; lines are neither parallel or perpendicular

12. $m_a = \frac{-2-14}{1-(-3)} = \frac{-16}{4} = -4$; $m_b = \frac{5-(-3)}{-2-0} = \frac{8}{-2} = -4$; lines are parallel

13. $m_a = \frac{-3-3}{-6-3} = \frac{-6}{-9} = \frac{1}{3}$; $m_b = \frac{4-(-8)}{-6-2} = \frac{12}{-8} = -\frac{3}{2}$; lines are neither parallel or perpendicular

14. **Line 1:**
$4y + x = 8$
$4y = -x + 8$
$y = -\frac{1}{4}x + 2$
Line 2:
$12y + 3x = 1$
$12y = -3x + 1$
$y = -\frac{1}{4}x + \frac{1}{12}$
Since they have the same slope, the lines are parallel.

15.
Line 1:
$5y + 3x = 1$
$5y = -3x + 1$
$y = -\frac{3}{5}x + \frac{1}{5}$
Line 2:
$6y + 10x = -3$
$6y = -10x - 3$
$y = -\frac{10}{6}x - \frac{3}{6}$
$y = -\frac{5}{3}x - \frac{1}{2}$
The lines are neither parallel nor perpendicular.

16. **Line 1:**
$2y - 3x + 1 = 0$
$2y = 3x - 1$
$y = \frac{3}{2}x - \frac{1}{2}$
Line 2:
$y + 6x = -3$
$y = -6x - 3$
The lines are neither parallel nor perpendicular.

17. Find the equation of the line parallel to $5x - 2y = 2$ that passes through point (3, –2).
First, we need to find the slope of the given line, so
$5x - 2y = 2$
$-2y = -5x + 2$
$y = \frac{5}{2}x - 1$
The slope of the given line and the new line is $\frac{5}{2}$.
Now we use the point-slope form of a line to find the equation of the new line.
$y + 2 = \frac{5}{2}(x - 3)$
$y + 2 = \frac{5}{2}x - \frac{15}{2}$
$y = \frac{5}{2}x - \frac{15}{2} - \frac{4}{2}$
$y = \frac{5}{2}x - \frac{19}{2}$

18. Find the equation of a line perpendicular to $y = -\frac{2}{5}x - 3$ that passes through point (2, 8).
The slope of the given line is $-\frac{2}{5}$, so the slope of a line perpendicular to it is $\frac{5}{2}$.
$y - 8 = \frac{5}{2}(x - 2)$
$y - 8 = \frac{5}{2}x - 5$
$y = \frac{5}{2}x - 5 + 8$
$y = \frac{5}{2}x + 3$

19. Find the equation of the line parallel to $7y + 2x - 10 = 0$ that passes through the point (2, 2).

$7y + 2x = 10$

$7y = -2x + 10$

$$y = -\frac{2}{7}x + \frac{10}{7}$$

A line parallel to the line has a slope of $-\frac{2}{7}$.

$$y - 2 = -\frac{2}{7}(x - 2)$$

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

$$y = -\frac{2}{7}x + \frac{4}{7} + \frac{14}{7}$$

$$y = -\frac{2}{7}x + \frac{18}{7}$$

20. Find the equation of the line perpendicular to $y + 5 = 3(x - 2)$ that passes through the point (6, 2).

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

$y + 5 = 3x - 6$

$y = 3x - 11$

The slope of a line perpendicular to the given line is $-\frac{1}{3}$.

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

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

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

21. Find the equation of the line through (2, –4) perpendicular to $y = \frac{2}{7}x + 3$.

The slope of a line perpendicular to the given line is $-\frac{7}{2}$.

$$y + 4 = -\frac{7}{2}(x - 2)$$

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

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

22. Find the equation of the line through (2, 3) parallel to $y=\frac{3}{2}x+5$.

A line parallel to the line has a slope of $\frac{3}{2}$.

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

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

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

23. All lines pass through point (0, 4).
Therefore, the equation of the family of equations is y = Ax + 4, where A is any real number.

24. All lines are perpendicular to 4x + 3y − 1 = 0.
3y = –4x + 1

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

The slope of any line perpendicular to the given line is $\frac{3}{4}$.

Therefore, the equation of the family of lines perpendicular to the given line is $y=\frac{3}{4}x+\mathrm{B}$, where B where B is any real number.

25. All lines are parallel to y − 3 = 4x + 2.
y = 4x + 5, so the slope of any line parallel to the given line is 4.
Therefore, the equation of the family of lines parallel to the given line is
y = 4x + B, where B where B is any real number.

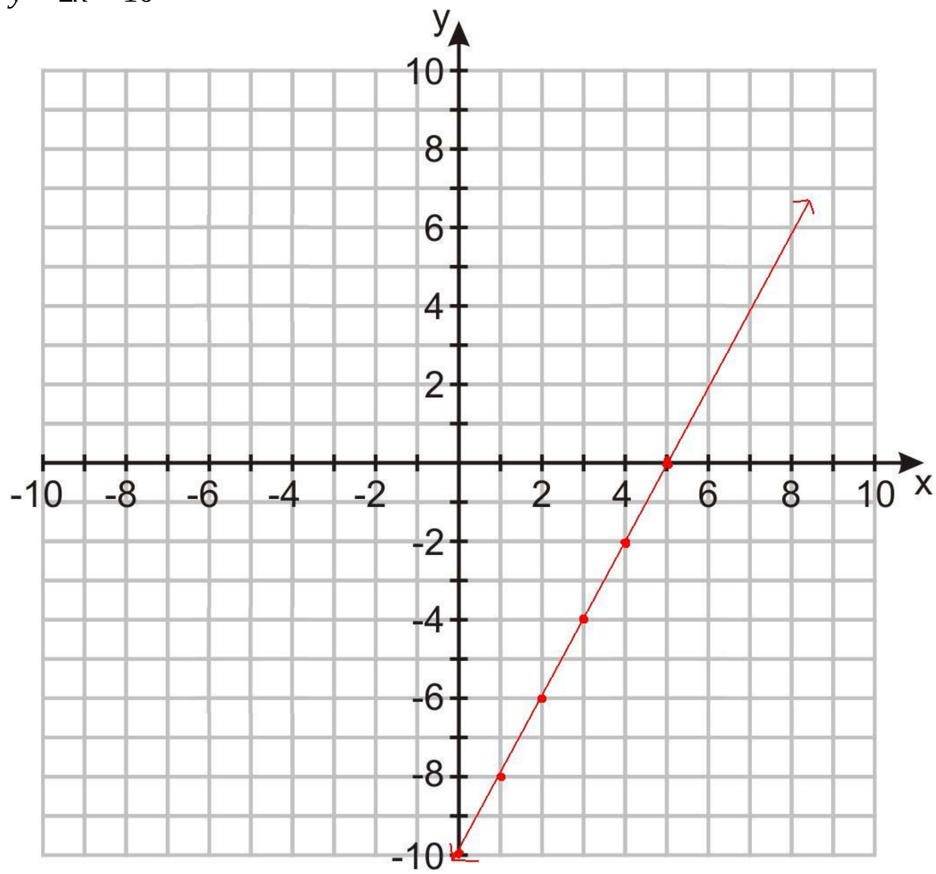
26. All lines pass through point (0, −1).
The y-intercept is −1. Therefore, the equation of the family of equations is
y = Ax − 1, where A is any real number.

27. Write an equation for a line parallel to the equation graphed at the right.

The slope of the graphed line is $\frac{1}{2}$. Therefore, the equation of the family of lines parallel to the given line is $y=\frac{1}{2}x$ + B, where B where B is any real number.

28. Write an equation for a line perpendicular to the equation graphed at the right passing through the ordered pair (0, −1).
The slope of any line perpendicular to the given line is −2. We now know the slope and the *y*-intercept (−1). The equation of the line new line is $y = -2x - 1$.

29. $2x - y = 10$
$-y = -2x + 10$
$y = 2x - 10$



30. $\frac{8 \text{ inches}}{6 \text{ feet}} = \frac{x \text{ inches}}{40 \text{ feet}}$
$6x = 320$
$x \approx 53.3$ inches

31. $\frac{50 \text{ words}}{\$11.50} = \frac{70 \text{ words}}{\$x}$
$50x = 805$
$x = \$16.10$

32. $\sqrt{112} = \sqrt{16(7)} = 4\sqrt{7}$

33. $\sqrt{12^2 - 7^2} = \sqrt{144 - 49} = \sqrt{95}$

34. $\sqrt{3} - \sqrt{2} \approx 0.3178372452\ldots$, so the answer is irrational. An irrational number minus another irrational number is irrational.

35. $15s = 6(s + 32)$
$15s = 6s + 192$
$9s = 192$
$s = 21\frac{1}{3}$

Quick Quiz

1. $y = \frac{4}{3}x + 8$

2. $m = \frac{-3-1}{7-6} = \frac{-4}{1} = -4$
$y - 1 = -4(x - 6)$
$y - 1 = -4x + 24$
$y = -4x + 25$

3. (2.5, 75) and (5, 168.75) are two points on the line.
$m = \frac{168.75 - 75}{5 - 2.5} = \frac{93.75}{2.5} = 37.5$
$y - 75 = 37.5(x - 2.5)$
$y - 75 = 37.5x - 93.5$
$y = 37.5x - 18.75$
When $x = 1$, $y = 37.5(1) - 18.75 = 18.75$
A one-hour job will cost $18.75.

4. $y = \frac{6}{5}x + 11$
$-\frac{6}{5}x + y = 11$
$6x - 5y = -55$

5. Let s = the number of student tickets and a = the number of adult tickets.
Then we can write $3s + 3.75a = 337.50$.
When $s = 75$,
$3(75) + 3.75a = 337.50$
$225 + 3.75a = 337.50$
$3.75a = 112.5$
$a = 30$
Thirty adult tickets were sold.

Lesson 5.5

1. A scatter plot is a relation that represents real data that may be linear or non-linear.

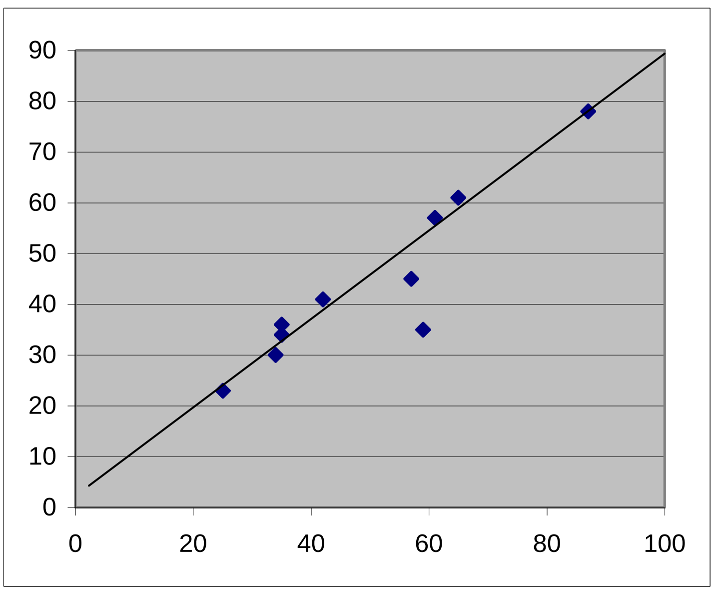
2. line of best fit – a line that best represents the data on a scatter plot.

3. outlier - a data point that does not fit with the general pattern of the data.

4. Two methods for finding the line of best fit –
   a) use a graphing calculator to plot the points and run the algorithm
   b) determine the equation of the line using the slope and intercept

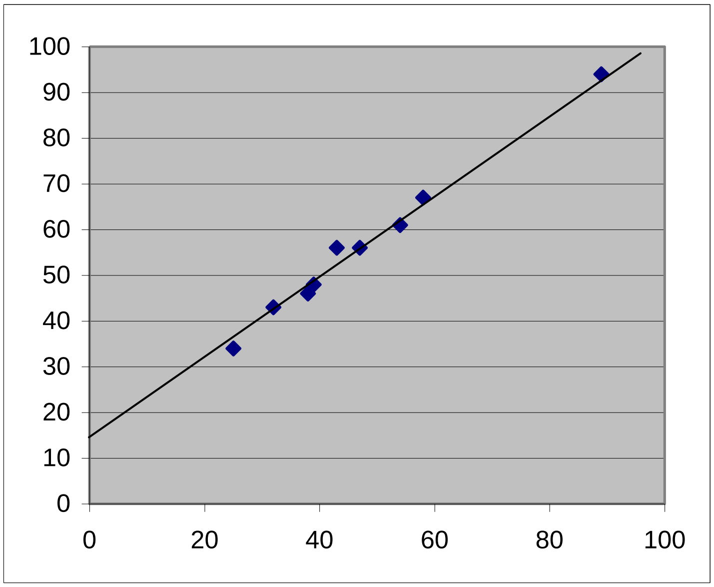
5. Draw a line of best fit, then chose two points on the line. Determine the slope and y-intercept of the line. Then write the equation of the line. Since each person may draw a slightly different line, the equations may not be the same.

6. (57, 45) (65, 61) (34, 30) (87, 78) (42, 41) (35, 36) (59, 35) (61, 57) (25, 23) (35, 34)



Two points on the line are (25, 23) and (87, 78). The slope of the line is
$m = \frac{78-23}{87-25} = \frac{55}{62} \approx 0.887$.
Then,
$y - 23 = 0.887(x - 25)$
$y - 23 = 0.887x - 22.175$
$y = 0.887x + 0.825$

7. (32, 43) (54, 61) (89, 94) (25, 34) (43, 56) (58, 67) (38, 46) (47, 56) (39, 48)



Two points on the line are (38, 46) and (58, 67). The slope of the line is

$m = \frac{67-46}{58-38} = \frac{21}{20} = 1.05$.

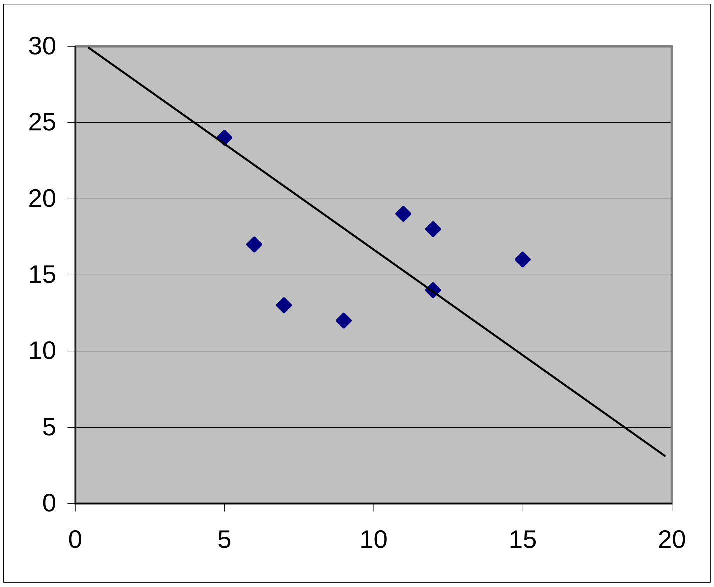
Then,

$y - 46 = 1.05(x - 38)$

$y - 46 = 1.05x - 39.9$

$y = 0.887x + 6.1$

8. (12, 18) (5, 24) (15, 16) (11, 19) (9, 12) (7, 13) (6, 17) (12, 14)



Two points on the line are (5, 24) and (12, 14). The slope of the line is

$m = \frac{14-24}{12-5} = \frac{-10}{7} \approx -1.429$.

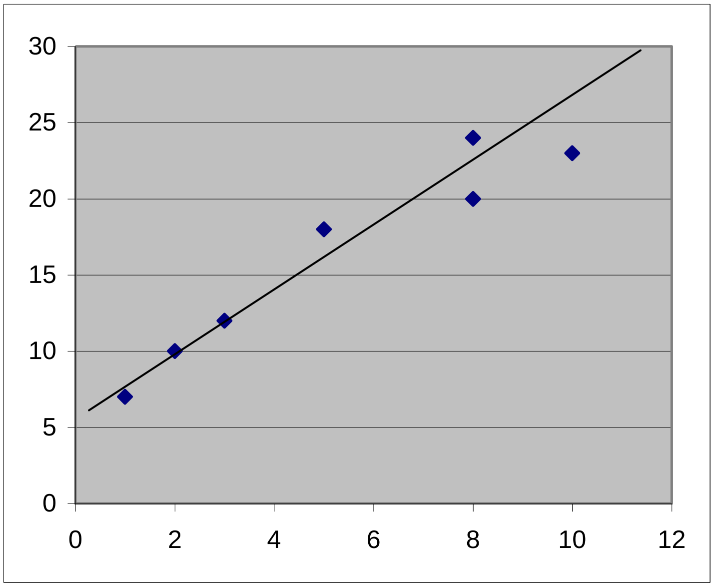
Then,

$y - 14 = -1.429(x - 12)$

$y - 14 = -1.429x + 17.148$

$y = -1.429x + 31.148$

9. (3, 12) (8, 20) (1, 7) (10, 23) (5, 18) (8, 24) (2, 10)



Two points on the line are (2, 10) and (3, 12). The slope of the line is

$m = \frac{12-10}{3-2} = \frac{2}{1} = 2$.

Then,

$y - 10 = 2(x - 2)$

$y - 10 = 2x - 4$

$y = 2x + 6$

10. Use the steps from pages 194 – 196 to plot the points and get the line of best fit. The equation is $y = 0.8102x + 3.4907$.

11. Use the steps from pages 194 – 196 to plot the points and get the line of best fit. The equation is $y = 0.9648x + 10.83$.

12. Use the steps from pages 194 – 196 to plot the points and get the line of best fit. The equation is $y = -0.8041x + 25.033$.

13. (5, 40) and (7, 45)

$m = \frac{45-40}{7-5} = \frac{5}{2} = 2.5$.

Then,

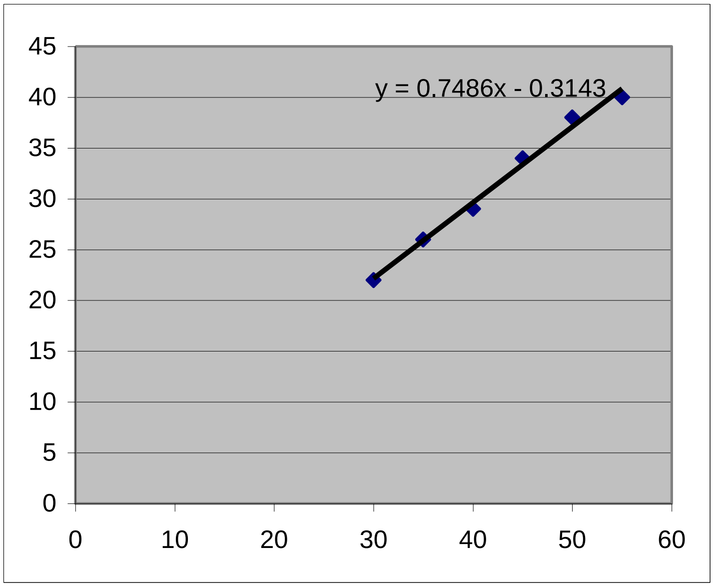
$y - 40 = 2.5(x - 5)$

$y - 40 = 2.5x - 12.5$

$y = 2.5x + 27.5$

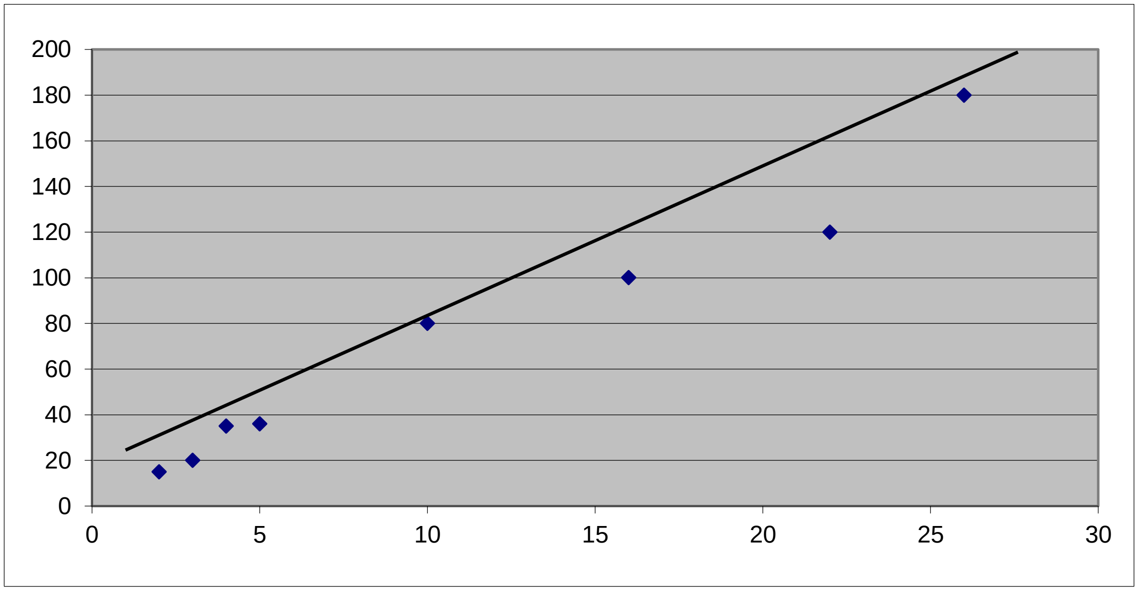
The y-intercept means that he could eat 27.5 samosas before he began training. The slope means that he will increase by 2.5 cookies each day he trains. In two weeks, or when $x = 14$, Shiva will be able to eat 2.5(14) + 27.5 = 62.5 cookies.

14.



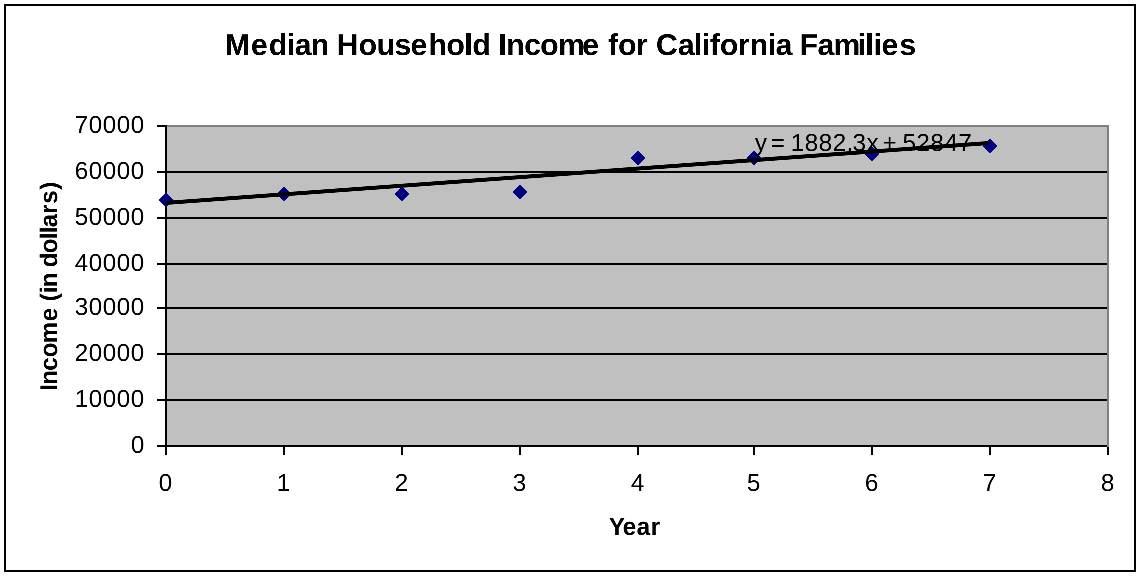
The initial height when the bounce is 65 cm is
$65 = 0.7486x - 0.3143$
$65.3143 = 0.7486x$
$x \approx 87.25$ cm
The y-intercept represents the initial height of the ball before it is dropped. The slope represents the speed in which the ball bounces.

15.



$y = 6.1196x - 5.9344$ (y is time, x is weight of candle)
$95 = 6.1196x - 5.9344$
x ≈ 14.55 oz

16. The first year is 1995, so that is year 0. Then the years are from 0 to 7, where 2002 = 7.



The equation for the line of best fit is $y = 1{,}882.3x + 52{,}847$. In 2010 (year = 15), the median income would be about $y = 1{,}882.3(15) + 52{,}847 = 81{,}081.50$, or \$81,081.50. The y-intercept represents the median income in 1995 when the census was complete, and the slope represents the amount the income increased each year.

17. First, the amount of change = 119.64 – 110.27 = 9.37. We want to know, "What percent of 119.64 is \$9.37?"
Let x = the percent as a decimal.
Then $x(119.64) = 9.37$

$$x = \frac{9.37}{119.64} \approx 0.0783$$

The tax rate was 7.83%.

18. The means are x and 141; the extremes are 4 and 98.

19. $$\frac{4}{x} = \frac{141}{98}$$
$141x = 392$
$x \approx 2.78$

20. Let t = the number of hours traveled.

$$\frac{328.5 \text{ miles}}{7.3 \text{ hours}} = \frac{82.8 \text{ miles}}{t \text{ hours}}$$

$328.5t = 604.44$
$t = 1.84$ hours

21. When $x = 6{,}015$, $t(6{,}015) = 0.85(6{,}015) = 5{,}112.75$

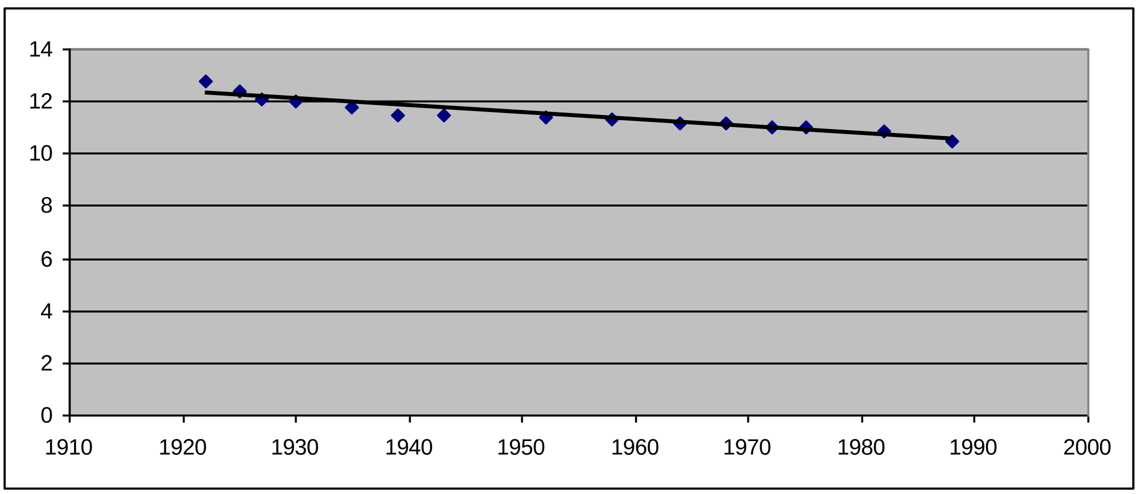
Lesson 5.6

1. To interpolate the data means to look for a value in between given data points. It would be helpful when the data skips values along the axes.

2. Extrapolation is making a prediction about data that is either before of after the set of data given. Extrapolation is typically more beneficial with non-linear data sets.

3. The problem with using extrapolation to determine the winning time is that the point trying to be found is too far away from the given set of data.

4. After fitting the line, we see that two of the points on the line is (1927, 12.1) and (1964, 11.2).



$$m = \frac{11.2 - 12.1}{1964 - 1927} = -\frac{0.9}{37} \approx -0.0243$$

$y = – 0.067x + b$

$11.2 = – 0.0243(1964) + b$

$b = 143.7$

$y = – 0.0243x + 58.9$

5. The points on the line that connect 1940 and 1950 are (1940, 21.5) and (1950, 20.3).

$$m = \frac{20.3 - 21.5}{1950 - 1940} = -\frac{1.2}{10} = -0.12$$

$y = -0.12x + b$

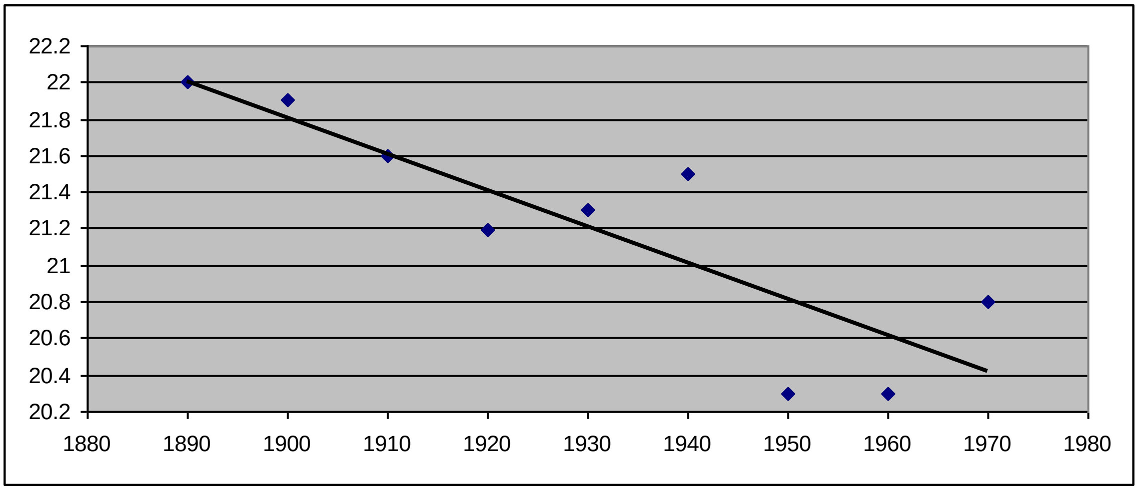
$20.3 = -0.12(1950) + b$

$b = 254.3$

$y = -0.12x + 254.3$

Then we can determine the age of marriage for females in 1946.

$y = -0.12(1946) + 254.3 = 20.78 \approx 20.8$ years



The line of best fit for the data up to 1970 can be found with two points (1890, 22) and (1910, 21.6).

$$m = \frac{22 - 21.6}{1890 - 1910} = -\frac{0.4}{20} = -0.02$$

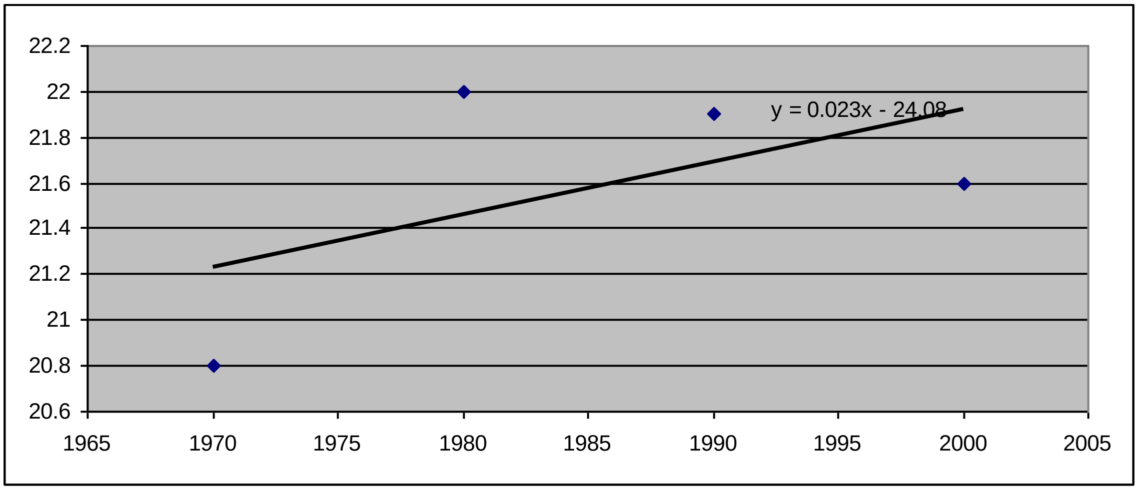
$y = -0.02x + b$

$22 = -0.02(1890) + b$

$b = 59.8$

$y = -0.02x + 59.8$

6. If we use just the points from 1970, the best-fit line does not actually pass through any of the data points. Therefore, is it more difficult to find the best-fit line. This computer-generated scatter plot shows the line of best fit for the data with the equation $y = 0.023x - 24.08$.



The age of marriage for females in 1984 was $y = 0.023(1984) - 24.08 = 21.552 \approx 21.6$ years.

7. The two points we need are (1990, 26.1) and (2000, 26.8). Then,

$$m = \frac{26.8 - 26.1}{2000 - 1990} = \frac{0.7}{10} = 0.07$$

$y = 0.07x + b$
$26.8 = 0.07(2000) + b$
$b = -113.2$
$y = 0.07x - 113.2$
In 1995, males were $y = 0.07(1995) - 113.2 = 26.45 \approx 26.5$ years old.

8. The two points we need are (1996, 13.6) and (2000, 12.2). Then,

$$m = \frac{12.2 - 13.6}{2000 - 1996} = \frac{-1.4}{4} = -0.35$$

$y = -0.35x + b$
$12.2 = -0.35(2000) + b$
$b = 712.2$
$y = -0.35x + 712.2$
In 1997, the percent of women smokers were $y = -0.35(1997) + 712.2 = 13.25\%$.

9. The two points we need are (2003, 10.4) and (2004, 10.2). Then,

$$m = \frac{10.2 - 10.4}{2004 - 2003} = \frac{-0.2}{1} = -0.2$$

$y = -0.2x + b$
$10.2 = -0.2(2004) + b$
$b = 411$
$y = -0.2x + 411$
In 2006, the percent of women smokers were $y = -0.2(2006) + 411 = 9.8\%$.

10. If we use the years 1922 and 1927, the points we will use are (1927, 12.1) and (1922, 12.8).

$$m = \frac{12.8 - 12.1}{1922 - 1927} = \frac{0.7}{-5} = -0.14$$

$y = -0.14x + b$
$12.8 = -0.14(1922) + b$
$b = 281.88$
$y = -0.14x + 281.88$
Then the winning time in 1920 was approximately $y = -0.14(1920) + 281.88 = 13.08$.

11. We will use the points (13, 66) and (13.8, 68).

$$m = \frac{68 - 66}{13.8 - 13} = \frac{2}{0.8} = 2.5$$

$y = 2.5x + b$
$68 = 2.5(13.8) + b$
$b = 33.5$
$y = 2.5x + 33.5$
Then we need to know the value of y when $x = 13.2$.
$y = 2.5(13.2) + 33.5 = 66.5$ degrees

12. We will use the points (10.25, 60) and (11.0, 62).

$$m = \frac{62 - 60}{11.0 - 10.25} = \frac{2}{0.75} \approx 2.67$$

$y = 2.67x + b$
$62 = 2.67(11.0) + b$
$b = 27.5$
$y = 2.67x + 27.5$
Then we need to know the value of y when $x = 9$.
$y = 2.67(9) + 27.5 = 51.53$ degrees
Using Excel, the best-fit line is $y = 1.9491x + 39.964$. So when $x = 9$,
$y = 1.9491(9) + 39.964 \approx 57.5$ degrees.

The estimate using extrapolation is not very accurate.

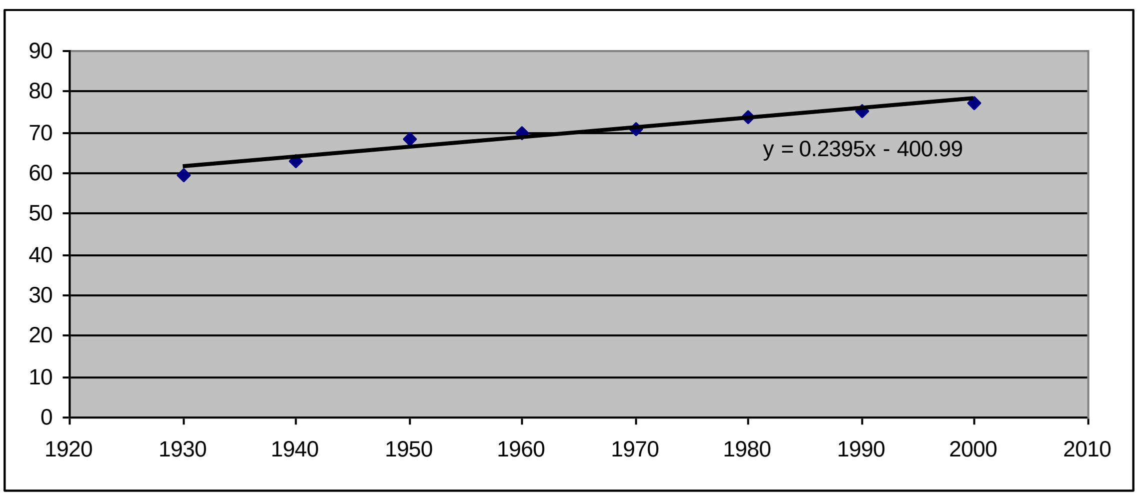
Lesson 5.7

A mathematical model allows us to use data to try to represent real-life scenarios. We can make predictions from the data that should reflect what might happen in the real world.

1. Linear modeling refers to scenarios that fit into a linear equation. The data must be somewhat linear in order to use a linear model.

2. We will use points (16, 17.1) and (18, 12.9).
$$m = \frac{12.9 - 17.1}{18 - 16} = \frac{-4.2}{2} \approx -2.1$$
$y = -2.1x + b$
$12.9 = -2.1(18) + b$
$b = 50.7$
$y = -2.1x + 50.7$
Then we need to know the value of y when $x = 17$.
$y = -2.1(17) + 50.7 = 15$
The height of the water at 17 seconds was 15 centimeters.

3. The best-fit line is $y = 0.2395x - 400.9$



4. When $x = 1955$, $y = 0.2395(1955) - 400.9 \approx 67.2$ years.

5. Using interpolation, we will use points (1950, 68.2) and (1960, 69.7). Then,
   $m = \frac{69.7 - 68.2}{1960 - 1950} = \frac{1.5}{10} = 0.15$
   $y = 0.5x + b$
   $68.2 = 0.5(1950) + b$
   $b = –906.8$
   $y = 0.5x – 906.8$
   Then we need to know the value of y when $x = 1955$.
   $y = 0.5(1955) – 906.8 = 70.7$ years

6. When $x = 1976$, $y = 0.2395(1976) – 400.9 \approx 72.4$ years.

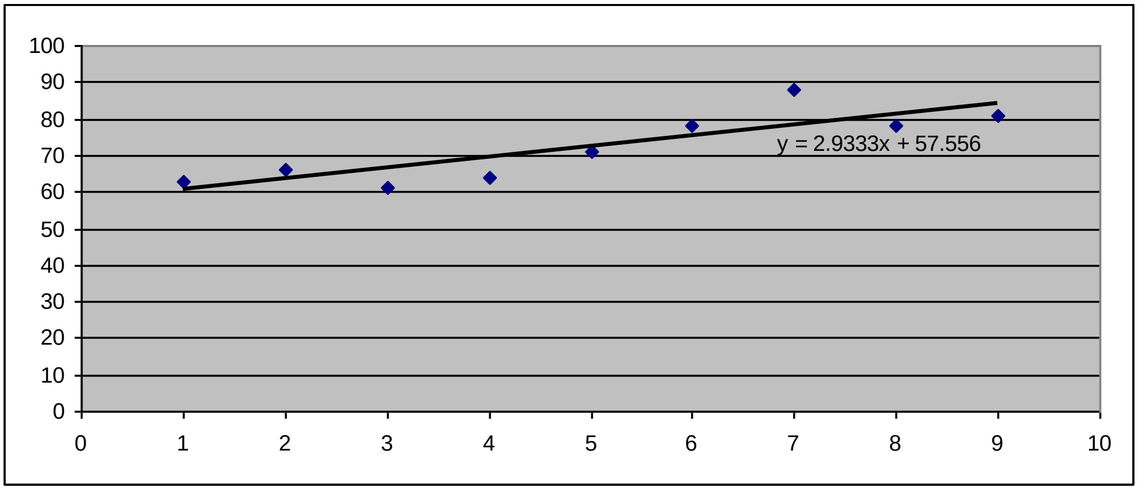
7. Using interpolation, we will use points (1970, 70.8) and (1980, 73.7). Then,
   $m = \frac{73.7 - 70.8}{1980 - 1970} = \frac{2.9}{10} = 0.29$
   $y = 0.29x + b$
   $73.7 = 0.29(1980) + b$
   $b = –500.5$
   $y = 0.29x – 500.5$
   Then we need to know the value of y when $x = 1976$.
   $y = 0.29(1976) –500.5 = 72.5$ years

8. When $x = 2012$, $y = 0.2395(2012) – 400.9 \approx 81.0$ years.

9. Using interpolation, we will use points (1990, 75.4) and (2000, 77). Then,
   $m = \frac{77 - 75.4}{2000 - 1990} = \frac{1.6}{10} = 0.16$
   $y = 0.16x + b$
   $77 = 0.16(2000) + b$
   $b = –243$
   $y = 0.16x – 243$
   Then we need to know the value of y when $x = 2012$.
   $y = 0.16(2012) –243 = 78.9$ years

10. The better estimates are the interpolations because the values are more closely aligned with the wanted values.

11.



12. When x = 4.5, y = 2.9333(4.5) + 57.556 = 70.8 degrees.

13. Using interpolation, we will use points (4, 64) and (5, 71). Then,

$$m = \frac{71-64}{5-4} = \frac{7}{1} = 7$$

$y = 7x + b$

$71 = 7(5) + b$

$b = 36$

$y = 7x + 36$

Then we need to know the value of y when x = 4.5.

y = 7(4.5) + 36 = 67.5 degrees

14. When x = 13, y = 2.9333(13) + 57.556 = 95.7 degrees.

15. Using interpolation, we will use points (8, 78) and (9, 81). Then,

$$m = \frac{81-78}{9-8} = \frac{3}{1} = 3$$

$y = 3x + b$

$81 = 3(9) + b$

$b = 54$

$y = 3x + 54$

Then we need to know the value of y when x = 13.

y = 3(13) + 54 = 93 degrees

16. The interpolation is a better estimate because the values are more closely aligned with the wanted values.

17. $6t(-2+7t) - t(4+3t) = -12t + 42t^2 - 4t - 3t^2 = 39t^2 - 16t$

18. $\frac{119}{8}=\frac{-10}{3}\left(y+\frac{7}{5}\right)-\frac{5}{2}$

$$120\left[\frac{119}{8}\right]=\left[\frac{-10}{3}\left(y+\frac{7}{5}\right)-\frac{5}{2}\right]120$$

$$1785=-400y-56-300$$

$$1785=-400y-356$$

$$2141=-400y$$

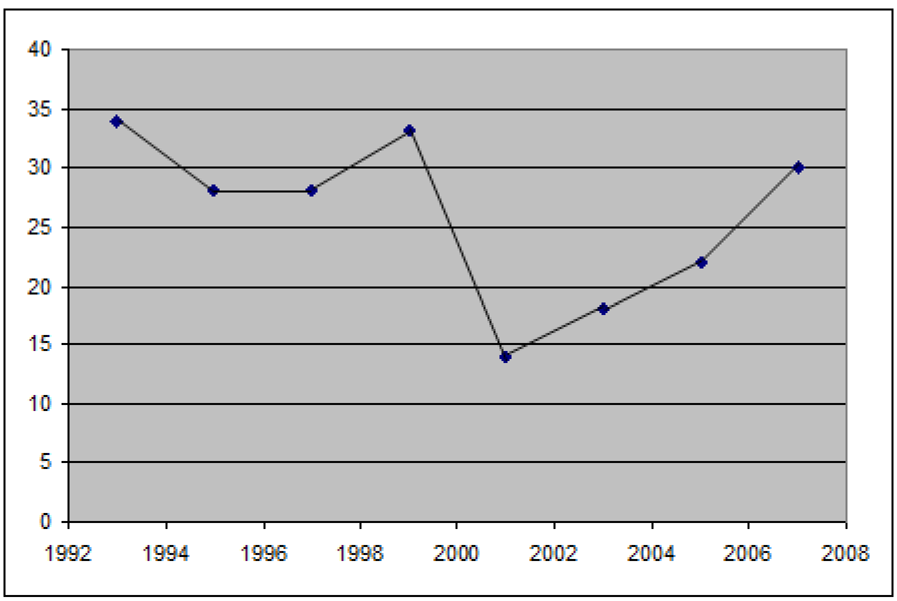
$$y=-5.3525$$

19. 45(1.15) = \$51.75. With sales tax, the total price is 51.75(1.08) = \$55.89.

20. $0.096=\frac{96}{1,000}=\frac{12}{125}$

21. This is direct variation because as one variable increases (or decreases), so will the other variable.

22. (a)



(b) There was a large decrease right before the turn of the century, but that number has steadily increased since.
(c) People might have been excited to see the new millennium, or the economy might have been doing really well during that period.
(d) In 2009, there will be approximately 35 – 40 homicides.

Lesson 5.8

1. This is false. Dimensional analysis does study space and time, but also could cover many other types of dimensions.

2. Identical units that are diagonal cancel out.

3. There are 5,280 feet in a mile.

4. $\frac{12 \text{ inches}}{1 \text{ foot}}\left(\frac{5,280 \text{ feet}}{1 \text{ mile}}\right) = 63,360 \text{ inches in 1 mile}$

5. $\frac{24 \text{ hours}}{1 \text{ day}}\left(\frac{3,600 \text{ seconds}}{1 \text{ hour}}\right) = 86,400 \text{ seconds in 1 day}$

6. $\frac{365 \text{ days}}{1 \text{ year}}\left(\frac{24 \text{ hours}}{1 \text{ day}}\right)\left(\frac{3,600 \text{ seconds}}{1 \text{ hour}}\right) = 31,536,000 \text{ seconds in 1 year}$

7. There are 660 feet in 1 furlong.

8. $\frac{12 \text{ inches}}{1 \text{ foot}}\left(\frac{3 \text{ feet}}{1 \text{ yard}}\right)100 \text{ yards} = 3,600 \text{ inches in 100 yards}$

9. $\left(\frac{2.54 \text{ centimeters}}{1 \text{ inch}}\right)5 \text{ inches} = 12.7 \text{ centimeters in 5 inches}$

10. $\left(\frac{1 \text{ meter}}{3.281 \text{ feet}}\right)90 \text{ feet} \approx 27.43 \text{ meters}$

11. $\left(\frac{1 \text{ meter}}{3.281 \text{ feet}}\right)\left(\frac{3 \text{ feet}}{1 \text{ yard}}\right)16 \text{ yards} \approx 14.63 \text{ meters}$

12. $\left(\frac{4.23 \text{ cups}}{1 \text{ liter}}\right)6 \text{ liters} \approx 25.38 \text{ cups}$

13. There are approximately 1.80 cubic inches in 1 ounce.

14. There are approximately 29.57 milliliters in 1 ounce, so $\left(\frac{29.57 \text{ milliliters}}{1 \text{ ounce}}\right)8 \text{ ounces} \approx 236.56 \text{ millilters}$

15. There are approximately 28.34 grams in 1 ounce.

$$\left(\frac{28.34\text{ grams}}{1\text{ ounce}}\right)\left(\frac{16\text{ ounces}}{1\text{ pound}}\right)100\text{ pounds} \approx 45,344\text{ grams}$$

16. $\left(\frac{15.432\text{ grains}}{1\text{ gram}}\right)25\text{ grams} = 385.8\text{ grains}$

17. $\left(\frac{68\text{ beats}}{1\text{ minute}}\right)\left(\frac{60\text{ minutes}}{1\text{ hour}}\right) = 4,080\text{ beats per hour}$

18. $\left(\frac{1\text{ fathom}}{6\text{ feet}}\right)\left(\frac{5,280\text{ feet}}{1\text{ mile}}\right)6.2\text{ miles} = 5,456\text{ fathoms}$

19. $\left(\frac{\$1.47}{1\text{ Pound sterling}}\right)\left(\frac{3.875\text{ litres}}{1\text{ gallon}}\right)\left(\frac{96.4\text{ Pounds sterling}}{1\text{ litre}}\right) = \$549.12/\text{gallon}$

20. $\left(\frac{186,000\text{ miles}}{1\text{ second}}\right)\left(\frac{3600\text{ seconds}}{1\text{ hour}}\right)\left(\frac{24\text{ hours}}{1\text{ day}}\right)\left(\frac{365\text{ days}}{1\text{ year}}\right) \approx 5.8657\times 10^{12}\text{ miles/year}$

21. $\left(\frac{63,240\text{ AU}}{1\text{ light-year}}\right)4.32\text{ light-years} = 273,196.8\text{ AU}$

22. $\left(\frac{43,560\text{ square feet}}{1\text{ acre}}\right)16\text{ acres} = 696,960\text{ square feet}$

23. $\left(\frac{1\text{ kilogram}}{2.205\text{ pounds}}\right)264\text{ pounds} \approx 119.728\text{ kilograms}$

24. $\left(\frac{65\text{ miles}}{1\text{ hour}}\right)\left(\frac{1.609344\text{ kilometers}}{1\text{ mile}}\right) \approx 104.607\text{ km/hr}$

25. $\left(\frac{1.805\text{ cubic inches}}{1\text{ ounce}}\right)32\text{ ounces} \approx 57.76\text{ cubic inches}$

26. $\left(\frac{28,000\text{ miles}}{1\text{ hour}}\right)\left(\frac{1\text{ hour}}{3600\text{ seconds}}\right)\left(\frac{5,280\text{ feet}}{1\text{ mile}}\right) \approx 41,066.7\text{ feet/second}$

27. $\left(\frac{14 \text{ days}}{1 \text{ fortnight}}\right)\left(\frac{24 \text{ hours}}{1 \text{ day}}\right) = 336$ hours in a fortnight

28. $\left(\frac{1 \text{ fortnight}}{14 \text{ days}}\right)\left(\frac{365 \text{ days}}{1 \text{ year}}\right) 2 \text{ years} \approx 52.14$ fortnights in 2 years

29. $32{,}000 \text{ pounds}\left(\frac{1 \text{ ton}}{2{,}000 \text{ pounds}}\right) = 16$ tons

30. Volume of a 2-liter bottle in pints = $2 \text{ liters}\left(\frac{1.06 \text{ quarts}}{1 \text{ liter}}\right)\left(\frac{2 \text{ pints}}{1 \text{ quart}}\right) = 4.24$ pints

Volume of 1 gallon of water in pints = $1 \text{ gallon}\left(\frac{8 \text{ pints}}{1 \text{ gallon}}\right) = 8$ pints

The human blood has the greatest volume.

31. $-2x + 8 = 8(1 - 4x)$
$-2x + 8 = 8 - 32x$
$\frac{30x}{30} = \frac{0}{30}$
$x = 0$

32. $3 - 2(5 - 8h) + 13h \cdot 3$
$3 - 10 + 16h + 39h$
$-7 + 55h$

33. $-26.375 - \left(-14\frac{1}{8}\right) = -26.375 + 14.125 = -12.25$

34. $-2\frac{3}{7} \bullet \frac{9}{10} = -\frac{17}{7} \bullet \frac{9}{10} = -\frac{153}{70}$ OR $-2\frac{13}{70}$

35. $\sqrt{80} = \sqrt{16 \bullet 5} = 4\sqrt{5}$

36. This number is not irrational because it is a repeating decimal. By definition, irrational numbers to do end or repeat.

37. The domain is {0, 1, 2, 3, 4, 5}.

38. The range is $\left\{\frac{1}{4}, \frac{1}{2}, 1, 2, 4, 8\right\}$.

39. The relation is a function.

40. The pattern is that for each increase of one in the domain, the range is halved.

Lesson 5.9 Chapter 5 Review

1. $y - y_1 = m(x - x_1)$

   $y - 4 = \frac{2}{3}(x - 3)$

   $y - 4 = \frac{2}{3}x - 2$

   $+ 4 \qquad + 4$

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

2. $y = -5x + 9$

3. $y - y_1 = m(x - x_1)$

   $y - 0 = -1(x - 6)$

   $y = -x + 6$

4. $m = \frac{6-1}{9-3.5} = \frac{5}{6.5} \approx 0.77$

   $y - y_1 = m(x - x_1)$

   $y - 6 = 0.77(x - 9)$

   $y - 6 = 0.77x - 6.93$

   $y = 0.77x - 0.93$

5. $y = 3x - 1$

6. $y + 4 = -\frac{1}{3}(x + 3)$

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

   $y + 4 = -\frac{1}{3}x - 7$

7. $m = \frac{-8-0}{9-0} = \frac{-8}{9} = -\frac{8}{9}$

   $y - y_1 = m(x - x_1)$

   $y = -\frac{8}{9}x$

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

9. $m = \frac{-3-2}{-6-5} = \frac{-5}{-11} = \frac{5}{11}$

$y - y_1 = m(x - x_1)$

$y - 2 = \frac{5}{11}x - 5$

$y = \frac{5}{11}x - 3$

10. $f(6) = 1$ means the function passes through (6, 1)

Therefore, $y - y_1 = m(x - x_1)$ becomes $y - 1 = 3(x - 6)$.

$y - 1 = 3x - 18$

$y = 3x - 17$

11. Two points on the function are (2, –5) and (–6, 3).

$m = \frac{3-(-5)}{-6-2} = \frac{8}{-8} = -1$

$y - y_1 = m(x - x_1)$

$y - 3 = -1(x + 6)$

$y - 3 = -x - 6$

$y = -x + 3$

12. $f(1) = 1$ means one point on the function is (1, 1).

Then $y - y_1 = m(x - x_1)$ becomes

$y - 1 = \frac{3}{8}(x - 1)$

$y - 1 = \frac{3}{8}x - \frac{3}{8}$

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

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

13. $y - y_1 = m(x - x_1)$

14. $y - y_1 = m(x - x_1)$

$y - 5 = \frac{1}{2}(x + 7)$

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

$y = \frac{1}{2}x + \frac{7}{2} + \frac{10}{2}$

$y = \frac{1}{2}x + \frac{17}{2}$

15. $y - y_1 = m(x - x_1)$

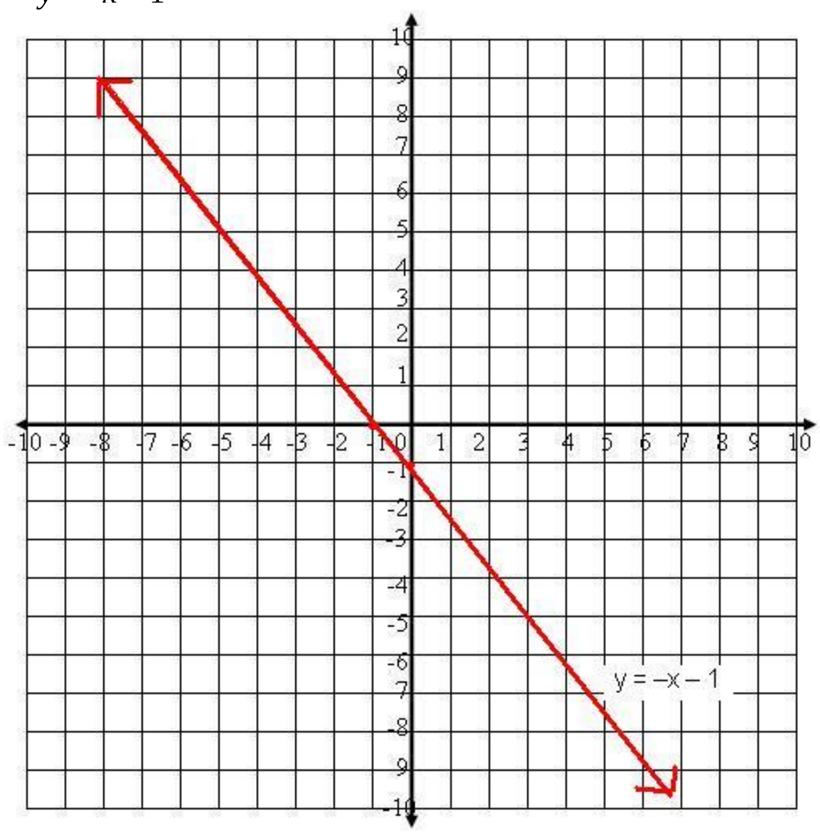
$y - 0 = 2(x - 7)$

$y = 2x - 14$

16. $y + 3 = -(x - 2)$

$y + 3 = -x + 2$

$y = -x - 1$

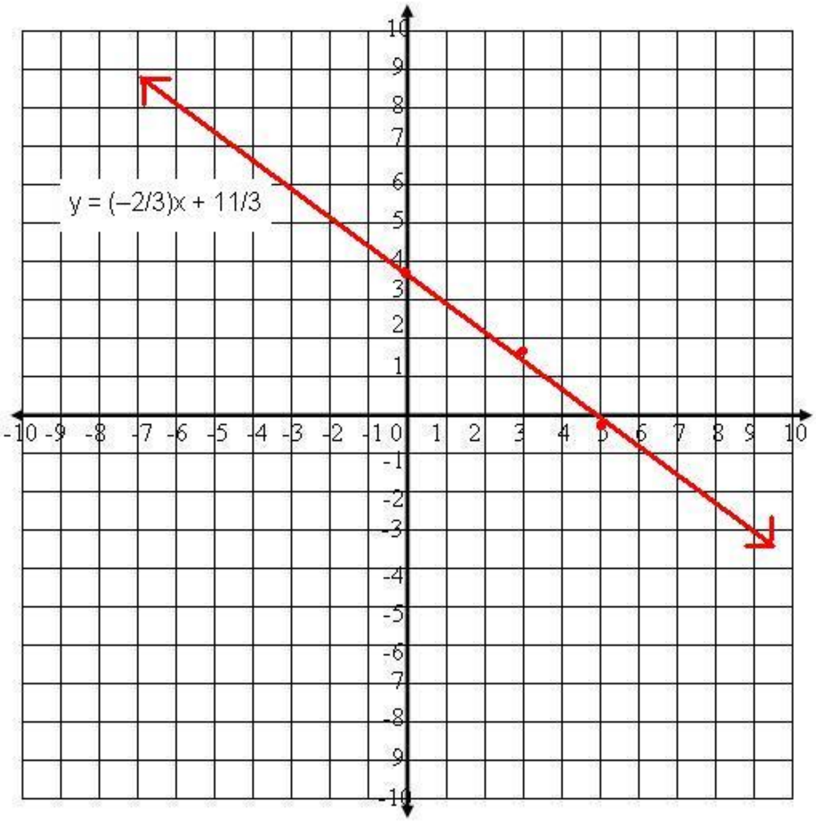


17. $y - 7 = \frac{-2}{3}(x + 5)$

$$y - 7 = -\frac{2}{3}x - \frac{10}{3}$$

$$y = -\frac{2}{3}x - \frac{10}{3} + \frac{21}{3}$$

$$y = -\frac{2}{3}x + \frac{11}{3}$$

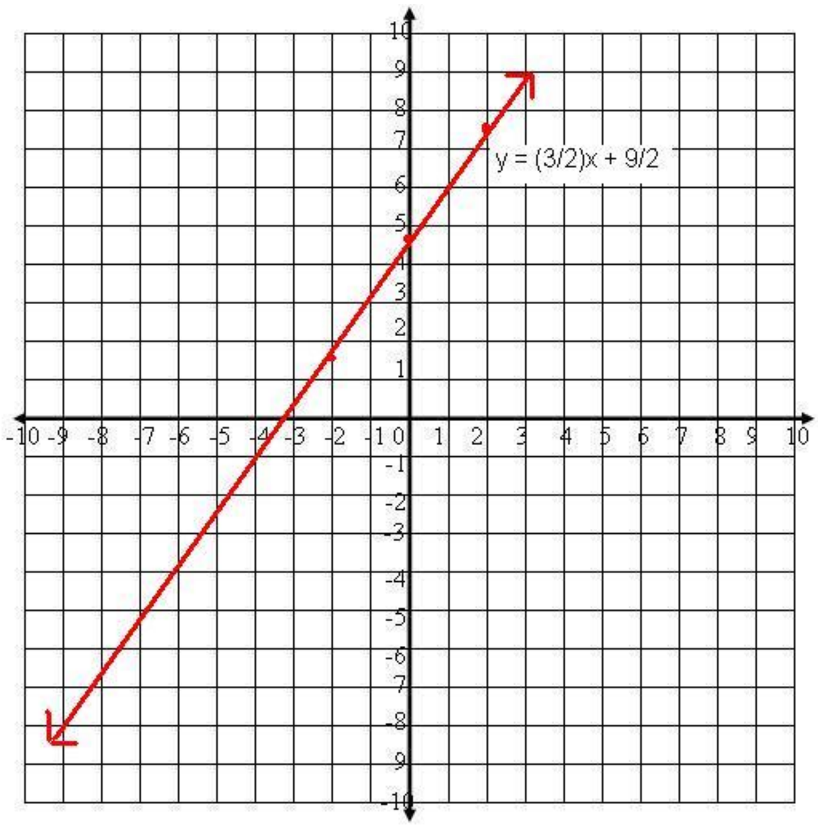


18. $y + 1.5 = \frac{3}{2}(x + 4)$

$y + 1.5 = \frac{3}{2}x + \frac{12}{2}$

$y = \frac{3}{2}x + \frac{12}{2} - \frac{3}{2}$

$y = \frac{3}{2}x + \frac{9}{2}$



19. Two points on the line are (1, –3) and (6, 0).

$m = \frac{0 - (-3)}{6 - 1} = \frac{3}{5}$

$y - y_1 = m(x - x_1)$

$y - 0 = \frac{3}{5}(x - 6)$

$y = \frac{3}{5}x - \frac{18}{5}$

20. Two points on the line are (9, 2) and (9, –5).

$$m = \frac{-5-2}{9-9} = \frac{-7}{0} = \text{undefined}$$

Since the slope is undefined, that means the *x*-value is always the same. Therefore, the equation is $x = 9$.

21. One point on the line is (2, 0), and the slope is $\frac{8}{3}$.

$y - y_1 = m(x - x_1)$

$y - 0 = \frac{8}{3}(x - 2)$

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

22. $y - 3 = \frac{-1}{4}(x + 4)$

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

$4(y - 3) = 4(-\frac{1}{4}x - 1)$

$4y - 12 = -1x - 4$

$x + 4y = 8$

23. $y = \frac{2}{7}(x - 21)$

$7(y) = 7[\frac{2}{7}(x - 21)]$

$7y = 2x - 42$

$-2x + 7y = -42$

$2x - 7y = 42$

24. $-3x - 25 = 5y$

$3x + 5y = -25$

25. Two points on the line are (0, –4) and (–1, 5).

$$m = \frac{5-(-4)}{-1-0} = \frac{9}{-1} = -9$$

$y - y_1 = m(x - x_1)$

$y + 4 = -9(x - 0)$

$y = -9x - 4$

$9x + y = -4$

26. $y - y_1 = m(x - x_1)$

$y - 2 = \frac{4}{3}(x - 3)$

$3(y - 2) = 3(\frac{4}{3}x - 4)$

$3y - 6 = 4x - 12$

$4x - 3y = 6$

27. The slope is 5, and the line passes through (5, 0).

$y - y_1 = m(x - x_1)$

$y - 0 = 5(x - 5)$

$y = 5x - 25$

$25 = 5x - y$

$5x - y = 25$

28. $7x + 5y = 16$

$5y = -7x + 16$

$y = \frac{-7x + 16}{5} = -\frac{7}{5}x + \frac{16}{5}$

Slope = $-\frac{7}{5}$; y-intercept = $\frac{16}{5}$

29. $7x - 7y = -14$

$-7y = -7x - 14$

$y = \frac{-7x - 14}{-7} = x + 2$

Slope = 1; y-intercept = 2

30. To determine if the lines are parallel or perpendicular, we need to find the slope of each line.

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

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

$y = -x + 10$

The slope of this line is –1.

$2x + 2y = 3$

$2y = -2x + 3$

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

The slope of the second line is –1. Since the lines have the same slope, the lines are parallel.

31. Since $x = 4$ is a vertical line, and $y = -2$ is horizontal, then the lines are perpendicular.

32. $2x + 8y = 26$

$8y = -2x + 26$

$$y = -\frac{2}{8}x + \frac{26}{8}$$

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

The slope of the first line is $-\frac{1}{4}$.

$x + 4y = 13$

$4y = -x + 13$

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

The slopes are the same, so one's first thought would be to say the lines are parallel. However, since the lines have the same y-intercept, then they are in fact the same line.

33. The slope of the given line is 3, so the slope of any line perpendicular to it must have a slope of $-\frac{1}{3}$. The line passes through (–5, 1), so we can determine the equation.

$y - y_1 = m(x - x_1)$

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

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

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

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

34. The slope of the given line is 1. Any line parallel to this line will have the same slope. The line passes through (–4, –4), so

$y - y_1 = m(x - x_1)$

$y + 4 = 1(x + 4)$

$y + 4 = x + 4$

$y = x$

35. We need to find the slope of the given line, $9x + 5y = 25$.

$9x + 5y = 25$

$5y = -9x + 25$

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

The slope of the given line is $-\frac{9}{5}$, so the slope of any line perpendicular to it must have a slope of $\frac{5}{9}$. The line passes through (–4, 4), so we can determine the equation.

$y - y_1 = m(x - x_1)$

$$y - 4 = \frac{5}{9}(x + 4)$$

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

$$y = \frac{5}{9}x + \frac{20}{9} + \frac{36}{9}$$

$$y = \frac{5}{9}x + \frac{56}{9}$$

36. The line $y = 5$ has zero slope. Therefore, a line parallel to the given line also has zero slope. The equation of the line parallel to the given line and that passes through (–7, 16) is $y = 16$.

37. The line $x = 0$ has an undefined slope. Parallel lines to this one also have undefined slope. The equation of the line parallel to the given line that passes through (4, 6) is $x = 4$.

38. The line $y = -2$ has zero slope. Therefore, the line perpendicular to the line must have an undefined slope. Only vertical lines have undefined slope. Therefore, the line perpendicular to the given line and passes through (10, 10) is $x = 10$.

39.

(a) Two points on the line are (65, 6) and (100, 8.25). The slope is

$$m = \frac{8.25 - 6}{100 - 65} = \frac{2.25}{35} \approx 0.064.$$

Then the equation is $y - 6 = 0.064(x - 65)$.

$y - 6 = 0.064x - 4.16$

$y = 0.064x + 2.16$

(b) The price to acquire the IP address is the y-intercept, which is \$2.16.

(c) The price per minute is the slope, so about 0.064, or 6.4¢ per minute.

40. (a) The slope is $\frac{1}{2}$, and the *y*-intercept is 5.

The equation is $y = \frac{1}{2}x + 5$.

(b) When y = 18, $y = \frac{1}{2}x + 5$ becomes $18 = \frac{1}{2}x + 5$

$13 = \frac{1}{2}x$

$x = 13(2) = 26$

It will take the plant 26 weeks to reach 18 inches.

41. Let *x* = the amount he paid for the television, and *y* = the amount he paid for the snake.

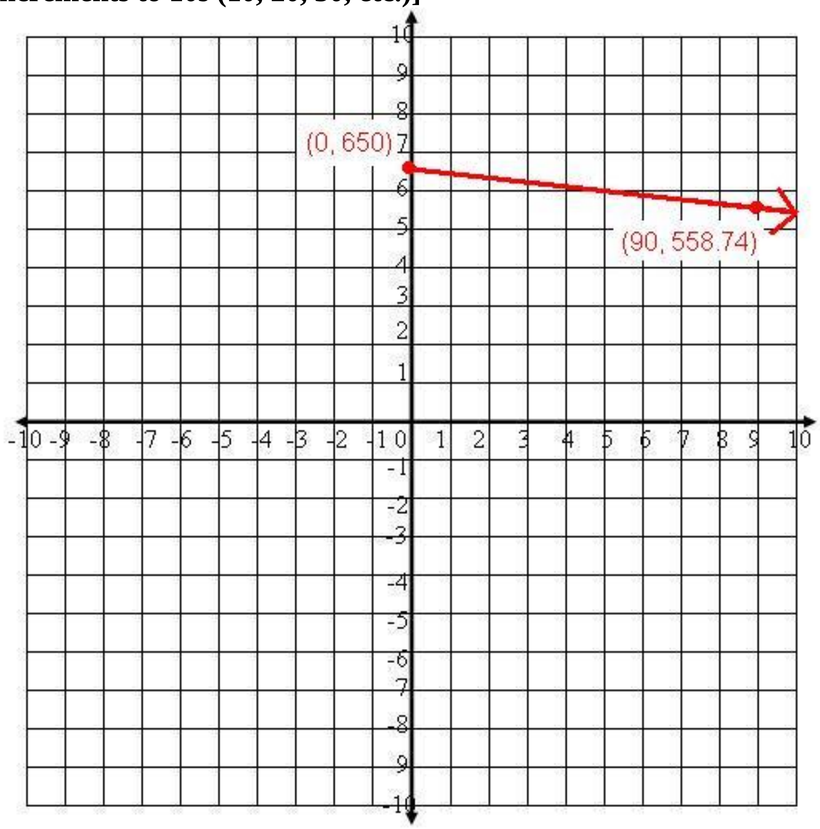
(a) 1.06*x* + 1.045*y* = 679.25

(b) 1.06*x* + 1.045*y* = 679.25

1.045*y* = –1.06*x* + 679.25

y = –1.014*x* + 650

[Note: change y-axis increments to 100s (100, 200, 300, etc.) and change x-axis increments to 10s (10, 20, 30, etc.)]



(c) Three possible solutions are (0, 650): *y* = –1.014(0) + 650 = 650,
(90, 558.74): *y* = –1.014(90) + 650 = 558.74, and
(200, 447.2): *y* = –1.014(200) + 650 = 447.2

42. (a) The slope is $-\frac{1}{4}$, and the y-intercept is 5. The equation is $y = -\frac{1}{4}x + 5$.

(b) We need to know when $y = 0$.

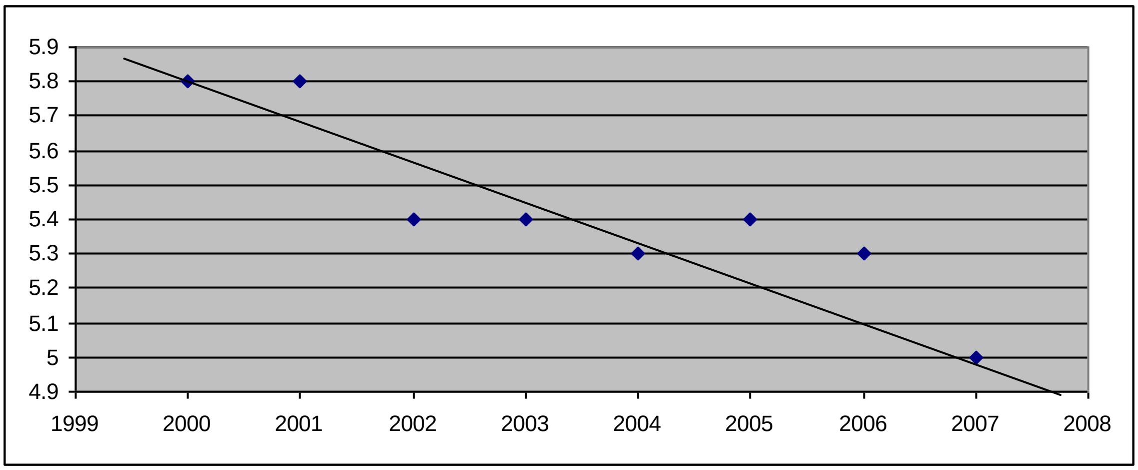
$$0 = -\frac{1}{4}x + 5$$

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

$$x = (-5)(-4) = 20$$

It will take 20 days to empty the bucket.

43. (a) and (b) The line of best fit is drawn on the graph.



(c) The line passes through (2000, 5.8) and (2007, 5).

$$m = \frac{5 - 5.8}{2007 - 2000} = \frac{-0.8}{7} \approx -0.114$$

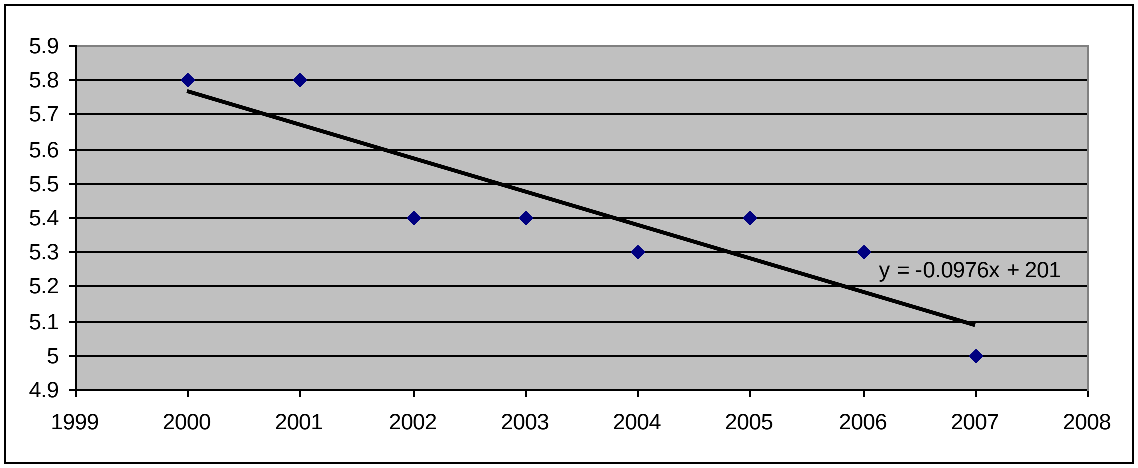
Then the equation is $y - 5 = -0.114(x - 2007)$

$y - 5 = -0.114x + 228.798$

$y = -0.114x + 233.798$

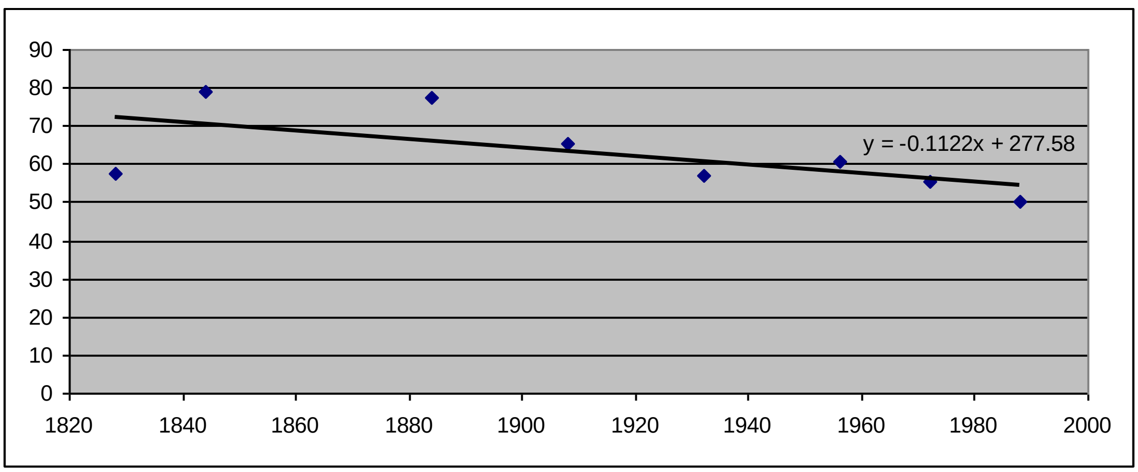
(d) $y = -0.114(2011) + 233.798 = y = -229.254 + 233.798 = 4.544$

(e)



From the computer-generated equation, the slope was close, but the *y*-intercept was not very close.

44. (a) and (b)



(c) $y = -0.1122(2008) + 277.58 = 52.28$

(d) The outliers are for the years 1844 and 1884. One reason could be that the elections right before and right after the Civil War has big implications.

45. (a) (4, 1600) and (5, 3200)

$$m = \frac{3200 - 1600}{5 - 4} = 1600$$

Then the equation is $y - 1600 = 1600(x - 4)$

$y - 1600 = 1600x - 6400$

$y = 1600x - 4800$

$y = 1600(4.25) - 4800 = 2000$

There should be about 2000 bacteria in 4.25 hours.

(b) The amount of bacteria doubles every hour. So, the next four hours will generate 12,800, 25,600, 51,200 and 102,400 bacteria.

(c) This data could not be represented by a line because the data does not increase at a linear rate.

46. $$3\text{ months}\left(\frac{30\text{ days}}{1\text{ month}}\right)\left(\frac{24\text{ hours}}{1\text{ day}}\right)\left(\frac{3600\text{ seconds}}{1\text{ hour}}\right) = 7,776,000\text{ seconds}$$

47. $$\left(\frac{1\text{ inch}}{2.54\text{ centimeters}}\right)\left(\frac{1000\text{ centimeters}}{1\text{ kilometer}}\right) = 393.7\text{ inches/kilometer}$$

48. $$\left(\frac{57.75\text{ cubic inches}}{1\text{ quart}}\right)\left(\frac{4\text{ quarts}}{1\text{ gallon}}\right) = 231\text{ cubic inches/gallon}$$

49. **[Note: It is not really possible to convert from meters to acres, but it is possible to convert from square meters to acres. That is what I have done.]**

$$\left(\frac{4046.86\text{ square meters}}{1\text{ acre}}\right)100\text{ acres} = 404,686\text{ square meters}$$

50. $$\left(\frac{6\text{ feet}}{1\text{ fathom}}\right)616\text{ fathoms} = 3,696\text{ feet}$$

Lesson 5.10 Chapter 5 Test

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

   $-2y = 3x + 4$

   $3x + 2y = -4$

2. The slope of the given line is $\frac{1}{3}$. So the slope of any line perpendicular to it will have a slope of –3. The line passes through (1, 2), so

   $y - 2 = -3x - 1$

   $y = -3x + 1$

3. $m = \frac{0.5 - 3}{-6 - 5} = \frac{-2.5}{-11} \approx 0.227$

   Then the equation is $y - 3 = 0.227(x - 5)$

   $y - 3 = 0.227x - 1.135$

4. $\left(\frac{80 \text{ miles}}{1 \text{ hour}}\right)\left(\frac{5280 \text{ feet}}{1 \text{ mile}}\right)\left(\frac{1 \text{ hour}}{3600 \text{ seconds}}\right) = 117.33 \text{ feet/second}$

5. $\left(\frac{1.61 \text{ kilometers}}{1 \text{ mile}}\right) 26.2 \text{ miles} = 42.182 \text{ kilometers}$

6. (a)

   Let r = the number of rooms. Then $5 - \frac{2}{3}r$.

   (b) $5 - \frac{2}{3}(7) = 4\frac{2}{3}$, so Lucas can paint 7 rooms before he runs out. He can start on an 8^{th}, but cannot finish.

7. The first line, $y = 3x - 1$ has a slope of 3 and a y-intercept of –1. The second line needs to be converted to slope-intercept form.

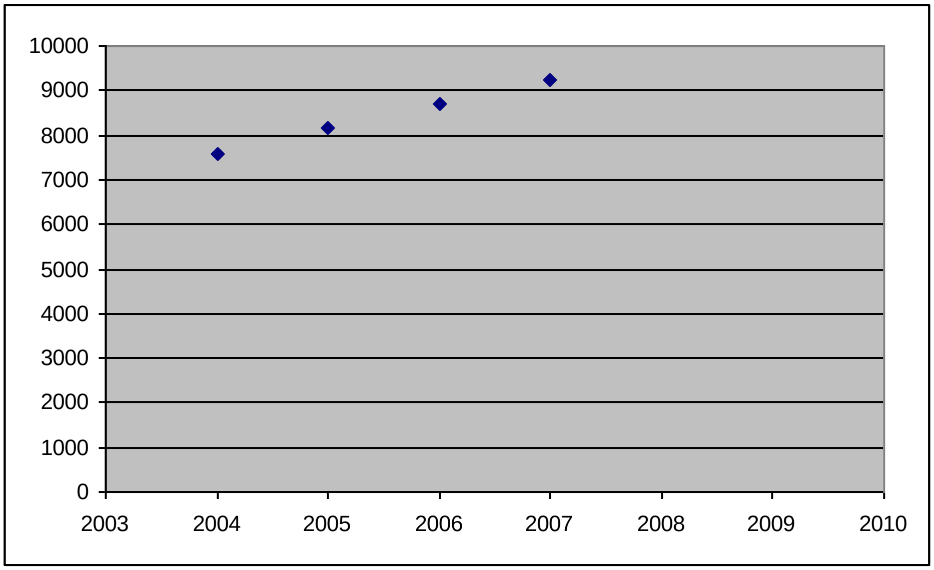
   $-x + 3y = 6$

   $3y = x + 6$

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

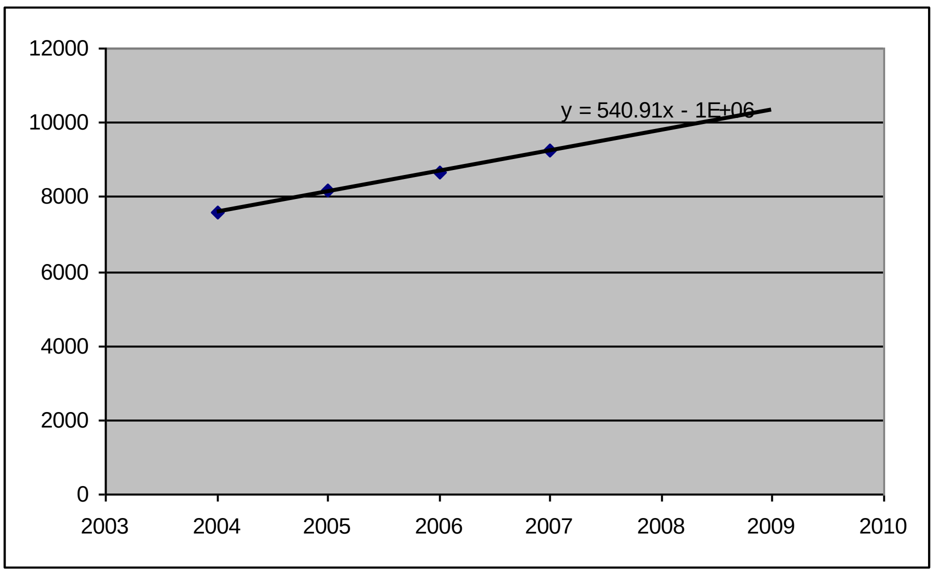
   The lines are neither parallel nor perpendicular.

8. (a)



(b) The average increase per year is about 550. So, in two years, the gross public debt will be about 9200 + 2(550) = 10,300.

(c) The equation is $y = 540.91x - 1{,}000{,}000$.

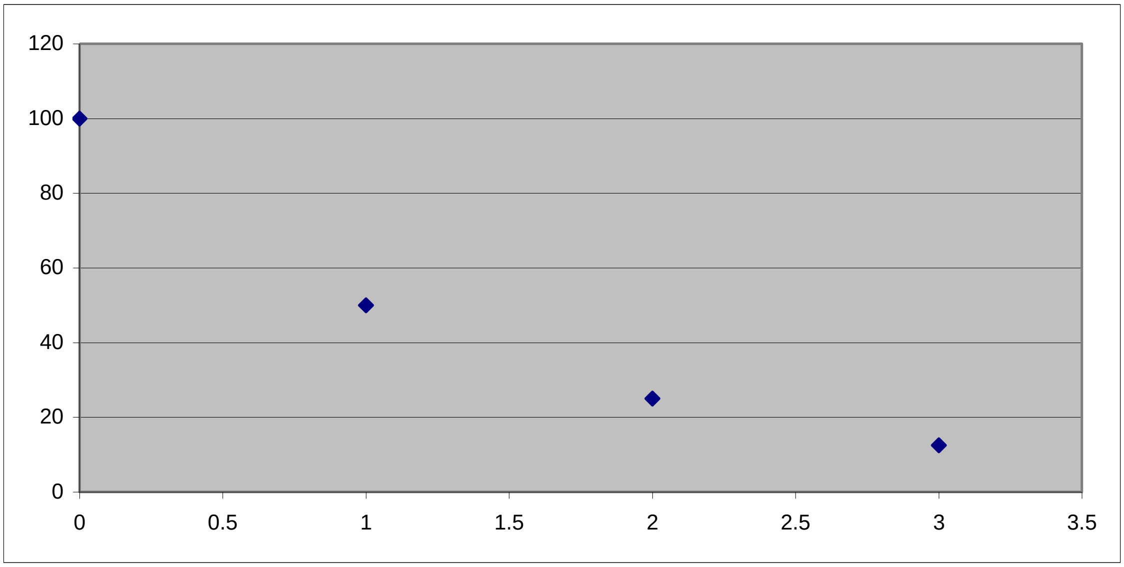


(d) $y = 540.91(2009) - 1{,}000{,}000 = 86{,}688.19$

(e) The extrapolation is much more accurate.

9. To interpolate a point, draw a line between the nearest data point to the left and the right of the desired data point. Then calculate the equation of the line by identifying the slope and using one of the given points.

10. (a)



(b) A linear regression line would not be the best way to represent the data because the points are not linear.

(c) $m = \frac{25-50}{2-1} = \frac{-25}{1} = -25$

Let p = percent remaining

$p - 50 = -25(h - 1)$

$p - 50 = -25h + 25$

$p = -25h + 75$

$p = -25(2.75) + 75 = -68.75 + 75 = 6.25$