INSTRUCTOR'S SOLUTIONS MANUAL

DIACRITECH

INTERMEDIATE ALGEBRA: FUNCTIONS AND AUTHENTIC APPLICATIONS

SIXTH EDITION

Jay Lehmann

College of San Mateo

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Contents

Chapter 5 Logarithmic Functions

Chapter 6 Polynomial Functions

Chapter 7 Quadratic Functions

Chapter 8 Rational Functions

Chapter 9 Radical Functions

Chapter 10 Sequences and Series

Chapter 11 Additional Topics

Appendix A Reviewing Prerequisite Material

Chapter 1
Linear Equations and Linear Functions

Homework 1.1

2. **a.** (c)

b. (b)

c. (a)

d. (d)

4. The more pencils there are to buy, the more the total cost. Total cost c is the response variable and the number of pencils n is the explanatory variable.

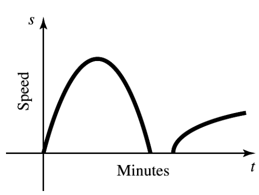
6. The greater the rate water is added to a pool, the less time it takes to fill the pool. The number of hours to fill a pool t is the response variable and the rate water is added r is the explanatory variable.

8. The older the car in years, the greater the annual cost of repairs. The number of annual cost of repairs c is the response variable and the age of a car a is the explanatory variable.

10. The hotter the temperature, the more people go to the beach. The number of people at the beach n is the response variable and the temperature at the beach F is the explanatory variable.

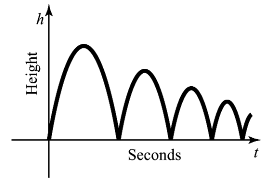
12. The greater your annual income, the more federal taxes you pay. The federal taxes T is the response variable and the person's annual income I is the explanatory variable.

14.



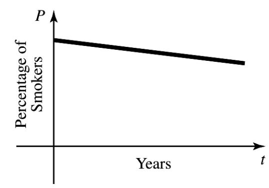
The response variable is s, the runner's speed, and the explanatory variable is t, time after she began her run. The graph shows her speed increases to a certain point and then decreases to a stop when $s = 0$. The rest of her time is spent walking at a moderate but slightly increasing speed.

16.



Height h is the response variable and time, t is the explanatory variable. The height of the tennis ball decreases as it drops. The height then increases after the ball bounces from $h = 0$. This pattern is repeated with the maximum height decreasing after each bounce until the ball stops at $h = 0$.

18.

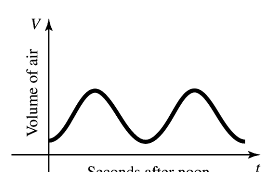


P, the percentage of smokers, is the response variable and t, time in years since 2010, is the explanatory variable. This graph shows that the percentage of smokers approximately steadily decreases as time increases from 2010.

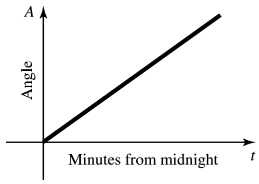
20.

The foreign born percentage, p, is the response variable and time since 1910, t, is the explanatory variable. The graph shows that the percentage of the U.S. population that is foreign born decreased from 1910 to 1970 and then increased over time.

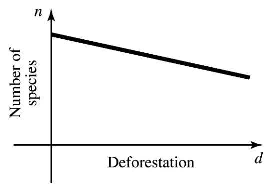
22.



Volume V is the response variable and time t is the explanatory variable. The graph shows the volume of air in a person's lungs alternately increases and decreases as air is taken in and out over time.

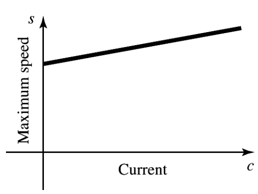
24. 

Angle A is the response variable and minutes t is the explanatory variable. The graph shows that as the number of minutes past midnight increases, the angle (in degrees) between the hour hand and the minute hand of a clock increases.

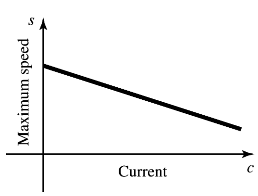
26. 

The response variable is n (species in existence) and the explanatory variable is d (amount of deforestation). The graph shows that the number of species in existence decreases steadily due to increased deforestation.

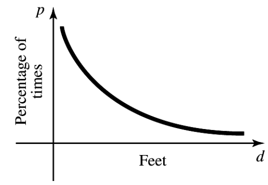
28. Speed, s, is the response variable and current in miles per hour, c, is the explanatory variable.

a. 

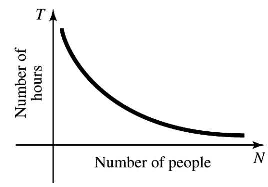
The graph shows that a speedboat travels faster downstream as the river current increases.

b. 

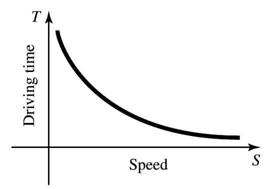
The graph shows that a speedboat travels slower upstream as the “opposing” river current increases.

30. 

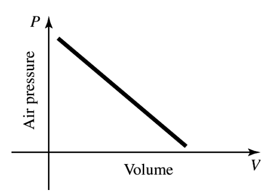
The percentage of times a person hits the bull’s-eye p is the response variable and the distance in feet from the dartboard d is the explanatory variable. The graph shows that as the distance in feet increases, the percentage of bull’s-eye hits decreases.

32. 

The number of hours to paint a house T is the response variable and the number of people on the painting crew N is the explanatory variable. The graph shows that as the number of people on the crew increases, the number of hours to paint decreases.

34. 

The driving time in hours T is the response variable and the speed in miles per hour the person drives S is the explanatory variable. The graph shows that as the speed in miles per hour increases, the driving time decreases.

36. 

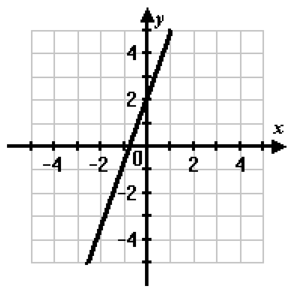
Pressure P is the response variable and volume V is the explanatory variable. The graph shows that pressure in the balloon is greater when the volume is lower.

38. An increasing curve can have at most two intercepts where it crosses each axis.

40. First, determine what the response variable is and place it on the vertical axis. Then place the explanatory variable on the horizontal axis. There is no need for scaling on these axes. Determine from the given situation how to describe the relationship between the two variables. Use this relationship to see if an increasing or decreasing line or curve is necessary. Note where a point of intersection is needed on one or both axes.

Homework 1.2

2.



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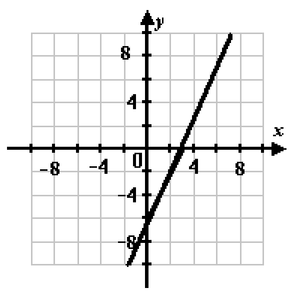

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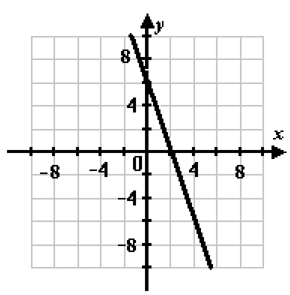

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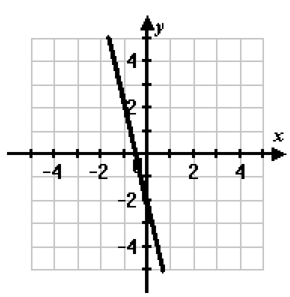

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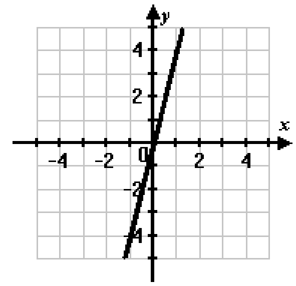

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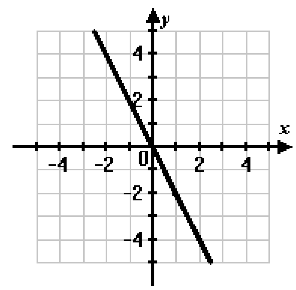

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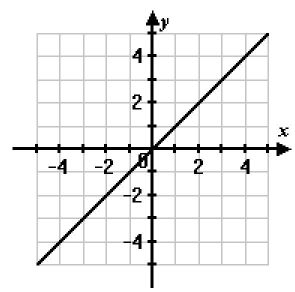
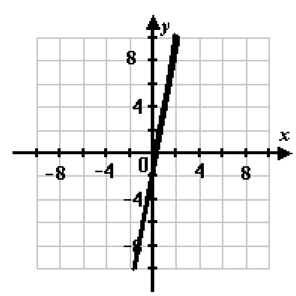


16.

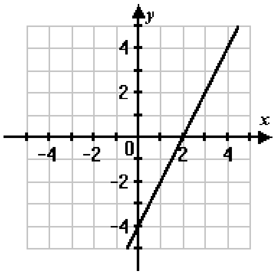
$$0 = 4y - 20x$$
$$\frac{20x}{4} = \frac{4y}{4}$$
$$5x = y$$



18. $10x - 5y = 20$

$$\frac{-5y}{-5} = \frac{-10x + 20}{-5}$$

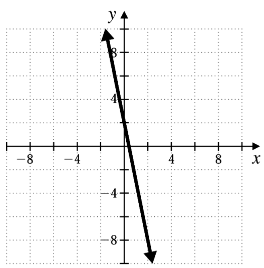
$$y = 2x - 4$$



20. $30x + 6y - 12 = 0$

$$\frac{6y}{6} = \frac{-30x + 12}{6}$$

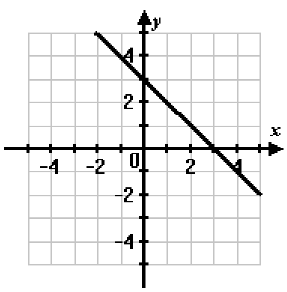
$$y = -5x + 2$$



22. $3y + 3x - 2 = 7$

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

$$y = -x + 3$$

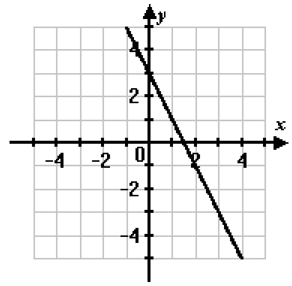


24. $6y - 4x - 1 = 7y - 2x - 4$

$$-y = 2x - 3$$

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

$$y = -2x + 3$$

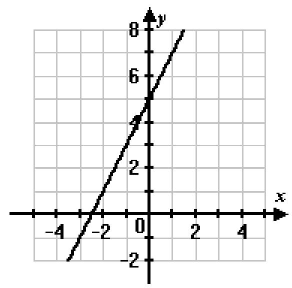


26. $2(y - 3) = 4(x + 1)$

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

$$\frac{2y}{2} = \frac{4x + 10}{2}$$

$$y = 2x + 5$$



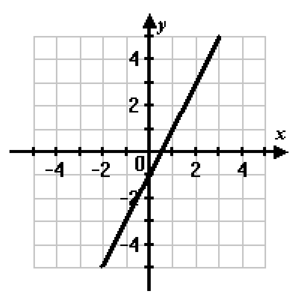
28. $5x - 2(3y - 1) = -2y - 3(x - 2)$

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

$$-6y + 2y = -3x - 5x + 4$$

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

$$y = 2x - 1$$



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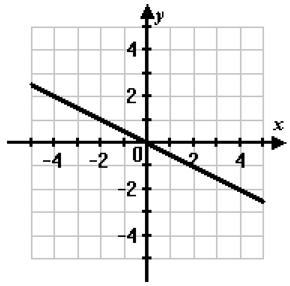

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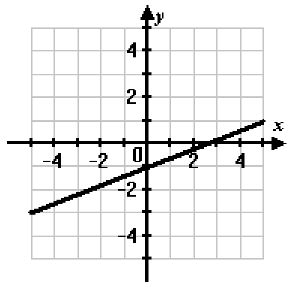

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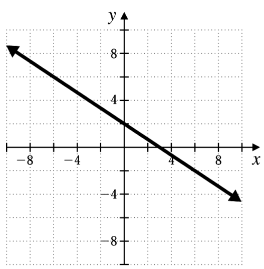
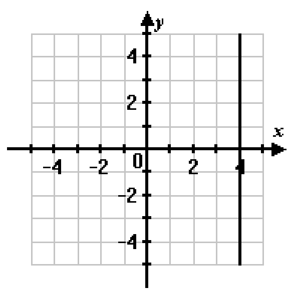
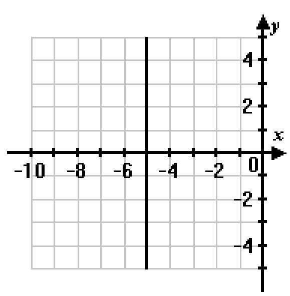


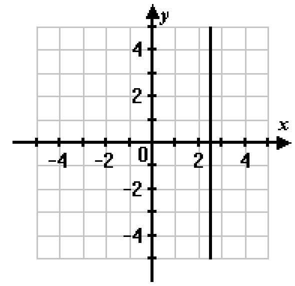
36. a. i.



ii.

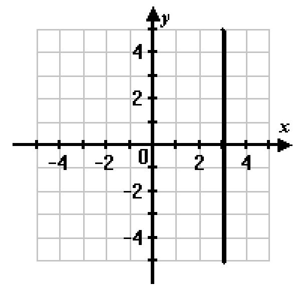


iii.



b. An equation of the form $x = a$ is a vertical line passing through $(a, 0)$.

38.



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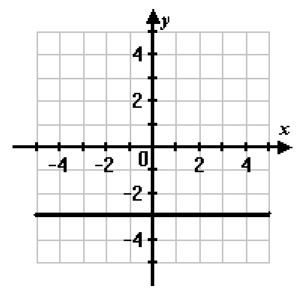
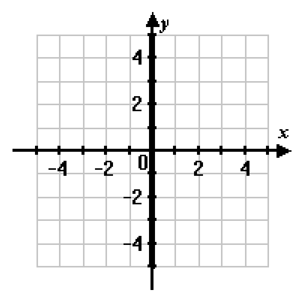


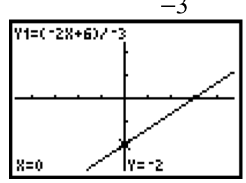
42.



44. $2x - 3y = 6$

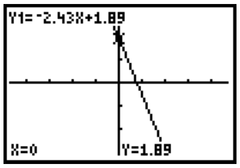
$$-3y = -2x + 6$$

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



(0, –2) is a point on the line.

$$\begin{aligned} 2x - 3y &= 6 \\ 2(0) - 3(-2) &\stackrel{?}{=} 6 \\ 0 + 6 &\stackrel{?}{=} 6 \\ 6 &\stackrel{?}{=} 6 \quad \text{true} \end{aligned}$$

46. a. 

b. Answers may vary. Example:

x	***y***
0	1.890
0.2	1.404
0.4	0.918
0.6	0.432
0.8	–0.054

48. $$\begin{aligned} 3 - 5x - 2 &= 4x + 9 - 7x \\ -5x + 1 &= -3x + 9 \\ \frac{-2x}{-2} &= \frac{8}{-2} \\ x &= -4 \end{aligned}$$

50. $$\begin{aligned} 4(2t - 1) &= -5t + 7 \\ 8t - 4 &= -5t + 7 \\ \frac{13t}{13} &= \frac{11}{13} \\ t &= \frac{11}{13} \end{aligned}$$

52. $$\begin{aligned} 7 - 2(5 - 4x) &= 3x - (8 - 3x) \\ 7 - 10 + 8x &= 3x - 8 + 3x \\ -3 + 8x &= 6x - 8 \\ \frac{2x}{2} &= \frac{-5}{2} \\ x &= -\frac{5}{2} \end{aligned}$$

54. $$\begin{aligned} -4(a + 6) + 5(a - 3) &= 3(a - 1) \\ -4a - 24 + 5a - 15 &= 3a - 3 \\ a - 39 &= 3a - 3 \\ \frac{-2a}{-2} &= \frac{36}{-2} \\ a &= -18 \end{aligned}$$

56. $$\begin{aligned} \frac{1}{3}x - \frac{1}{4} &= \frac{2}{3} \\ 12\left(\frac{1}{3}x - \frac{1}{4}\right) &= 12\left(\frac{2}{3}\right) \\ 4x - 3 &= 8 \\ \frac{4x}{4} &= \frac{11}{4} \\ x &= \frac{11}{4} \end{aligned}$$

58. $$\begin{aligned} -\frac{3}{4}w - \frac{5}{8} &= \frac{3}{2}w + \frac{1}{4} \\ 8\left(-\frac{3}{4}w - \frac{5}{8}\right) &= 8\left(\frac{3}{2}w + \frac{1}{4}\right) \\ -6w - 5 &= 12w + 2 \\ \frac{-18w}{-18} &= \frac{7}{-18} \\ w &= -\frac{7}{18} \end{aligned}$$

60. $$\begin{aligned} -6.54x + 87.35 &= -4.66x - 99.03 \\ \frac{-1.88x}{-1.88} &= \frac{-186.38}{-1.88} \\ x &\approx 99.14 \end{aligned}$$

62. $$\begin{aligned} ax + by &= c \\ \frac{by}{b} &= \frac{c - ax}{b} \\ y &= \frac{c - ax}{b} \end{aligned}$$

64. $$\begin{aligned} \frac{x}{a} + \frac{y}{a} &= 1 \\ a\left(\frac{x}{a} + \frac{y}{a}\right) &= a(1) \\ x + y &= a \\ y &= a - x \end{aligned}$$

66. $y = -3x - 12$

To find the x-intercept, let $y = 0$ and solve for x.

$$\begin{aligned} 0 &= -3x - 12 \\ 12 &= -3x \\ -4 &= x \end{aligned}$$

The x-intercept is (–4, 0). To find the y-intercept, let $x = 0$ and solve for y.

$$y = -3(0) - 12 = 0 - 12 = -12$$

The y-intercept is (0, –12).

68. $5x - 4y = 20$

To find the x-intercept, let $y = 0$ and solve for x.

$$\begin{aligned}5x-4(0)&=20\\5x-0&=20\\5x&=20\\x&=4\end{aligned}$$

The x-intercept is (4, 0). To find the y-intercept, let $x = 0$ and solve for y.

$$\begin{aligned}5(0)-4y&=20\\0-4y&=20\\-4y&=20\\y&=-5\end{aligned}$$

The y-intercept is (0, –5).

70. $y=-2x$

To find the x-intercept, let $y = 0$ and solve for x.

$$\begin{aligned}0&=-2x\\0&=x\end{aligned}$$

The x-intercept is (0, 0). This is also the y-intercept.

72. $x=-2$

Since $x = -2$ is a vertical line, it never intersects the y-axis. Therefore, there is no y-intercept.
Since the graph passes through (–2, 0), this is the x-intercept.

74. $ax+by=c$

To find the x-intercept, let $y = 0$ and solve for x.

$$\begin{aligned}ax+b(0)&=c\\ax&=c\\x&=\frac{c}{a}\end{aligned}$$

The x-intercept is $\left(\frac{c}{a},0\right)$.

To find the y-intercept, let $x = 0$ and solve for y.

$$\begin{aligned}a(0)+by&=c\\by&=c\\y&=\frac{c}{b}\end{aligned}$$

The y-intercept is $\left(0,\frac{c}{b}\right)$.

76. $a(x-by)=c$

To find the x-intercept, let $y = 0$ and solve for x.

$$\begin{aligned}a(x-b\cdot 0)&=c\\ax&=c\\x&=\frac{c}{a}\end{aligned}$$

The x-intercept is $\left(\frac{c}{a},0\right)$.

To find the y-intercept, let $x = 0$ and solve for y.

$$\begin{aligned}a(0-by)&=c\\-aby&=c\\y&=-\frac{c}{ab}\end{aligned}$$

The y-intercept is $\left(0,-\frac{c}{ab}\right)$.

78. $ay=b(c+dx)$

To find the x-intercept, let $y = 0$ and solve for x.

$$\begin{aligned}a(0)&=b(c+dx)\\0&=bc+bdx\\-bdx&=bc\\x&=-\frac{c}{d}\end{aligned}$$

The x-intercept is $\left(-\frac{c}{d},0\right)$.

To find the y-intercept, let $x = 0$ and solve for y.

$$\begin{aligned}ay&=b(c+d\cdot 0)\\ay&=bc\\y&=\frac{bc}{a}\end{aligned}$$

The y-intercept is $\left(0,\frac{bc}{a}\right)$.

80. $\frac{y-b}{m}=x$

To find the x-intercept, let $y = 0$ and solve for x.

$$\begin{aligned}\frac{(0)-b}{m}&=x\\\frac{-b}{m}&=x\end{aligned}$$

The x-intercept is $\left(\frac{-b}{m},0\right)$.

To find the y-intercept, let $x = 0$ and solve for y.

$$\begin{aligned}\frac{y-b}{m}&=0\\y-b&=0\\y&=b\end{aligned}$$

The y-intercept is (0, b).

82. Answers may vary. Example:

x	y
–3	–3
0	–1
1.5	0
3	1
6	3

84. $x=2$

86. $y = 1$

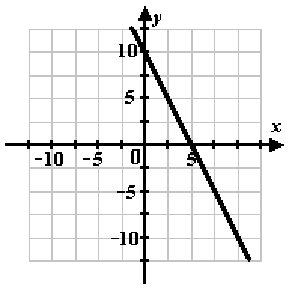
88. $y \approx -\frac{1}{2}$

90. $x = 8$

92. $x = -6$

94. $x \approx -1$

96. **a.**



b. To find the y-intercept, let $x = 0$ and solve for y.
$y = -2(0) + 10 = 0 + 10 = 10$
The y-intercept is (0, 10). This means that there are 10 gallons of gas in the tank at the time of refueling.

c. To find the x-intercept, let $y = 0$ and solve for x.
$$0 = -2x + 10$$
$$2x = 10$$
$$x = 5$$
The x-intercept is (5, 0). This means that when 5 hours have passed since filling the tank, the tank will be empty.

98. The graph of $y + x^2 = 5x + x^2 + 1$ is a line. When combining like terms, note that the equation becomes $y = 5x + 1$. The x^2 term cancels out. It is now an equation in the form $y = mx + b$.

100. Since (2, 11) is a point on the graph of the equation $y = mx + 3$, (2, 11) satisfies the equation. Substitute $x = 2$ and $y = 11$ into $y = mx + 3$ and solve for m.
$$11 = m(2) + 3$$
$$8 = 2m$$
$$4 = m$$
Therefore, $m = 4$ in $y = mx + 3$.

102. **a.** Points A and F satisfy the equation $y = ax + b$ since these points lie on the line for this equation.

b. Points D and F satisfy the equation $y = cx + d$ since these points lie on the line for this equation.

c. Point F satisfies both equations since it lies on both lines. It lies at the point where the lines intersect.

d. Points B, C, and E do not satisfy either equation since they do not lie on either line.

104. The y-coordinate of the x-intercept is 0 because the x-intercept is a point on the x-axis. All points on the x-axis have a y-coordinate equal to 0. The x-coordinate of the y-intercept is 0 because the y-intercept is a point on the y-axis. All points on the y-axis have an x-coordinate equal to 0.

106. No, every line does not have an x-intercept. Answers may vary. Example:
Most horizontal lines do not have x-intercepts. For example, the line $y = 1$. does not have an x-intercept.

Homework 1.3

2. $m_A = \frac{2500}{8000} = 0.3125$
$m_B = \frac{3100}{9500} \approx 0.326$
Airplane B is making a steeper climb than airplane A.

4. The slope of the ski run from the top of the mountain to the chairlift is $\frac{|-100|}{400} = \frac{1}{4}$. If the vertical distance from the top of the mountain to the chairlift is 100 yards and the vertical distance for the entire run is 415 yards, then the vertical distance from the chairlift to the restaurant is 415 – 100 = 315 yards. Also, since the horizontal distance from the top of the mountain to the chairlift is 400 yards and the horizontal distance for the entire run is 1300 yards, the horizontal distance from the chairlift to the restaurant is 1300 – 400 = 900 yards. Therefore, the slope of the ski run from the chairlift to the restaurant is
$\frac{|-315|}{900} = \frac{315}{900}$ or $\frac{7}{20}$.

6. $m = \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{8-4}{1-5} = \dfrac{4}{-4} = -1$
Since m is negative 1, the line is decreasing.

8. $m = \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{6-(-2)}{2-8} = \dfrac{8}{-6} = -\dfrac{4}{3}$
Since m is negative $\dfrac{4}{3}$, the line is decreasing.

10. $m = \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{6-(-10)}{-3-1} = \dfrac{16}{-4} = -4$
Since m is negative 4, the line is decreasing.

12. $m = \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{-3-(-9)}{2-6} = \dfrac{6}{-4} = -\dfrac{3}{2}$
Since m is negative $\dfrac{3}{2}$, the line is decreasing.

14. $m = \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{-12-(-2)}{-1-7} = \dfrac{-10}{-8} = \dfrac{5}{4}$
Since m is positive $\dfrac{5}{4}$, the line is increasing.

16. $m = \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{-6-(-5)}{-1-(-2)} = \dfrac{-6+5}{-1+2} = \dfrac{-1}{1} = -1$
Since m is negative 1, the line is decreasing.

18. $m = \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{100-0}{100-0} = \dfrac{100}{100} = 1$
Since m is positive 1, the line is increasing.

20. $m = \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{-1-(-1)}{-3-5} = \dfrac{0}{-8} = 0$
Since m is zero, the line is horizontal.

22. $m = \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{-1-8}{4-4} = \dfrac{-9}{0} = \text{undefined}$
Since m is undefined, the line is vertical.

24. $m = \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{0-(-3)}{-6-0} = \dfrac{3}{-6} = -\dfrac{1}{2}$
Since m is negative $\dfrac{1}{2}$, the line is decreasing.

26. $m = \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{-7.6-2.2}{-5.1-(-3.9)} = \dfrac{-9.8}{-1.2} = 8.17$
Since m is positive 8.17, the line is increasing.

28. $m = \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{82.78-(-66.66)}{-25.41-(-11.26)} = \dfrac{149.44}{-14.15}$
$= -10.56$
Since m is negative 10.56, the line is decreasing.

30. The points (0, 4) and (–2, 1) lie on the line.
$m = \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{4-1}{0-(-2)} = \dfrac{3}{2}$
The slope of the line is $\dfrac{3}{2}$.

32. Since $m_2 = m_1$, the lines are parallel.

34. Since $m_2 = -\dfrac{1}{m_1}$, the lines are perpendicular.

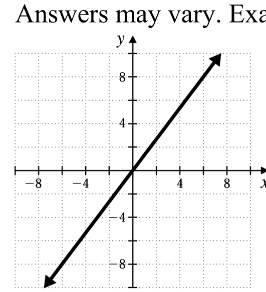
36. Since $m_2 = -\dfrac{1}{m_1}$, the lines are perpendicular.

38. Since $m_2 = m_1$, the lines are parallel.

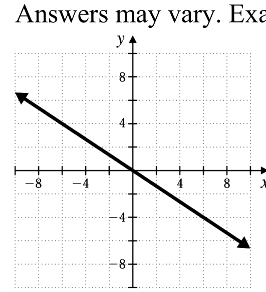
40. Since m_1 and m_2 are undefined, l_1 and l_2 are vertical lines. Vertical lines are parallel.

42. The two lines are not parallel, since their slopes, $\dfrac{1}{3}$ and $\dfrac{3}{10}$, are not equal.

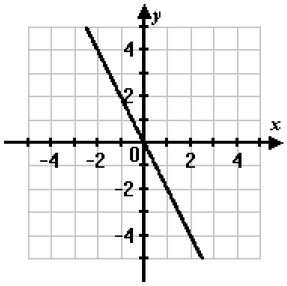
44. Answers may vary. Example:



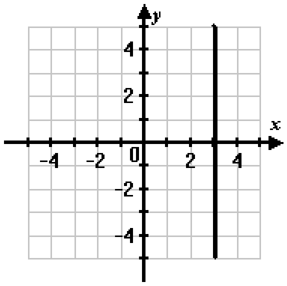
46. Answers may vary. Example:



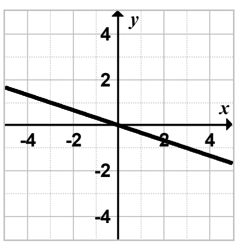
48. Answers may vary. Example:



50. Answers may vary. Example:



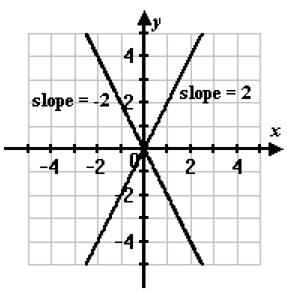
52.



Answers may vary. Example:

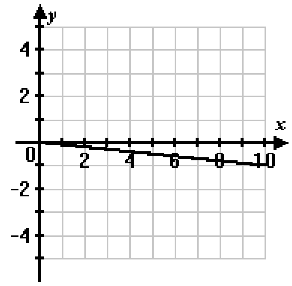
Since $\frac{-2}{6}=-\frac{1}{3}$ and $\frac{1}{-3}=-\frac{1}{3}$, the slopes are the same. Both lines have the same slope and the same y-intercept, so they must be the same line.

54. Answers may vary. Example:



The lines have the same steepness.

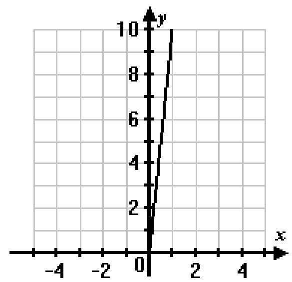
56. Answers may vary. Example:



The points (0, 0) and (10, −1) are on the line and can be used to find the slope.

$$m=\frac{y_2-y_1}{x_2-x_1}=\frac{-1-0}{10-0}=\frac{-1}{10}=-\frac{1}{10}$$

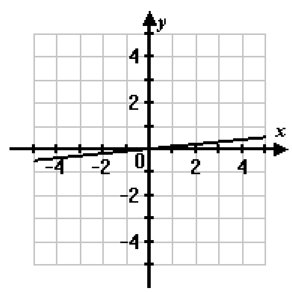
58. Answers may vary. Example:



The points (0, 0) and (1, 10) are on the line and can be used to find the slope.

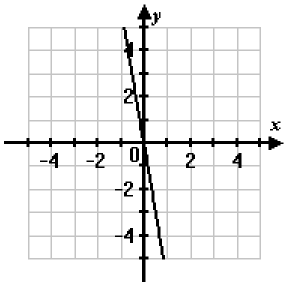
$$m=\frac{y_2-y_1}{x_2-x_1}=\frac{10-0}{1-0}=\frac{10}{1}=10$$

60. Answers may vary. Example:



The line must be increasing and almost horizontal.

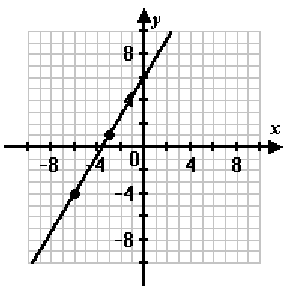
62. Answers may vary. Example:



The line must be decreasing and almost vertical.

64. The student exchanged y_1 with y_2 in calculating the slope. The correct slope is negative instead of positive since
$m = \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{1-9}{7-2} = \dfrac{-8}{5} = -\dfrac{8}{5}$.

66.



Answers may vary. Example:
Three points that lie on the line are (3, 11), (0, 6), and (–9, –9) since the line equation is
$y = \dfrac{5}{3}x + 6$.

68. **a.** $m = \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{5-3}{7-2} = \dfrac{2}{5}$

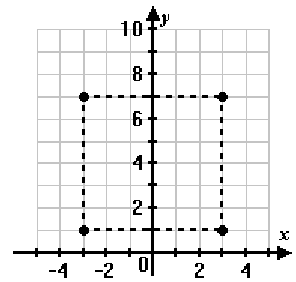
b. $m = \dfrac{y_1 - y_2}{x_1 - x_2} = \dfrac{3-5}{2-7} = \dfrac{-2}{-5} = \dfrac{2}{5}$

c. The results are the same. It does not matter which point is taken first.

d.
$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{y_1 - y_2}{x_1 - x_2}$$
$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{y_2 - y_1}{x_2 - x_1} \cdot \frac{-1}{-1}$$
$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{y_2 - y_1}{y_2 - y_1} \cdot 1$$
$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{y_2 - y_1}{y_2 - y_1}$$

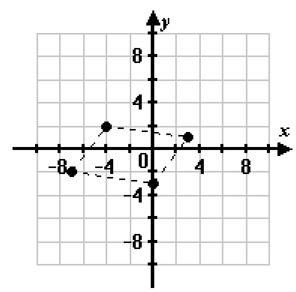
e. It does not matter which point is used first and which point is used second. The slope will be the same regardless of which point is considered first.

70. **a.**

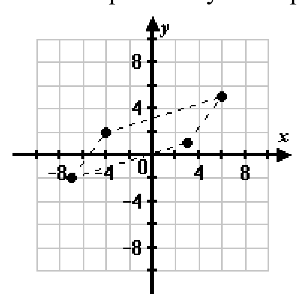


There are two possibilities for the other two vertices, since the figure is a square and sides must have equal length. The coordinates for the vertices are (–3, 1) and (–3, 7). Another possibility is (9, 1) and (9, 7).

b. One possibility is the point (0, –3).

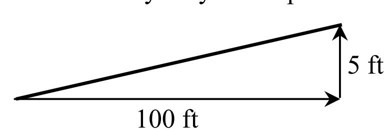


A second possibility is the point (6, 5).



Another possibility is (−14, −1).

72. Answers may vary. Example:

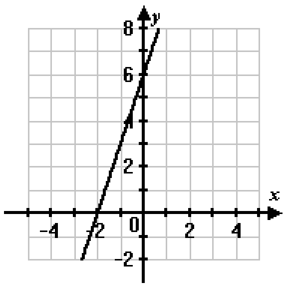


Road with 5% grade

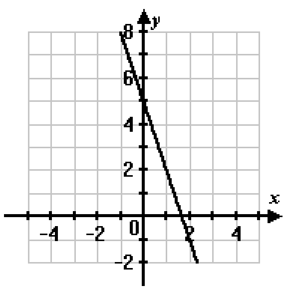
74. Answers may vary.

Homework 1.4

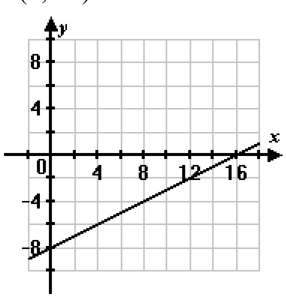
2. Since $y = 3x + 6$ is in the form $y = mx + b$, the slope is $m = 3 = \frac{3}{1} = \frac{\text{rise}}{\text{run}}$, and the y-intercept is (0, 6).



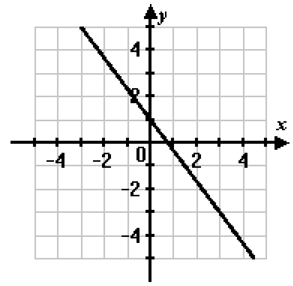
4. Since $y = -3x + 5$ is in the form $y = mx + b$, the slope is $m = -3 = \frac{-3}{1} = \frac{\text{rise}}{\text{run}}$, and the y-intercept is (0, 5).



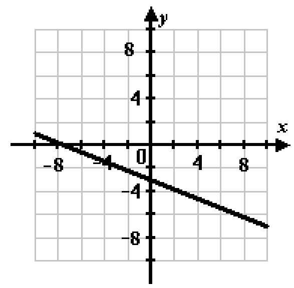
6. Since $y = \frac{1}{2}x - 8$ is in the form $y = mx + b$, the slope is $m = \frac{1}{2} = \frac{\text{rise}}{\text{run}}$, and the y-intercept is (0, −8).



8. Since $y = -\frac{4}{3}x + 1$ is in the form $y = mx + b$, the slope is $m = -\frac{4}{3} = \frac{-4}{3} = \frac{\text{rise}}{\text{run}}$, and the y-intercept is (0, 1).



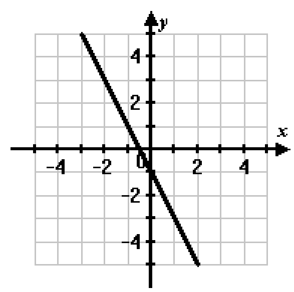
10. Since $y = -\frac{2}{5}x - 3$ is in the form $y = mx + b$, the slope is $m = -\frac{2}{5} = \frac{-2}{5} = \frac{\text{rise}}{\text{run}}$, and the y-intercept is $(0, -3)$.



12. First, rewrite $2x + y = -1$ in slope–intercept form.

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

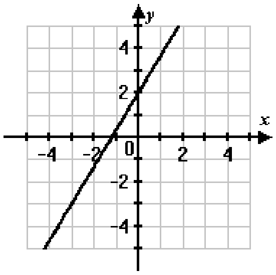
The slope is $m = -2 = \frac{-2}{1} = \frac{\text{rise}}{\text{run}}$, and the y-intercept is $(0, -1)$.



14. First, rewrite $3y - 5x = 6$ in slope–intercept form.

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

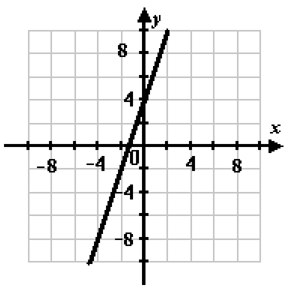
The slope is $m = \frac{5}{3} = \frac{\text{rise}}{\text{run}}$ and the y-intercept is (0, 2).



16. First, rewrite $2(y-3x)=8$ in slope–intercept form.

$$\begin{aligned} 2(y-3x) &= 8 \\ 2y-6x &= 8 \\ 2y &= 8+6x \\ y &= 4+3x \end{aligned}$$

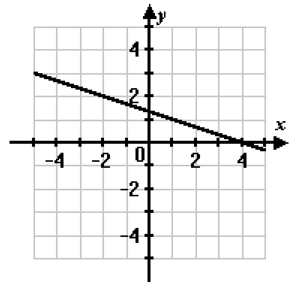
The slope is $m = 3 = \frac{3}{1} = \frac{\text{rise}}{\text{run}}$, and the y-intercept is $(0,4)$.



18. First, rewrite $-5x-15y+23=3$ in slope–intercept form.

$$\begin{aligned} -5x-15y+23 &= 3 \\ -5x-15y &= -20 \\ -15y &= 5x-20 \\ y &= -\frac{1}{3}x+\frac{4}{3} \end{aligned}$$

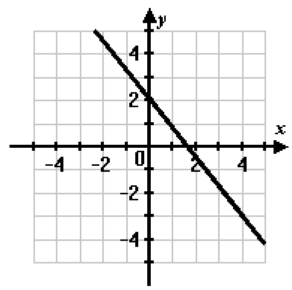
The slope is $m = -\frac{1}{3} = \frac{-1}{3} = \frac{\text{rise}}{\text{run}}$, and the y-intercept is $\left(0,\frac{4}{3}\right)$.



20. First, rewrite $3y-6x+2=7y-x-6$ in slope–intercept form.

$$\begin{aligned} 3y-6x+2 &= 7y-x-6 \\ -4y &= 5x-8 \\ y &= -\frac{5}{4}x+2 \end{aligned}$$

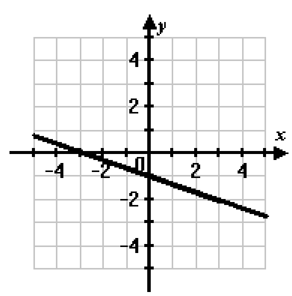
The slope is $m = -\frac{5}{4} = \frac{-5}{4} = \frac{\text{rise}}{\text{run}}$, and the y-intercept is $(0,2)$.



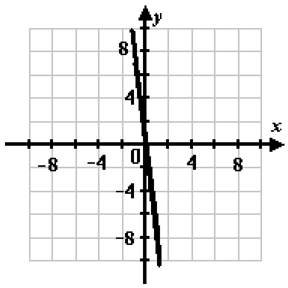
22. First, rewrite $8-2(y-3x)=2+4(x-2y)$ in slope–intercept form.

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

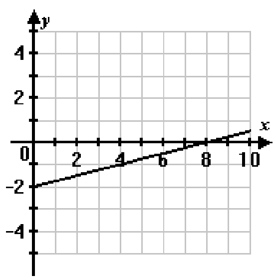
The slope is $m = -\frac{1}{3} = \frac{-1}{3} = \frac{\text{rise}}{\text{run}}$, and the y-intercept is $(0,-1)$.



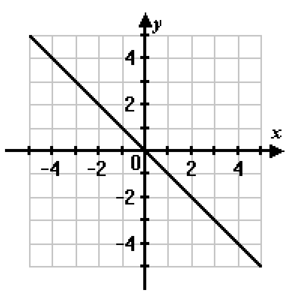
24. Rewrite $y = -7x$ as $y = -7x + 0$ to obtain slope–intercept form. The slope is $m = -7 = \frac{-7}{1} = \frac{\text{rise}}{\text{run}}$, and the y-intercept is $(0, 0)$.



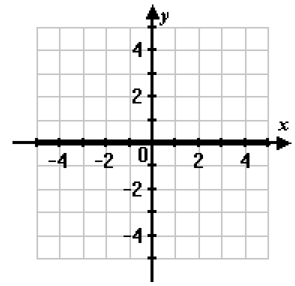
26. Since $y = 0.25x - 2$ is in the form $y = mx + b$, the slope is $m = 0.25 = \frac{1}{4} = \frac{\text{rise}}{\text{run}}$, and the y-intercept is $(0, -2)$.



28. Rewrite $y = -x$ as $y = -1x + 0$ to obtain slope–intercept form. The slope is $m = -1 = \frac{-1}{1} = \frac{\text{rise}}{\text{run}}$, and the y-intercept is $(0, 0)$.



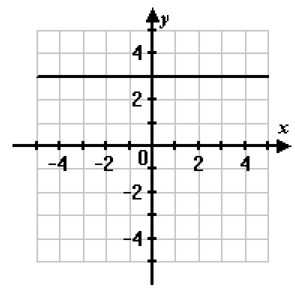
30. The linear equation $y = 0$ is a horizontal line. The slope of a horizontal line is $m = 0$. Since this is the equation of the x-axis, there are an infinite number of x-intercepts. The y-intercept is at $(0, 0)$.



32. Solve for y.

$$y - 3 = 0$$
$$y = 3$$

The linear equation $y = 3$ is a horizontal line. The slope of a horizontal line is $m = 0$, and there is no x-intercept. The y-intercept is $(0, 3)$.



34. Solve for y.

$$ax + by + c = 0$$
$$by = -ax - c$$
$$y = -\frac{a}{b}x - \frac{c}{b}$$

The slope is $-\frac{a}{b}$ and the y-intercept is $\left(0, -\frac{c}{b}\right)$.

36. Solve for y.

$$ay = b(x + d)$$
$$ay = bx + bd$$
$$y = \frac{b}{a}x + \frac{bd}{a}$$

The slope is $\frac{b}{a}$ and the y-intercept is $\left(0, \frac{bd}{a}\right)$.

38. Solve for y.

$$a(y-b)=x$$
$$y-b=\frac{1}{a}x$$
$$y=\frac{1}{a}x+b$$

The slope is $\frac{1}{a}$ and the y-intercept is $(0, b)$.

40. Solve for y.

$$a(x+y)=d$$
$$x+y=\frac{d}{a}$$
$$y=-x+\frac{d}{a}$$

The slope is -1 and the y-intercept is $\left(0, \frac{d}{a}\right)$.

42. Solve for y.

$$\frac{y+b}{a}=x$$
$$y+b=ax$$
$$y=ax-b$$

The slope is a and the y-intercept is $(0, -b)$.

44. Set 1 is linear. As x increases by 1, y decreases by 3. The slope is $\frac{-3}{1}=-3$.
Set 2 is linear. As x increases by 2, y increases by 3. The slope is $\frac{3}{2}$.
Set 3 is linear. Regardless of the value of x, y is 8. All points lie on the line $y = 8$. The slope of the (horizontal) line is 0.
Set 4 is linear. Regardless of the value of y, x is 5. The points lie on the line $x = 5$. The slope of the (vertical) line is undefined.

46.

Eq. 1		**Eq. 2**		**Eq. 3**		**Eq. 4**	
x	***y***	***x***	***y***	***x***	***y***	***x***	***y***
0	16	0	–6	1	36	10	80
1	23	1	–2	2	32	11	77.5
2	30	2	2	3	28	12	75
3	37	3	6	4	24	13	72.5
4	44	4	10	5	20	14	70
5	51	5	14	6	16	15	67.5

48. Since the slopes of 7 and –7 are neither the same nor negative reciprocals, the lines are neither parallel nor perpendicular.

50. Since $-\frac{5}{2}$ and $\frac{2}{5}$ are negative reciprocals, the lines are perpendicular.

52. Solve each equation for y.

$$4x+y=6 \qquad\qquad x-4y=5$$
$$y=-4x+6 \qquad\qquad -4y=-x+5$$
$$y=\frac{1}{4}x-\frac{5}{4}$$

Since -4 and $\frac{1}{4}$ are negative reciprocals, the lines are perpendicular.

54. Solve each equation for y.

$$8x-4y=1 \qquad\qquad x+2y=6$$
$$-4y=-8x+1 \qquad\qquad 2y=-x+6$$
$$y=2x-\frac{1}{4} \qquad\qquad y=-\frac{1}{2}x+3$$

Since 2 and $-\frac{1}{2}$ are negative reciprocals, the lines are perpendicular.

56. $y=5$ and $y=-2$ are both horizontal lines. Horizontal lines do not intersect. Therefore, these lines are parallel.

58. $x=-2$ is a vertical line and $y=-4$ is a horizontal line. All vertical and horizontal lines are perpendicular.

60. **a.** Substitute values for x in the equation $y=-400x+2400$ to solve for y.
When $x = 0$, $y=-400(0)+2400=2400$.
When $x = 1$, $y=-400(1)+2400=2000$.
Similar calculations yield the following table.

Time (minutes) ***x***	**Altitude (feet)** ***y***
0	2400
1	2000
2	1600
3	1200
4	800
5	400
6	0

b. Each minute, the height of the balloon decreases by 400 feet. The slope of –400 in the equation shows this decrease of 400. As the value of the explanatory variable (time) increases by 1, the value of the response variable (altitude) decreases by 400 as determined by the slope. After 6 minutes, the balloon will have descended to the ground.

62. a. Substitute values for x in the equation $y = 0.5x + 6$ to solve for y and complete the table.

When $x = 0$, $y = 0.5(0) + 6 = 6$.

When $x = 1$, $y = 0.5(1) + 6 = 0.5 + 6 = 6.5$.

Similar calculations yield the following table.

Number of Years College Has Been Open x	Enrollment (thousands of students) y
0	6.0
1	6.5
2	7.0
3	7.5
4	8.0

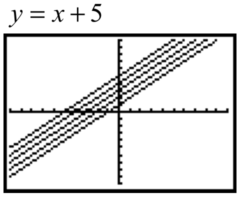
b. Each year the college's enrollment increases by 500 students. This corresponds to the slope of $y = 0.5x + 6$, since $0.5(1000) = 500$. As the value of the explanatory variable (number of years that the college has been open) increases by 1, the value of the response variable (enrollment in thousands of students) increases by 500 as determined by the slope.

64. Answers may vary. Example:

$y = x + 1$ $\quad y = x + 2$

$y = x + 3$ $\quad y = x + 4$

$y = x + 5$

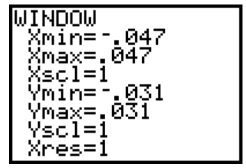


66. The slope is $m = \frac{\text{rise}}{\text{run}} = \frac{2}{3}$. The y-intercept is $(0, -1)$. The equation of the line is $y = \frac{2}{3}x - 1$.

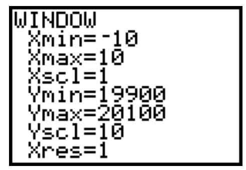
68. Answers may vary. Example: $y = 500x - 3$. The slope is a large positive number, and the y-intercept is negative.

70. Answers may vary. Example: $y = -\frac{1}{200}x + 5$. The slope is a small negative number, and the y-intercept is positive.

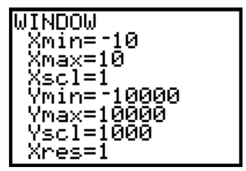
72. a.



b.



c.

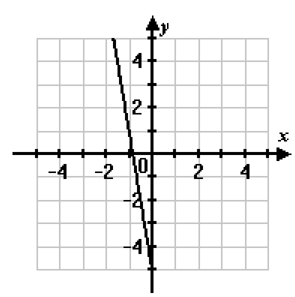


74. Since we have the slope, $m = -5$, and a point on the line, (0, 4), we can substitute in the equation $y = mx + b$ to find the y-intercept, b.

$y = mx + b$
$4 = -5(0) + b$
$4 = b$

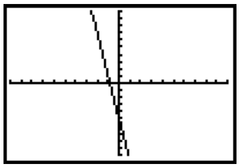
We can now write the equation of the line in slope–intercept form, $y = -5x + 4$.

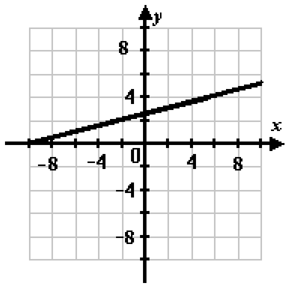
76. a.



b. From the graph in part (a), we see that the y-intercept, b, is -5. Using the slope and the y-intercept, we can write the equation of the line in slope–intercept form.

$y = -6x + (-5)$
$y = -6x - 5$

c. 

78. a. 

$y = mx + b$

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

Substitute $(x, y) = (-3, 2)$

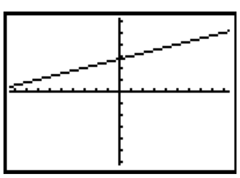
$y = mx + b$

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

$b = \frac{11}{4}$

b. From part (a), we see that the y-intercept, b, is $2\frac{3}{4}$ or $\frac{11}{4}$. Using the slope and the y-intercept, we can write the equation of the line in slope–intercept form.

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

c. 

80. a. Each line is a vertical line with an undefined slope.

b. The slope of the graph for any linear equation of the form $x = k$ is undefined when k is a constant.

82. No. When the linear equation is written in slope–intercept form, the coefficient of x is the slope of a line. So, instead of $3x$, the slope is 3.

84. Answers may vary. Example:
$y = 2x - 3$

Let $x_1 = 1$: $y_1 = 2(1) - 3 = 2 - 3 = -1$

Let $x_2 = -1$: $y_2 = 2(-1) - 3 = -2 - 3 = -5$

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

The slope is the same as m in the equation.

86. Answers may vary.

Homework 1.5

2. We are given the slope, $m = 2$, and a point on the line, (3, 1). Use $y = mx + b$ to find b.

$y = mx + b$

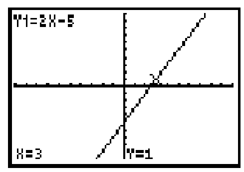
$1 = 2(3) + b$

$1 = 6 + b$

$-5 = b$

Now, substitute for m and b in slope–intercept form to obtain the equation of the line.

$y = 2x - 5$



The sign of m (positive) agrees with the increasing line from the graphing calculator.

4. We are given the slope, $m = -4$, and a point on the line, (–2, –8). Use $y = mx + b$ to find b.

$y = mx + b$

$-8 = -4(-2) + b$

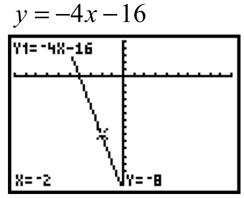
$-8 = 8 + b$

$-16 = b$

Now, substitute for m and b in slope–intercept form to obtain the equation of the line.

$y = -4x + (-16)$

$y = -4x - 16$



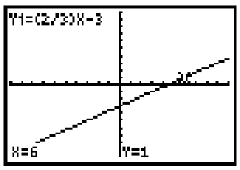
The sign of m (negative) agrees with the decreasing line from the graphing calculator.

6. We are given the slope, $m = \frac{2}{3}$, and a point on the line, (6, 1). Use $y = mx + b$ to find b.

$$y = mx + b$$
$$1 = \frac{2}{3}(6) + b$$
$$1 = 4 + b$$
$$-3 = b$$

Now, substitute for m and b in slope–intercept form to obtain the equation of the line.

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



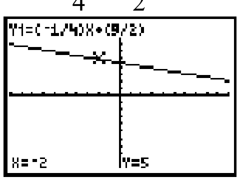
The sign of m (positive) agrees with the increasing line shown on the graphing calculator screen.

8. We are given the slope, $m = -\frac{1}{4}$, and a point on the line, (–2, 5). Use $y = mx + b$ to find b.

$$y = mx + b$$
$$5 = -\frac{1}{4}(-2) + b$$
$$5 = \frac{1}{2} + b$$
$$\frac{10}{2} = \frac{1}{2} + b$$
$$\frac{9}{2} = b$$

Now, substitute for m and b in slope–intercept form to obtain the equation of the line.

$$y = -\frac{1}{4}x + \frac{9}{2}$$



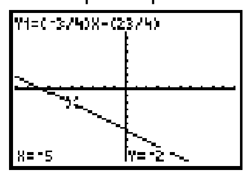
The sign of m (negative) agrees with the decreasing line shown on the graphing calculator screen.

10. We are given the slope, $m = -\frac{3}{4}$, and a point on the line, (–5, –2). Use $y = mx + b$ to find b.

$$y = mx + b$$
$$-2 = -\frac{3}{4}(-5) + b$$
$$-2 = \frac{15}{4} + b$$
$$-\frac{8}{4} = \frac{15}{4} + b$$
$$-\frac{23}{4} = b$$

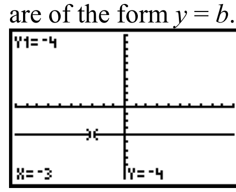
Now, substitute for m and b in slope–intercept form to obtain the equation of the line.

$$y = -\frac{3}{4}x - \frac{23}{4}$$



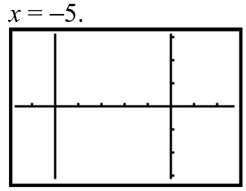
The sign of m (negative) agrees with the decreasing line shown on the graphing calculator screen.

12. We are given the slope, $m = 0$, and a point on the line, (–3, –4). We know that a line with a slope of 0 is a horizontal line. Horizontal lines are of the form $y = b$. In this example, $y = -4$.



Since m is zero, the line is horizontal. This is shown on the graphing calculator screen.

14. We are given that m is undefined, and a point on the line is (–5, 1). We know that a line with an undefined slope is a vertical line. Vertical lines are of the form $x = a$. In this example, $x = -5$.



Since m is undefined, the line is vertical. This is shown on the graphing calculator screen.

16. We are given the slope, $m = -2.7$, and a point on the line, (6.2, –4.9). Use $y = mx + b$ to find b.

$$y = mx + b$$
$$-4.9 = -2.7(6.2) + b$$
$$-4.9 = -16.74 + b$$
$$11.84 = b$$

Now, substitute for m and b in slope–intercept form to obtain the equation of the line.
$y = -2.7x + 11.84$

To check, substitute (6.2, –4.9) into the equation.

$$\begin{aligned} y &= -2.7x + 11.84 \\ -4.9 &\stackrel{?}{=} -2.7(6.2) + 11.84 \\ -4.9 &\stackrel{?}{=} -16.74 + 11.84 \\ -4.9 &\stackrel{?}{=} -4.9 \text{ true} \end{aligned}$$

18. We are given the slope, $m = 1.94$, and a point on the line, $(-2.53, -3.77)$. Use $y = mx + b$ to find b.

$$\begin{aligned} y &= mx + b \\ -3.77 &= 1.94(-2.53) + b \\ -3.77 &= -4.9082 + b \\ 1.14 &\approx b \end{aligned}$$

Substitute m and b in slope–intercept form to obtain the equation of the line.
$y = 1.94x + 1.14$

To check, substitute $(-2.53, -3.77)$ into the equation.

$$\begin{aligned} y &= 1.94x + 1.14 \\ -3.77 &\stackrel{?}{=} 1.94(-2.53) + 1.14 \\ -3.77 &\stackrel{?}{=} -4.9082 + 1.14 \\ -3.77 &\stackrel{?}{=} -3.77 \text{ true} \end{aligned}$$

20. First, find the slope.

$$m = \frac{5-1}{3-7} = \frac{4}{-4} = -1$$

So, $y = -x + b$. Since the line contains (3, 5), substitute 3 for x and 5 for y and solve for b.

$$\begin{aligned} 5 &= -1(3) + b \\ 5 &= -3 + b \\ 8 &= b \end{aligned}$$

So, the equation is $y = -x + 8$.

22. First, find the slope.

$$m = \frac{3-(-9)}{-1-2} = \frac{12}{-3} = -4$$

So, $y = -4x + b$. Since the line contains (–1, 3), substitute –1 for x and 3 for y and solve for b.

$$\begin{aligned} 3 &= -4(-1) + b \\ 3 &= 4 + b \\ -1 &= b \end{aligned}$$

So, the equation is $y = -4x - 1$.

24. First, find the slope.

$$m = \frac{-1-(-7)}{-4-(-2)} = \frac{-1+7}{-4+2} = \frac{6}{-2} = -3$$

So, $y = -3x + b$. Since the line contains (–4, –1), substitute –4 and for x and –1 for y solve for b.

$$\begin{aligned} -1 &= -3(-4) + b \\ -1 &= 12 + b \\ -13 &= b \end{aligned}$$

So, the equation is $y = -3x - 13$.

26. First, find the slope.

$$m = \frac{8-5}{0-4} = \frac{3}{-4} = -\frac{3}{4}$$

So, $y = -\frac{3}{4}x + b$. Since the line contains (0, 8), substitute 0 for x and 8 for y to solve for b.

$$\begin{aligned} 8 &= -\frac{3}{4}(0) + b \\ 8 &= b \end{aligned}$$

So, the equation is $y = -\frac{3}{4}x + 8$.

28. First, find the slope.

$$m = \frac{9-2}{5-3} = \frac{7}{2}$$

So, $y = \frac{7}{2}x + b$. Since the line passes through $(3, 2)$, substitute 3 for x and 2 for y to solve for b.

$$\begin{aligned} 2 &= \frac{7}{2}(3) + b \\ 2 &= \frac{21}{2} + b \\ \frac{4}{2} &= \frac{21}{2} + b \\ -\frac{17}{2} &= b \end{aligned}$$

So, the equation is $y = \frac{7}{2}x - \frac{17}{2}$.

30. First, find the slope.

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

So, $y = -\frac{2}{3}x + b$. Since the line passes through (2, –1), substitute 2 for x and –1 for y to solve for b.

$$-1=-\frac{2}{3}(2)+b$$
$$-1=-\frac{4}{3}+b$$
$$-\frac{3}{3}=-\frac{4}{3}+b$$
$$\frac{1}{3}=b$$

So, the equation is $y=-\frac{2}{3}x+\frac{1}{3}$.

32. First, find the slope.

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

So, $y=-\frac{1}{3}x+b$. Since the line passes through (–5, –3), substitute –5 for x and –3 for y to solve for b.

$$-3=-\frac{1}{3}(-5)+b$$
$$-3=\frac{5}{3}+b$$
$$-\frac{9}{3}=\frac{5}{3}+b$$
$$-\frac{14}{3}=b$$

So, the equation is $y=-\frac{1}{3}x-\frac{14}{3}$.

34. First, find the slope.

$$m=\frac{-2-(-2)}{-5-1}=\frac{0}{-6}=0$$

A line with zero slope is a horizontal line with an equation of the form $y=b$. Substitute the y-value for $(-5,-2)$ or $(1,-2)$ to get $y=-2$.

36. First, find the slope.

$$m=\frac{-7-(-3)}{4-4}=\frac{-4}{0}=\text{undefined}$$

A line with an undefined slope is a vertical line with an equation of the form $x=c$. Substitute the x-value for $(4,-7)$ or $(4,3)$ to get $x=4$.

38. First, find the slope.

$$m=\frac{7.1-(-2.3)}{-9.4-3.9}=\frac{7.1+2.3}{-13.3}=\frac{9.4}{-13.3}\approx-0.71$$

So, $y=-0.71x+b$. Since the line contains $(3.9,-2.3)$, substitute 3.9 for x and –2.3 for y to solve for b.

$$-2.3=-0.71(3.9)+b$$
$$-2.3=-2.769+b$$
$$0.47\approx b$$

So, the equation is $y=-0.71x+0.47$.

40. First, find the slope.

$$m=\frac{-2.21-(-7.78)}{-7.13-(-4.99)}=\frac{5.57}{-2.14}\approx-2.60$$

So, $y=-2.60x+b$. Since the line passes through (–7.13, –2.21), substitute –7.13 for x and –2.21 for y to solve for b.

$$-2.21=-2.60(-7.13)+b$$
$$-2.21=18.538+b$$
$$-20.75\approx b$$

So, the equation is $y=-2.60x-20.75$

42. The slope of the given line is 4. A line parallel to the given line has a slope of 4, so $y=4x+b$ is the equation for the parallel line. Substitute 1 for x and 4 for y to solve for b since the parallel line contains (1, 4).

$$4=4(1)+b$$
$$4=4+b$$
$$0=b$$

The parallel line’s equation is $y=4x$.

44. The slope of the given line is –1. A line parallel to the given line also has a slope of –1, so $y=-x+b$ is the equation for the parallel line. Substitute 2 for x and –3 for y to solve for b since the parallel line contains (2, –3).

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

The parallel line’s equation is $y=-x-1$.

46. The slope of the given line is $-\frac{2}{3}$. A line parallel to the given line also has a slope of $-\frac{2}{3}$, so $y=-\frac{2}{3}x+b$ is the equation for the parallel line. Substitute 6 for x and –3 for y to solve for b since the parallel line contains (6, –3).

$$-3=-\frac{2}{3}(6)+b$$
$$-3=-4+b$$
$$1=b$$

The parallel line’s equation is $y=-\frac{2}{3}x+1$.

48. To find the slope, isolate y first.

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

The slope is $-\frac{5}{2}$. A line parallel to the given line has the same slope. The equation for the parallel line is $y=-\frac{5}{2}x+b$. Substitute 4 for x and -1 for y to solve for b since the parallel line contains $(4,-1)$.

$$-1=-\frac{5}{2}(4)+b$$
$$-1=-10+b$$
$$9=b$$

The parallel line's equation is $y=-\frac{5}{2}x+9$.

50. To find the slope, isolate y first.

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

The slope is $-\frac{5}{3}$. A line parallel to the given line has the same slope. The equation for the parallel line is $y=-\frac{5}{3}x+b$. Substitute -1 for x and -4 for y to solve for b since the parallel line contains $(-1,-4)$.

$$-4=-\frac{5}{3}(-1)+b$$
$$-4=\frac{5}{3}+b$$
$$-\frac{12}{3}=\frac{5}{3}+b$$
$$-\frac{17}{3}=b$$

The parallel line's equation is $y=-\frac{5}{3}x-\frac{17}{3}$.

52. The slope of the line $y=-4$ is 0. The line is horizontal. A line parallel to $y=-4$ has a slope of 0, as well. Since the parallel line contains $(3,-1)$ and the y-value is -1 at this point, then the equation of the line is $y=-1$.

54. The line $x=1$ is vertical and has undefined slope. A line parallel to $x=1$ is also vertical. Since vertical lines are of the form $x=a$, and the parallel line contains $(-2,-5)$, the equation of the line is $x=-2$.

56. The slope of the given line is 5. A line perpendicular to the given line must have a slope of $-\frac{1}{5}$ and an equation of the form $y=-\frac{1}{5}x+b$. Substitute 2 for x and 1 for y to solve for b since the line contains $(2, 1)$.

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

The equation of the line is $y=-\frac{1}{5}x+\frac{7}{5}$ or $y=-0.2x+1.4$.

58. The slope of the given line is -6. A line perpendicular to the given line must then have a slope of $\frac{1}{6}$ and an equation of the form $y=\frac{1}{6}x+b$. Substitute -3 for x and -2 for y to solve for b since the line contains $(-3,-2)$.

$$-2=\frac{1}{6}(-3)+b$$
$$-2=-\frac{1}{2}+b$$
$$-\frac{4}{2}=-\frac{1}{2}+b$$
$$-\frac{3}{2}=b$$

The equation of the line is $y=\frac{1}{6}x-\frac{3}{2}$.

60. The slope of the given line is $\frac{1}{3}$. A line perpendicular to the given line must then have a slope of -3 and an equation of the form $y=-3x+b$. Substitute 1 for x and -2 for y to solve for b since the line contains $(1,-2)$.

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

The equation of the line is $y=-3x+1$.

62. To find the slope of the given line, isolate y first.

$$5x+2y=-9$$
$$2y=-5x-9$$
$$y=-\frac{5}{2}x-\frac{9}{2}$$

The slope of the line is $-\frac{5}{2}$. A line that is perpendicular to this line must have a slope of $\frac{2}{5}$ with equation $y=\frac{2}{5}x+b$. Substitute 6 for x and -1 for y to solve for b since the line contains (6, −1).

$$-1=\frac{2}{5}(6)+b$$
$$-1=\frac{12}{5}+b$$
$$-\frac{5}{5}=\frac{12}{5}+b$$
$$-\frac{17}{5}=b$$

The equation of the line is $y=\frac{2}{5}x-\frac{17}{5}$ or $y=0.4x-3.4$.

64. To find the slope of the given line, isolate y first.

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

The slope of the line is $-\frac{3}{4}$. A line perpendicular to this line must have a slope of $\frac{4}{3}$ with equation $y=\frac{4}{3}x+b$. Substitute -1 for x and 2 for y to solve for b since the line contains (−1, 2).

$$2=\frac{4}{3}(-1)+b$$
$$2=-\frac{4}{3}+b$$
$$\frac{6}{3}=-\frac{4}{3}+b$$
$$\frac{10}{3}=b$$

The equation of the line is $y=\frac{4}{3}x+\frac{10}{3}$.

66. The slope of the equation, $x=-1$, is undefined. The graph of the equation is a vertical line. A line perpendicular to $x=-1$ is a horizontal line with a slope of 0. Since this perpendicular line contains (−4, −2) and the y-value at this point is −2, the equation of the line is $y=-2$.

68. The slope of the equation, $y=7$, is 0. The graph of the equation is a horizontal line. A line perpendicular to $y=7$ is a vertical line with an undefined slope. Since this perpendicular line contains (1, −1) and the x-value at this point is 1, the equation of the line is $x=1$.

70. Choose any two points to find the slope.

$$m=\frac{58-55}{1-0}=\frac{3}{1}=3$$

So, $y=3x+b$. Since the point (0, 55) is a solution to the equation, substitute 0 for x and 55 for y to solve for b.

$$55=3(0)+b$$
$$55=0+b$$
$$55=b$$

The equation describing the relationship between x and y is $y=3x+55$.

72. Choose two points on the line to find the slope, such as (1, 1) and (4, −1).

$$m=\frac{1-(-1)}{1-4}=\frac{1+1}{-3}=-\frac{2}{3}$$

So, $y=-\frac{2}{3}x+b$. Since the line contains (1, 1), substitute 1 for x and 1 for y to solve for b.

$$1=-\frac{2}{3}(1)+b$$
$$\frac{3}{3}=-\frac{2}{3}+b$$
$$\frac{5}{3}=b$$

The equation for the line is $y=-\frac{2}{3}x+\frac{5}{3}$.

74. Choose two points on the line to find the slope, such as $(-2,4)$ and $(-4,-2)$.

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

So, $y=3x+b$. Since the line contains $(-2,4)$, substitute -2 for x and 4 for y to solve for b.

$4 = 3(-2) + b$
$4 = -6 + b$
$10 = b$
The equation for the line is $y = 3x + 10$.

76. **a.** Answers may vary. Example:
It is possible for a line to have no *y*-intercepts. Vertical lines of the form $x = k$ (where *k* is a constant not equal to 0) have no *y*-intercepts.

b. Answers may vary. Example:
It is possible for a line to have exactly one *y*-intercept. One example is $y = x + 1$ where the *y*-intercept is (0, 1). In general, any equation of the form $y = mx + b$ (where m is any real number) will have exactly one *y*-intercept.

c. Answers may vary. Example:
It is not possible for a line to have exactly two *y*-intercepts. A line can never intersect the *y*-axis at exactly two points.

d. Answers may vary. Example:
It is possible for a line to have an infinite number of *y*-intercepts. The line $x = 0$ is a vertical line that lies on the *y*-axis and therefore, intersects it at an infinite number of points.

78. No, there is no line that contains all the points.
Answers may vary. Example:
The slope of the line that contains $(-1, 5)$, (1, 1), (3, –3) and (4, –5) is –2. So, $y = -2x + b$. Substitute −1 for *x* and 5 for *y* since the line contains (–1, 5) and solve for *b*.
$5 = -2(-1) + b$
$5 = 2 + b$
$3 = b$
The equation of the line that contains all the points (except (–3, 7)) is $y = -2x + 3$.

80. The *y* values must increase by 0.5. Therefore, the resulting line that is actually parallel to the given line has an equation of
$y = -4x + (3 + 0.5) = -4x + 3.5$.

82. Answers may vary. Example:
Find a line that satisfies $(x, y) = (3,1)$.
For example $y = \frac{1}{3}x$. A line perpendicular to it will have slope –3, and it should also satisfy
$(x, y) = (3,1)$
$y = -3x + b$
$1 = -3(3) + b$
$b = 10$
So $y = -3x + 10$

84. Answers may vary. Example:
A line with undefined slope is a vertical line. The *x*-coordinates of the two given points are the same.

86. The equation does not include both points, although it does contain the point (1, 5).
Answers may vary. Example:
First find the slope.
$$m = \frac{5-9}{1-3} = \frac{-4}{-2} = 2$$
So, $y = 2x + b$. Since the line contains (1, 5), substitute 1 for *x* and 5 for *y* to solve for *b*.
$y = 2x + b$
$5 = 2(1) + b$
$3 = b$
The correct equation is $y = 2x + 3$.

Homework 1.6

2. **a.** Relation 3 and 4 could possibly be functions since each input yields only one output.

b. Relation 3 could be a linear function since the values of *y* change at a constant rate of –5 when *x* increases by 1.

4. Yes, this relation could be a function since each input yields exactly one output.

6. No, this relation is not a function since the input, $x = 4$, yields *two* outputs, $y = 5$ and $y = 9$.

8. This graph is not a function since a vertical line can intersect the graph at more than one point.

10. This graph is a function since it passes the vertical line test.

12. This graph is a function since it passes the vertical line test.

14. This graph is not a function since a vertical line intersects it at an infinite number of points.

16. The relation $y=-3x+8$ is a function since it can be put into the form $y=mx+b$, which defines a linear function.

18. First, isolate y.

$$4x+3y=24$$
$$3y=-4x+24$$
$$y=-\frac{4}{3}x+8$$

This relation is a function since it can be put into the form $y=mx+b$ which defines a linear function.

20. $y=-1$ is a horizontal line. Because every horizontal line passes the vertical line test, $y=-1$ is a function.

22. $x=0$ is a vertical line and does not pass the vertical line test. This is not a function.

24. First, isolate y.

$$2x+5y=9-4(x+2y)$$
$$2x+5y=9-4x-8y$$
$$5y+8y=-2x-4x+9$$
$$\frac{13y}{13}=\frac{-6x+9}{13}$$
$$y=\frac{-6}{13}x+\frac{9}{13}$$

This relation is a function since it can be put into the form $y=mx+b$ which defines a linear function.

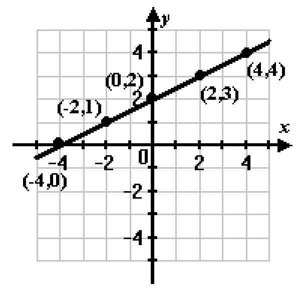
26. No, a vertical line is not a function since it does not pass the vertical line test.

28. Yes, a semicircle that is the "upper half" of a circle is a function since no vertical line intersects the semicircle at more than one point.

30. a.

x	y
–4	$\frac{1}{2}(-4)+2=0$
–2	$\frac{1}{2}(-2)+2=1$
0	$\frac{1}{2}(0)+2=2$
2	$\frac{1}{2}(2)+2=3$
4	$\frac{1}{2}(4)+2=4$

b.



c. For each input–output pair, the output is 2 more than $\frac{1}{2}$ times the input.

32. The domain is $-2\le x\le 3$ and the range is $-2\le y\le 4$.

34. The domain is $-4\le x\le 5$ and the range is $-3\le y\le 4$. The highest point on the graph appears to include a y-value of 4.

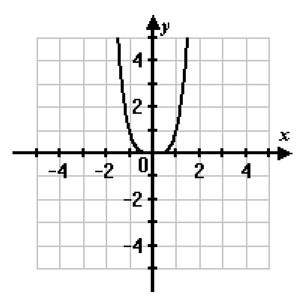
36. The domain is $-3\le x\le 5$ and the range is $0\le y\le 4$. The lowest point on the graph appears to include a y-value of 0 and the highest point appears to include 4.

38. The domain is $-3\le x\le 3$ and the range is $0\le y\le 3$.

40. The domain is all real numbers and the range is $y\ge 1$.

42. The domain is all real numbers and the range is all real numbers.

44. Sketch the graph of $y=x^4$.



Note that since this graph passes the vertical line test, $y=x^4$ is a function.