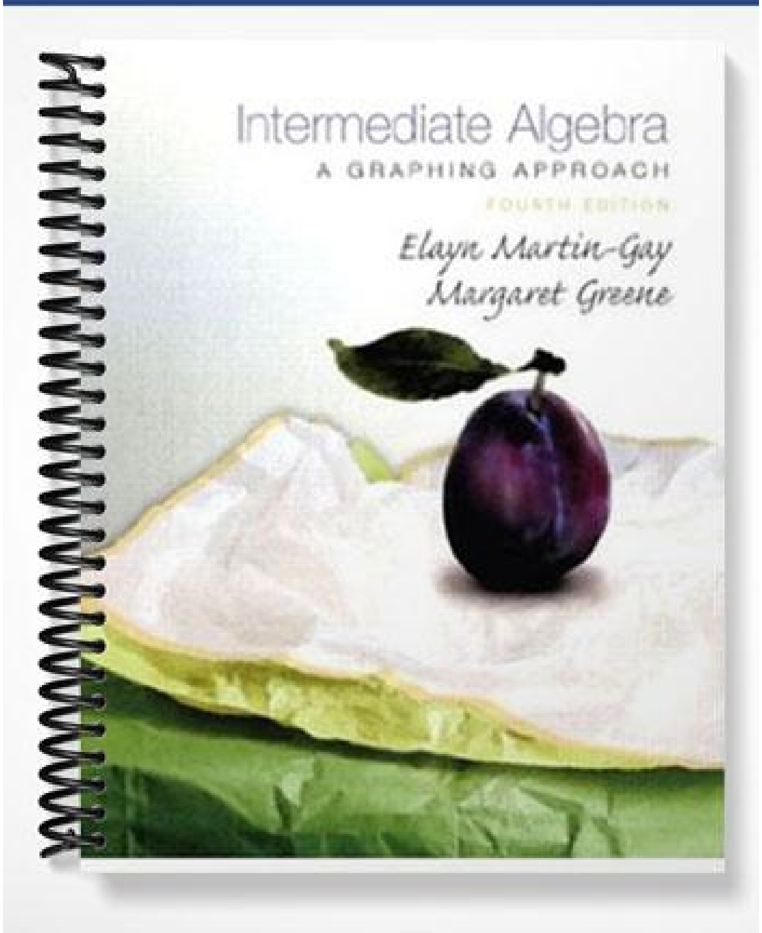
SOLUTIONS MANUAL

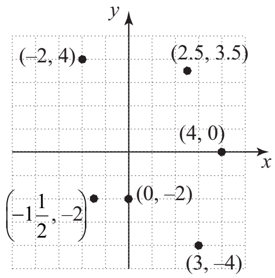


Chapter 2

Section 2.1

Practice Exercises

1. The six points are graphed as shown.



a. (3, −4) lies in quadrant IV.

b. (0, −2) is on the y-axis.

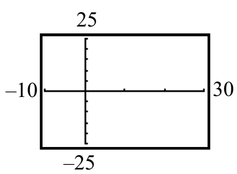
c. (−2, 4) lies in quadrant II.

d. (4, 0) is on the x-axis.

e. $\left(-1\frac{1}{2},\ -2\right)$ is in quadrant III.

f. (2.5, 3.5) is in quadrant I.

2.



3. Let $x = 1$ and $y = 4$.

$$4x+y=8$$
$$4(1)+4\stackrel{?}{=}8$$
$$4+4\stackrel{?}{=}8$$
$$8=8 \quad \text{True}$$

Let $x = 0$ and $y = 6$.

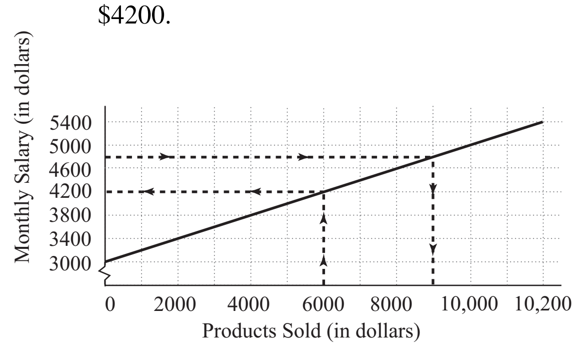
$$4x+y=8$$
$$4(0)+6\stackrel{?}{=}8$$
$$0+6\stackrel{?}{=}8$$
$$6=8 \quad \text{False}$$

Let $x = 3$ and $y = -4$.

$$4x+y=8$$
$$4(3)+(-4)\stackrel{?}{=}8$$
$$12-4\stackrel{?}{=}8$$
$$8=8 \quad \text{True}$$

Thus, (0, 6) is not a solution, but both (1, 4) and (3, −4) are solutions.

4. a. Since x is products sold, find 6000 along the x-axis and move vertically up until you reach a point on the line. From this point on the line, move horizontally to the left until you reach the y-axis. Its value on the y-axis is 4200, which means if \$6000 worth of products is sold, the salary for the month is \$4200.



b. Since y is monthly salary, find 4800 along the y-axis and move horizontally to the right until you reach a point on the line. Move vertically downward until you reach the x-axis. The corresponding x-value is 9000. This means that \$9000 worth of products sold gives a salary of \$4800 for the month. For the salary to be greater than \$4800, products sold must be greater than \$9000.

5. $y=-3x-2$

This is a linear equation. (In standard form, it is $3x + y = -2$.) Since the equation is solved for y, we choose three x-values.

Let $x = 0$.

$$y=-3x-2$$
$$y=-3\cdot 0-2$$
$$y=-2$$

Let $x = -1$.

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

Let $x = -2$.

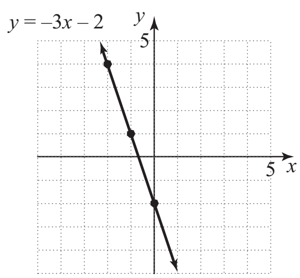
$y = -3x - 2$

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

$y = 4$

The three ordered pairs (0, −2), (−1, 1), and (−2, 4) are listed in the table.

x	y
0	−2
−1	1
−2	4



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

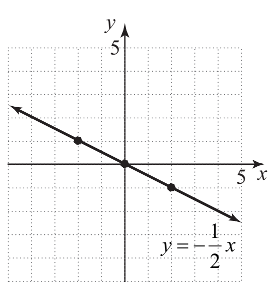
To avoid fractions, we choose x-values that are multiples of 2. To find the y-intercept, we let $x = 0$.

If $x = 0$, then $y = -\frac{1}{2}(0)$, or 0.

If $x = 2$, then $y = -\frac{1}{2}(2)$, or −1.

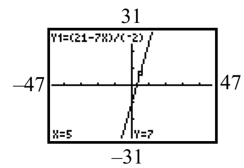
If $x = -2$, then $y = -\frac{1}{2}(-2)$, or 1.

x	y
0	0
2	−1
−2	1



7. First solve the equation for y.

$$7x - 2y = 21$$
$$7x - 7x - 2y = -7x + 21$$
$$-2y = -7x + 21$$
$$y = \frac{-7x + 21}{-2}$$



8. $y = 2x^2$

This equation is not linear because of the x^2 term. Its graph is not a line.

If $x = -3$, then $y = 2(-3)^2$, or 18.

If $x = -2$, then $y = 2(-2)^2$, or 8.

If $x = -1$, then $y = 2(-1)^2$, or 2.

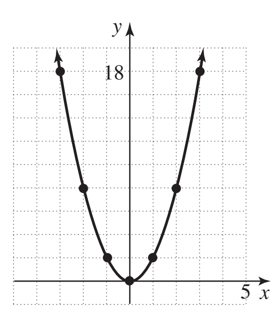
If $x = 0$, then $y = 2(0)^2$, or 0.

If $x = 1$, then $y = 2(1)^2$, or 2.

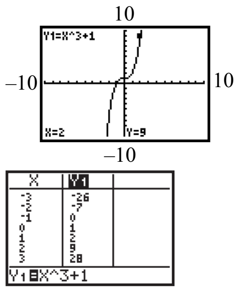
If $x = 2$, then $y = 2(2)^2$, or 8.

If $x = 3$, then $y = 2(3)^2$, or 18.

x	y
−3	18
−2	8
−1	2
0	0
1	2
2	8
3	18



9.



For each integer x-value from −3 to 3, the y-values in the Practice 9 table are 1 unit greater than those in the Example 9 table.

10. $y = -|x|$

This equation is not linear because it cannot be written in the form $Ax + By = C$. Its graph is not a line.

If $x = -3$, then $y = -|-3|$, or −3.

If $x = -2$, then $y = -|-2|$, or −2.

If $x = -1$, then $y = -|-1|$, or −1.

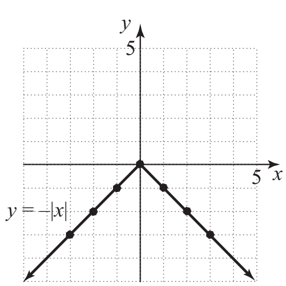
If $x = 0$, then $y = -|0|$, or 0.

If $x = 1$, then $y = -|1|$, or −1.

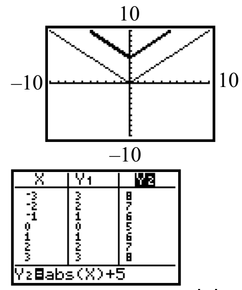
If $x = 2$, then $y = -|2|$, or −2.

If $x = 3$, then $y = -|3|$, or −3.

x	y
−3	−3
−2	−2
−1	−1
0	0
1	−1
2	−2
3	−3



11.



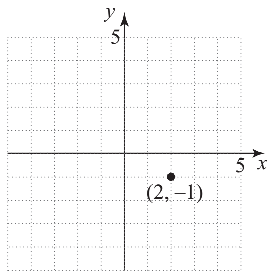
The graph of $y = |x| + 5$ is the same as the graph of $y = |x|$, except raised 5 units.

Vocabulary and Readiness Check

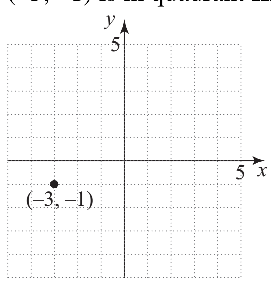
1. Point A is (5, 2).
2. Point B is (2, 5).
3. Point C is (3, 0).
4. Point D is (−1, 3).
5. Point E is (−5, −2).
6. Point F is (−3, 5).
7. Point G is (−1, 0).
8. Point H is (0, −3).
9. (2, 3); QI
10. (0, 5); y-axis
11. (−2, 7); QII
12. (−3, 0); x-axis
13. (−1, −4); QIII
14. (4, −2); QIV
15. (0, −100); y-axis
16. (10, 30); QI
17. (−10, −30); QIII
18. (0, 0); x- and y-axis
19. (−87, 0); x-axis
20. (−42, 17); QII

Exercise Set 2.1

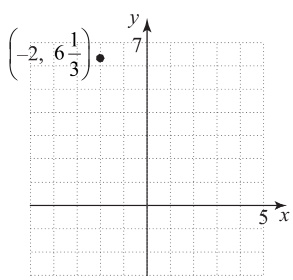
2. (2, –1) is in quadrant IV.



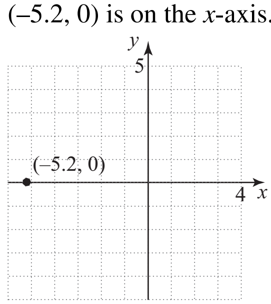
4. (–3, –1) is in quadrant III.



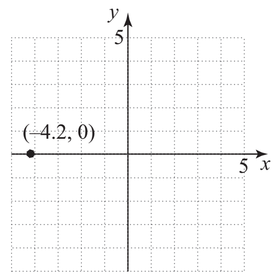
6. $\left(-2, 6\frac{1}{3}\right)$ is in quadrant II.



8. (–5.2, 0) is on the x-axis.



10. (–4.2, 0) is on the x-axis.



12. $(-x, y)$ lies in quadrant II.

14. $(0, -y)$ lies on the y-axis.

16. (0, 0) is the origin.

18. Each tick mark on the x-axis represents 1 unit, while each tick mark on the y-axis represents 2 units. Thus, the point shown is (–3, 2) in quadrant II.

20. Each tick mark on both the x-axis and y-axis represents 1 unit. Thus, the point shown is (–2, –3) in quadrant III.

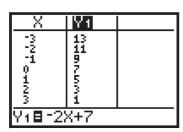
22. Possible answer: [–15, 15, 1] by [–15, 15, 1]

24. Possible answer: [–150, 150, 10] by [–150, 150, 10]

26. The screen shows window setting B.

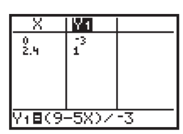
28. The screen shows window setting A.

30.



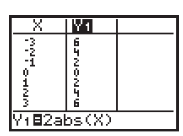
(1, 5) is a solution; (–2, 3) is not a solution.

32.



Neither (0, 3) nor $\left(\frac{12}{5}, -1\right)$ are solutions.

34.



(–1, 2) is a solution; (0, 2) is not a solution.

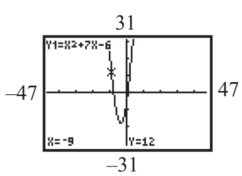
36.

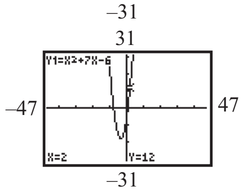
Equation	*Linear or Nonlinear*	*Shape (Line, Parabola, Cubic, V-shaped)*
$x+y=3$	linear	line
$y=4-x$	linear	line
$y=2x^2-5$	nonlinear	parabola
$y=-8x+6$	linear	line
$y=\|x-3\|$	nonlinear	V-shaped
$y=7x^2$	nonlinear	parabola
$2x-y=5$	linear	line
$y=-\|x-1\|$	nonlinear	V-shaped
$y=x^3-2$	nonlinear	cubic

38.
$$\begin{aligned} -6x+y&=2 \\ 6x-6x+y&=6x+2 \\ y&=6x+2 \end{aligned}$$

40.
$$\begin{aligned} 5x-11y&=-1.2 \\ -5x+5x-11y&=-5x-1.2 \\ -11y&=-5x-1.2 \\ \frac{-11y}{-11}&=\frac{-5x-1.2}{-11} \\ y&=\frac{-5x-1.5}{-11} \end{aligned}$$

42.

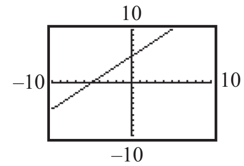




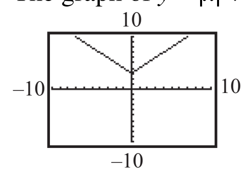
The points are (–9, 12) and (2, 12).

44. An integer window only displays coordinates with integer x-values, thus (1.7, 4) would not be displayed; a.

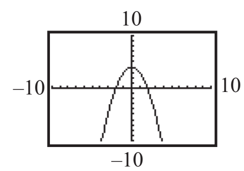
46. $y=x+5$ is a line; D.



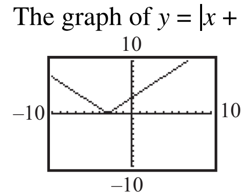
48. The graph of $y=|x|+3$ is V-shaped; B.



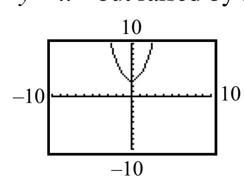
50. The graph of $y=-x^2+4$ is a parabola; B.



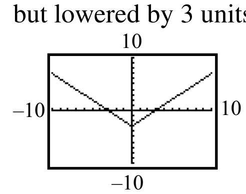
52. The graph of $y=|x+3|$ is V-shaped; A.



54. The graph shows a parabola that is the same as $y=x^2$ but raised by 3 units; B.



56. The graph is V-shaped and is the same as $y=|x|$ but lowered by 3 units; D.



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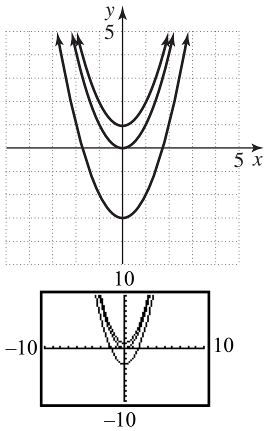
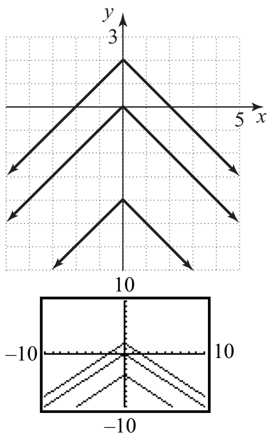
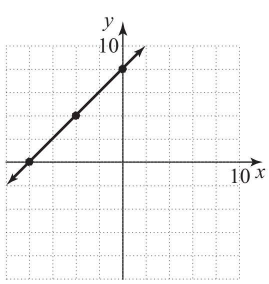


60.



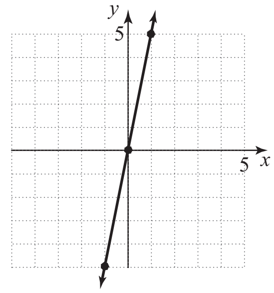
62. $y - x = 8$

x	0	−8	−4
y	8	0	4



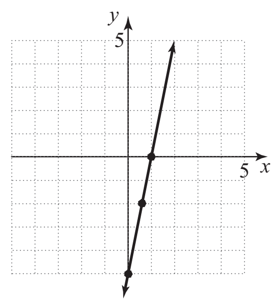
64. $y = 6x$

x	−1	0	1
y	−6	0	6



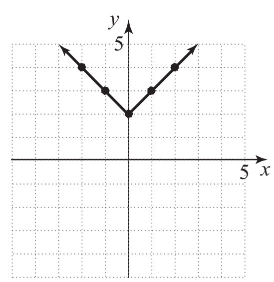
66. $y = 6x - 5$

x	0	$\frac{1}{2}$	1
y	−5	−2	1



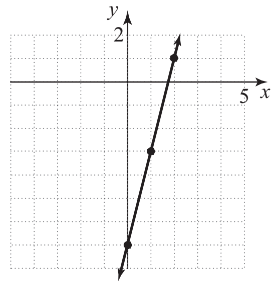
68. $y = |x| + 2$

x	−3	−2	−1	0	1	2	3
y	5	4	3	2	3	4	5



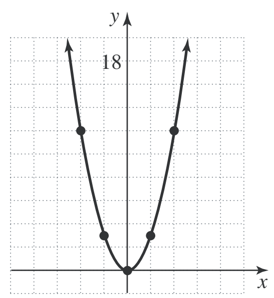
70. $4x - y = 7$

x	0	1	2
y	−7	−3	1



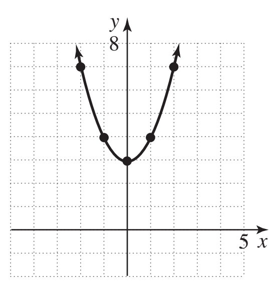
72. $y = 3x^2$

x	-3	-2	-1	0	1	2	3
	27	12	3	0	3	12	27



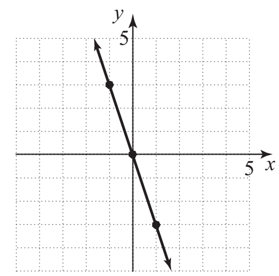
74. $y = x^2 + 3$

x	-3	-2	-1	0	1	2	3
y	12	7	4	3	4	7	12



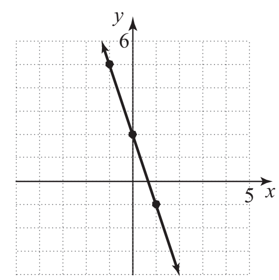
76. $y = -3x$

x	-1	0	1
y	3	0	-3



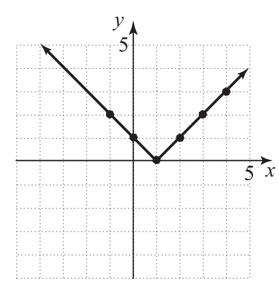
78. $y = -3x + 2$

x	-1	0	1
y	5	2	-1



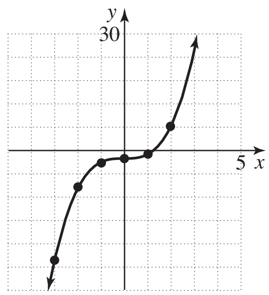
80. $y = |x - 1|$

x	-1	0	1	2	3	4
y	2	1	0	1	2	3



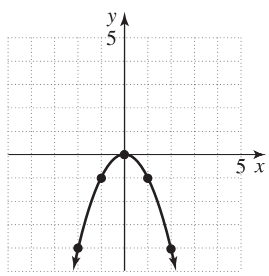
82. $y = x^3 - 2$

x	-3	-2	-1	0	1	2
y	-29	-10	-3	-2	-1	6

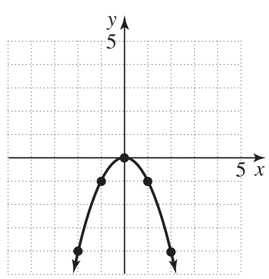


84. $y = -x^2$

x	-3	-2	-1	0	1	2	3
y	-9	-4	-1	0	-1	-4	-9



86.



$y = -x^2$

88. a. The shape of the graph from 20°C to 60°C resembles a <u>parabola</u>.

b. The shape of the graph from 0°C to 20°C resembles a <u>line</u>.

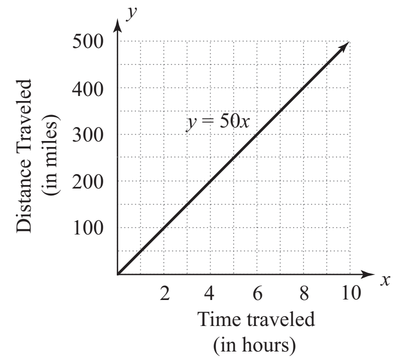
90. a. The shape of the graph from 600 nm to 700 nm resembles a <u>parabola</u>.

b. The shape of the graph from 550 nm to 625 nm resembles a <u>line</u>.

92. $y = 50x$

a.

x	0	3	6
y	0	150	300



b. When x is 6, y is 300. Thus, the distance traveled after 6 hours is 300 miles.

94.
$$\begin{aligned} 5+7(x+1) &= 12+10x \\ 5+7x+7 &= 12+10x \\ 7x+12 &= 12+10x \\ -3x &= 0 \\ x &= 0 \end{aligned}$$
The solution is 0.

96.
$$\begin{aligned} \frac{1}{6}+2x &= \frac{2}{3} \\ 1+12x &= 4 \\ 12x &= 3 \\ x &= \frac{1}{4} \end{aligned}$$
The solution is $\frac{1}{4}$.

98. The first coordinate, 0, indicates that the point is on the y-axis. The second coordinate, $-\frac{3}{4}$, indicates that the point is $\frac{3}{4}$ unit below the x-axis. The answer is d.

100. Look for the graph where the decrease in y-values from 40 to 0 and increase from 0 to 60 is gradual. The answer is d.

102. Look for the graph that ends in February. The answer is a.

104. The first segment in the graph with y-coordinate greater than 0.30 begins in January 1995. Thus, 1995 is the first year that the price of a first-class stamp rose above \$0.30.

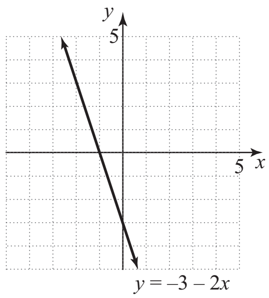
106. The price increased to \$0.41 in 2007. The difference is \$0.41 – \$0.02 or \$0.39.

108. When x is 7, y is 3.5. Thus, the value in 7 years is $3500.

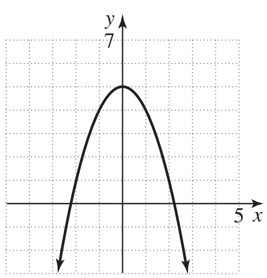
110. 6500 – 6000 = $500

112. Answers may vary

114. "The y-value is −3 decreased by twice the x-value" is written as $y = -3 - 2x$.



116. "The y-value is 5 decreased by the square of the x-value" is written as $y = 5 - x^2$.



Section 2.2

Practice Exercises

1. a. The domain is the set of all first coordinates, {4, 5}. The range is the set of all second coordinates, {1, −3, −2, 6}.

b. Ordered pairs are not listed here but are given in graph form. The relation is {(3, −4), (3, −3), (3, −2), (3, −1), (3, 0), (3, 1), (3, 2), (3, 3), (3, 4)}. The domain is {3}. The range is {−4, −3, −2, −1, 0, 1, 2, 3, 4}.

c. The domain is the set of inputs, {Administrative Secretary, Game Developer, Engineer, Restaurant Manager, Marketing}. The range is comprised of the numbers in the set of outputs that correspond to elements in the set of inputs, {27, 73, 50, 35}.

2. a. Although the ordered pairs (3, 1) and (9, 1) have the same y-value, each x-value is assigned to only one y-value, so this set of ordered pairs is a function.

b. The x-value −2 is assigned to two y-values, −3 and 4, in this graph, so this relation does not define a function.

c. This relation is a function because although two different people may have the same birth date, each person has only one birth date. This means that each element in the first set is assigned to only one element in the second set.

3. The relation $y = -3x + 5$ is a function if each x-value corresponds to just one y-value. For each x-value substituted into the equation $y = -3x + 5$, the multiplication and addition performed on each gives a single result, so only one y-value will be associated with each x-value. Thus, $y = -3x + 5$ is a function.

4. The relation $y = -x^2$ is a function if each x-value corresponds to just one y-value. For each x-value substituted into the equation $y = -x^2$, squaring each gives a single result, so only one y-value will be associated with each x-value. Thus, $y = -x^2$ is a function.

5. a. Yes, this is the graph of a function since no vertical line will intersect this graph more than once.

b. Yes, this is the graph of a function since no vertical line will intersect this graph more than once.

c. No, this is not the graph of a function. Note that vertical lines can be drawn that intersect the graph in two points.

d. Yes, this is the graph of a function since no vertical line will intersect this graph more than once.

e. No, this is not the graph of a function. A vertical line can be drawn that intersects this line at every point.

f. Yes, this is the graph of a function since no vertical line will intersect this graph more than once.

6. a. By the vertical line test, the graph is the graph of a function. The x-values are graphed from −1 to 2, so the domain is $\{x|-1 \le x \le 2\}$. The y-values are graphed from −2 to 9, so the range is $\{y|-2 \le y \le 9\}$.

b. By the vertical line test, the graph is not the graph of a function. The x-values are graphed from −1 to 1, so the domain is $\{x|-1 \le x \le 1\}$. The y-values are graphed from −4 to 4, so the range is $\{y|-4 \le y \le 4\}$.

c. By the vertical line test, the graph is the graph of a function. The arrows indicate that the graph continues forever. All x-values are graphed, so the domain is all real numbers. The y-values for 4 and numbers less than 4 are graphed, so the range is $\{y|y \le 4\}$.

d. By the vertical line test, the graph is the graph of a function. The arrows indicate that the graph continues forever. All x-values and all y-values are graphed, so the domain is all real numbers and the range is all real numbers.

7. a. Substitute 1 for x in $f(x)$.
$f(x) = 3x - 2$
$f(1) = 3(1) - 2 = 3 - 2 = 1$

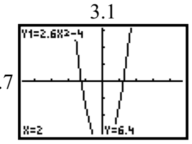
b. Substitute 1 for x in $g(x)$.
$$g(x) = 5x^2 + 2x - 1$$
$$\begin{aligned} g(1) &= 5(1)^2 + 2(1) - 1 \\ &= 5 + 2 - 1 \\ &= 6 \end{aligned}$$

c. Substitute 0 for x in $f(x)$.
$f(x) = 3x - 2$
$f(0) = 3(0) - 2 = 0 - 2 = -2$

d. Substitute −2 for x in $g(x)$.
$$g(x) = 5x^2 + 2x - 1$$
$$\begin{aligned} g(-2) &= 5(-2)^2 + 2(-2) - 1 \\ &= 5(4) - 4 - 1 \\ &= 20 - 4 - 1 = 15 \end{aligned}$$

8. a. Define $y_1 = 2.6x^2 - 4$ and graph using a decimal window. Move the cursor to find $x = 2$.

3.1

−4.7  4.7

−3.1

Since 2 is paired with 6.4, $f(2) = 6.4$.

b. Move the cursor to $x = -4$ and see that $y = 37.6$, so $f(-4) = 37.6$.

c. Move the cursor to $x = 0$ and see that $y = -4$, so $f(0) = -4$.

d. Move the cursor to $x = 0.7$ and see that $y = -2.726$, so $f(0.7) = -2.726$.

9. a. To find $f(1)$, find the y-value when $x = 1$. We see from the graph that when $x = 1$, y or $f(x) = -3$.
Thus, $f(1) = -3$.

b. $f(0) = -2$ from the ordered pair (0, −2).

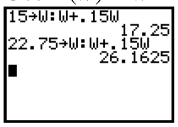
c. $g(-2) = 3$ from the ordered pair (−2, 3).

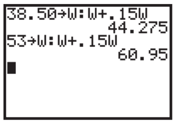
d. $g(0) = 1$ from the ordered pair (0, 1).

e. To find x-values such that $f(x) = 1$, we are looking for any ordered pairs on the graph of f whose $f(x)$ or y-value is 1. They are (−1, 1) and (3, 1). Thus, $f(-1) = 1$ and $f(3) = 1$. The x-values are −1 and 3.

f. Find ordered pairs on the graph of g whose $g(x)$ or y-value is −2. There is one such ordered pair, (−3, −2). Thus, $g(-3) = -2$. The only x-value is −3.

10. Use $R(w) = w + 0.15w$.





Wholesale Cost	w	\$15.00	\$22.75	\$38.50	\$53.00
Retail Price	$R(w)$	\$17.25	\$26.16	\$44.28	\$60.95

11. Find the year 2003 and move upward until you reach the graph. From the point on the graph, move horizontally to the left until the other axis is reached. In 2003, approximately \$35 billion was spent.

12. Find $f(2012)$.

$$f(x) = 2.602x - 5178$$
$$f(2012) = 2.602(2012) - 5178$$
$$= 57.224$$

We predict that \$57.224 billion will be spent in 2012.

Vocabulary and Readiness Check

1. The intersection of the x-axis and y-axis is a point, called the origin.

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

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

4. The graph of $Ax + By = C$, where A and B are not both 0 is a line.

5. The graph of $y = |x|$ looks V-shaped.

6. The graph of $y = x^2$ is a parabola.

7. A relation is a set of ordered pairs.

8. The range of a relation is the set of all second components of the ordered pairs.

9. The domain of a relation is the set of all first components of the ordered pairs.

10. A function is a relation in which each first component in the ordered pairs corresponds to *exactly* one second component.

11. By the vertical line test, all linear equations are functions except those whose graphs are vertical lines.

12. If $f(-2) = 1.7$, the corresponding ordered pair is $(-2, 1.7)$.

Exercise Set 2.2

2. The domain is the set of all first coordinates and the range is the set of all second coordinates.
Domain = {4, –4, 2, 10}
Range = {9, 3, –5}
Function since each x-value corresponds to exactly one y-value.

4. The domain is the set of all first coordinates and the range is the set of all second coordinates.
Domain = {6, 5, 7}
Range = {6, –2}
Not a function since 5 is paired with both 6 and –2.

6. The domain is the set of all first coordinates and the range is the set of all second coordinates.
Domain = {1, 2, 3, 4}
Range = {1}
Function since each x-value corresponds to exactly one y-value.

8. The domain is the set of all first coordinates and the range is the set of all second coordinates.
Domain = {π, 0, –2, 4}
Range = {0, π, 4, –2}
Function since each x-value corresponds to exactly one y-value.

10. The domain is the set of all first coordinates and the range is the set of all second coordinates.
Domain = $\left\{\frac{1}{2}, 0\right\}$
Range = $\left\{\frac{1}{4}, \frac{7}{8}, \pi\right\}$
Not a function since $\frac{1}{2}$ (or 0.5) is paired with both $\frac{1}{4}$ and π.

12. Points on graph: (−1, 1), (0, 0), (1, −1), (2, −2)
Domain = {−1, 0, 1, 2}
Range = {–2, –1, 0, 1}
Function since each x-value corresponds to exactly one y-value.

14. Domain = {Polar Bear, Cow, Chimpanzee, Giraffe, Gorilla, Kangaroo, Red Fox}
Range = {20, 15, 10, 7}
Function since each input corresponds to exactly one output.

16. Domain = {Cat, Dog, To, Of, Given}
Range = {3, 5, 2}
Function since each input corresponds to exactly one output.

18. Domain = {A, B, C}
Range = {1, 2, 3}
Not a function since the input A corresponds to two different outputs, 1 and 2.

20. This relation is a function because although two different people may have the same birth date, each person has only one birth date. This means that each element in the first set is assigned to only one element in the second set.

22. This relation is not a function because at least one of the numbers 0 to 4 will have to be assigned to more than one of the 50 women. This means that one element in the first set is assigned to more than one element in the second set.

24. No, this is not the graph of a function. Note that a vertical line can be drawn that intersects the graph in more than one point. The line itself is the vertical line.

26. No, this is not the graph of a function. Note that vertical lines can be drawn that intersect the graph in two points. The y-axis is such a vertical line.

28. No, this is not the graph of a function. Note that vertical lines can be drawn that intersect the graph in two or more points. The y-axis is such a vertical line.

30. No, this is not the graph of a function. Note that vertical lines can be drawn that intersect the graph in two points. The line $x = 1$ is such a vertical line.

32. Yes, this is the graph of a function since no vertical line will intersect this graph more than once.

34. The x-values go on forever;
domain = all real numbers
The y-values are graphed from 0 to ∞;
range = $\{y|y \geq 0\}$
Function since it passes the vertical line test.

36. The x-values are graphed from −3 to 3;
domain = $\{x|-3 \leq x \leq 3\}$
The y-values are graphed from −3 to 3;
range = $\{y|-3 \leq y \leq 3\}$
Not a function since it fails the vertical line test (try $x = 0$).

38. The x-values do not include $-2 < x < 2$;
domain = $\{x|x \leq -2 \text{ or } x \geq 2\}$
The y-values go on forever;
range = all real numbers
Not a function since it fails the vertical line test (try $x = 3$).

40. The x-values are graphed from 3 to ∞;
domain = $\{x|x \geq 3\}$
The y-values go on forever;
range = all real numbers
Not a function since it fails the vertical line test (try $x = 4$).

42. The x-values go on forever;
domain = all real numbers
The only y-value is 3; range = $\{3\}$
Function since it passes the vertical line test.

44. The x-values go on forever;
domain = all real numbers
The y-values go on forever;
range = all real numbers
Function since it passes the vertical line test.

46. The x-values go on forever;
domain = all real numbers
The y-values are graphed from -5 to ∞;
range = $\{y|y \geq -5\}$
Function since it passes the vertical line test.

48. Answers may vary

50. $y = x - 1$
For each x-value substituted into the equation $y = x - 1$, the subtraction performed gives a single result, so only one y-value will be associated with each x-value. Thus, $y = x - 1$ is a function.

52. $y = x^2$
For each x-value substituted into the equation $y = x^2$, the squaring x gives a single result, so only one y-value will be associated with each x-value. Thus, $y = x^2$ is a function.

54. $2x - 3y = 9$
For each x-value substituted into the equation $2x - 3y = 9$, the process of solving for y gives a single result, so only one y-value will be associated with each x-value. Thus, $2x - 3y = 9$ is a function.

56. $y = \frac{1}{x-3}$
For each x-value substituted into the equation $y = \frac{1}{x-3}$, the subtraction and division performed gives a single result, so only one y-value will be associated with each x-value.
Thus, $y = \frac{1}{x-3}$ is a function.

58. $y = \frac{1}{2}x + 4$
For each x-value substituted into the equation $y = \frac{1}{2}x + 4$ the multiplication and addition performed on each gives a single result, so only one y-value will be associated with each x-value.
Thus, $y = \frac{1}{2}x + 4$ is a function.

60. $x = |y|$
The x-value 2 is associated with two y-values, -2 and 2. Thus, $x = |y|$ is not a function.

62. $f(x) = 3x + 3$
$f(-1) = 3(-1) + 3 = 0$

64. $h(x) = 5x^2 - 7$
$h(0) = 5(0)^2 - 7 = -7$

66. $g(x) = 4x^2 - 6x + 3$
$g(1) = 4(1)^2 - 6(1) + 3 = 1$

68. $h(x) = 5x^2 - 7$
$h(-2) = 5(-2)^2 - 7 = 20 - 7 = 13$

70. $g(x) = -\frac{1}{3}x$

a. $g(0) = -\frac{1}{3}(0) = 0$

b. $g(-1) = -\frac{1}{3}(-1) = \frac{1}{3}$

c. $g(3) = -\frac{1}{3}(3) = -1$

72. $h(x) = -x^2$

a. $h(-5) = -(-5)^2 = -25$

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

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

74. $h(x) = 7$

a. $h(7) = 7$

b. $h(542) = 7$

c. $h\left(-\frac{3}{4}\right) = 7$

76. $g(x) = 2.7x^2 + 6.8x - 10.2$

a. $g(1) = 2.7(1)^2 + 6.8(1) - 10.2 = -0.7$

b. $g(-5) = 2.7(-5)^2 + 6.8(-5) - 10.2$
$= 23.3$

c. $g(7.2) = 2.7(7.2)^2 + 6.8(7.2) - 10.2$
$= 178.728$

78. **a.** $f(-4) = 124$

b. $f(2) = -14$

c. $f(6) = -426$

80. $f(-2) = -3$

82. If $f(-5) = -10$, then $y = -10$ when $x = -5$. The ordered pair is $(-5, -10)$.

84. If $g(-2) = 8$, then $y = 8$ when $x = -2$. The ordered pair is $(-2, 8)$.

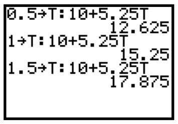
86. The ordered pair $(-2, -1)$ is on the graph of f. Thus, $f(-2) = -1$.

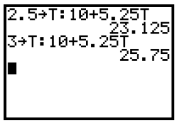
88. The ordered pair $(-4, -5)$ is on the graph of g. Thus, $g(-4) = -5$.

90. There are two ordered pairs on the graph of f with a y-value of -2, $(-3, -2)$ and $(-1, -2)$. The x-values are -3 and -1.

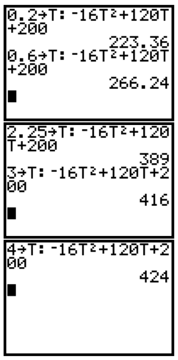
92. Since $g(x) = 0$ for values of x where the graph crosses the x-axis, the x-values are -3, 0, and 2.

94. 1; otherwise, it would fail the vertical line test.

96. 



Time in Hours	t	0.5	1	1.5	2.5	3
Total Cost	$C(t)$	12.63	15.25	17.88	23.13	25.75

98. 

a. $h(0.2) = 223.36$

b. $h(0.6) = 266.24$

c. $h(2.25) = 389$

d. $h(3) = 416$

e. $h(4) = 424$

100. **a.** Find the year 1999 and move upward until you reach the graph. From the point on the graph, move horizontally to the left until the other axis is reached. In 1999, approximately \$23 billion was spent.

b. Find $f(1999)$.
$f(x) = 2.602x - 5178$
$f(1999) = 2.602(1999) - 5178 = 23.398$
Approximately \$23.398 billion was spent in 1999.

102. Since 2015 is 15 years after 2000, find $f(15)$.
$f(x) = 0.42x + 10.5$
$f(15) = 0.42(15) + 10.5 = 16.8$
We predict that diamond production will be \$16.8 billion in 2015.

104. Answers may vary

106. $A(r) = \pi r^2$
$A(8) = \pi(8)^2 = 64\pi$ square feet

108. $V(x) = x^3$
$V(1.7) = (1.7)^3 = 4.913$ cubic cm

110. $H(t) = 2.72t + 61.28$
$H(35) = 2.72(35) + 61.28$
$= 156.48$ centimeters

112. $D(x) = \frac{136}{25}x$
$D(50) = \frac{136}{25}(50) = 272$ milligrams

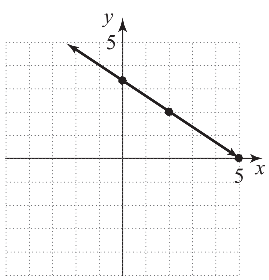
114. $y = -0.09x + 8.02$

a. $x = 1995 - 1970 = 25$
$y = -0.09(25) + 8.02 = 5.77$ days

b. $x = 2011 - 1970 = 41$
$y = -0.09(41) + 8.02 = 4.33$ days

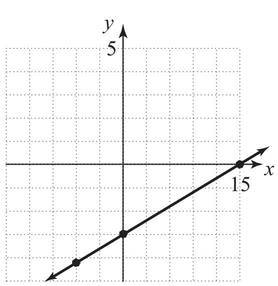
116. $2x + 3y = 10$

x	0	5	2
y	$\frac{10}{3}$	0	2



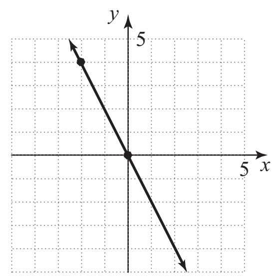
118. $5y - x = -15$

x	0	15	−2
y	−3	0	$-\frac{17}{5}$



120. $y = -2x$

x	0	0	−2
y	0	0	4



122. $f(7) = 50$ means that $y = 50$ when $x = 7$. Thus, (7, 50) is an ordered pair of the function. The given statement is true.

124. Since $f(7) = 50$ when $f(x) = x^2 + 1$, the statement is true.

126. $f(x) = 2x + 7$

a. $f(2) = 2(2) + 7 = 11$

b. $f(a) = 2a + 7$

128. $h(x) = x^2 + 7$

a. $h(3) = (3)^2 + 7 = 16$

b. $h(a) = a^2 + 7$

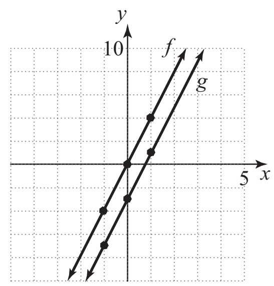
130. Answers may vary

Section 2.3

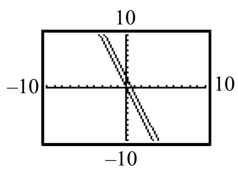
Practice Exercises

1. $f(x) = 4x,\ g(x) = 4x - 3$

x	f(x)	g(x)
0	0	−3
−1	−4	−7
1	4	1

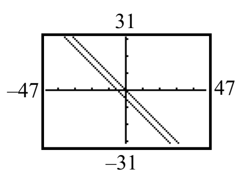


2.



The graph of $g(x) = -3x + 2$ can be obtained from the graph of $f(x) = -3x$ by shifting the graph of $f(x)$ up 2 units.

3.



The graph of $y_2 = -x - 5$ can be obtained from the graph of $y_1 = -x$ by shifting the graph of y_1 down 5 units.

4. $4x - 5y = -20$

Let $x = 0$.

$$\begin{aligned} 4x - 5y &= -20 \\ 4 \cdot 0 - 5y &= -20 \\ -5y &= -20 \\ y &= 4 \end{aligned}$$

Let $y = 0$.

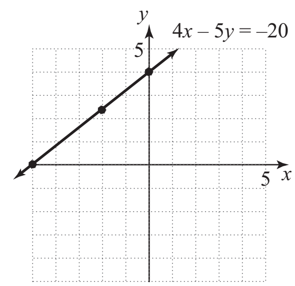
$$\begin{aligned} 4x - 5y &= -20 \\ 4x - 5 \cdot 0 &= -20 \\ 4x &= -20 \\ x &= -5 \end{aligned}$$

Let $x = -2$.

$$\begin{aligned} 4x - 5y &= -20 \\ 4(-2) - 5y &= -20 \\ -8 - 5y &= -20 \\ -5y &= -12 \\ y &= \frac{12}{5} = 2\frac{2}{5} \end{aligned}$$

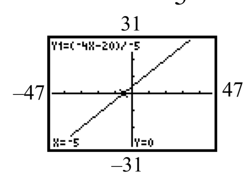
The ordered pairs are in the table.

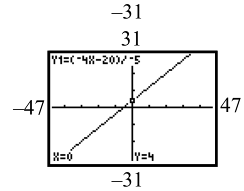
x	y
0	4
–5	0
–2	$2\frac{2}{5}$



Solve for y to check.

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





5. a. The y-intercept of $f(x) = \frac{3}{4}x - \frac{2}{5}$ is $\left(0, -\frac{2}{5}\right)$.

b. The y-intercept of $y = 2.6x + 4.1$ is $(0, 4.1)$.

6. $y = -3x$

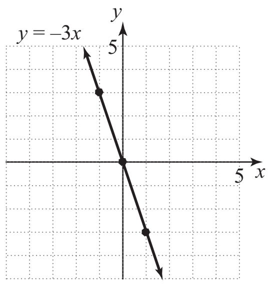
If $x = 0$, then $y = -3(0) = 0$.

If $x = 1$, then $y = -3(1) = -3$.

If $x = -1$, then $y = -3(-1) = 3$.

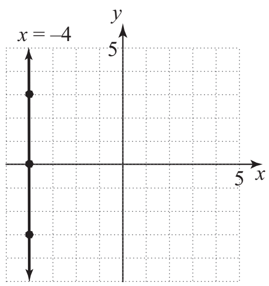
The ordered pairs are in the table.

x	y
0	0
1	−3
−1	3



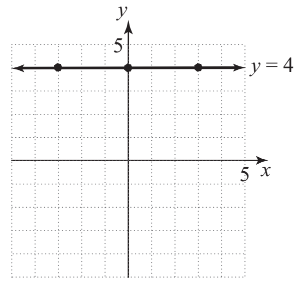
7. $x = -4$
The equation can be written as $x + 0y = -4$. For any y-value chosen, notice that x is −4.

x	y
−4	−3
−4	0
−4	3

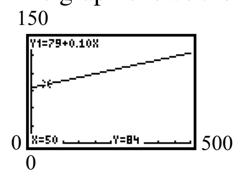


8. $y = 4$
The equation can be written as $0x + y = 4$. For any x-value chosen, notice that y is 4.

x	y
−3	4
0	4
3	4



9. Define $y_1 = 79 + 0.10x$ and graph in a [0, 500, 50] by [0, 150, 25] window.
The graph shows the cost for 50 miles.



No. of miles (x)	50	175	230	450
Cost $C(x)$	84	96.50	102	124

Vocabulary and Readiness Check

1. A linear function can be written in the form $f(x) = mx + b$.

2. In the form $f(x) = mx + b$, the y-intercept is $(0, b)$.

3. The graph of $x = c$ is a vertical line with x-intercept $(c, 0)$.

4. The graph of $y = c$ is a horizontal line with y-intercept $(0, c)$.

5. To find an x-intercept, let $y = 0$ or $f(x) = 0$ and solve for x.

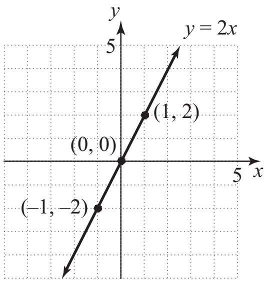
6. To find a y-intercept, let $x = 0$ and solve for y.

Exercise Set 2.3

2. $f(x) = 2x$

x	0	−1	1
y	0	−2	2

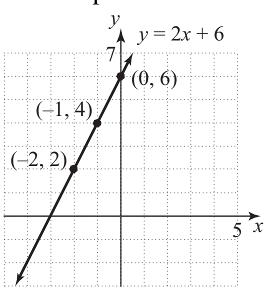
Plot the points to obtain the graph.



4. $f(x) = 2x + 6$

x	0	–1	–2
y	6	4	2

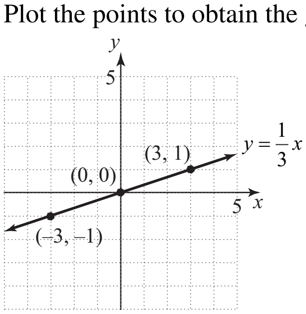
Plot the points to obtain the graph.



6. $f(x) = \frac{1}{3}x$

x	0	3	–3
y	0	1	–1

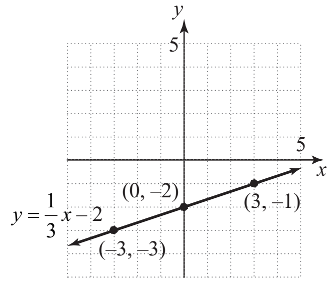
Plot the points to obtain the graph.



8. $f(x) = \frac{1}{3}x - 2$

x	0	3	–3
y	–2	–1	–3

Plot the points to obtain the graph.



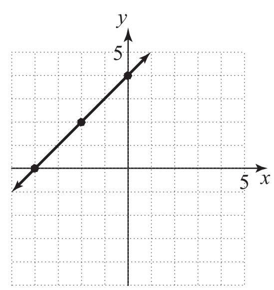
10. The graph of $f(x) = 5x - 2$ is the graph of $f(x) = 5x$ shifted down 2 units. The correct graph is A.

12. The graph of $f(x) = 5x + 3$ is the graph of $f(x) = 5x$ shifted up 3 units. The correct graph is B.

14. $x - y = -4$

x	$x - y = -4$	y
0	$0 - y = -4$	4
–4	$x - 0 = -4$	0
–2	$-2 - y = -4$	2

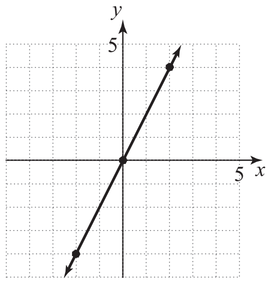
x-intercept: (–4, 0), y-intercept: (0, 4)
$f(x) = x + 4$



16. $2x = y$

x	$2x = y$	y
0	$2(0) = y$	0
2	$2(2) = y$	4
–2	$2(-2) = y$	–4

x-intercept: (0, 0), y-intercept: (0, 0)
$f(x) = 2x$

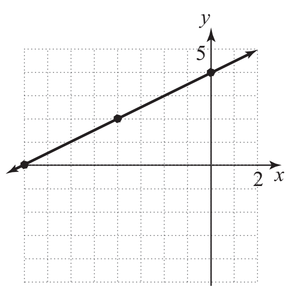


18. $x - 2y = -8$

x	$x - 2y = -8$	y
0	$0 - 2y = -8$	4
–8	$x - 2(0) = -8$	0
–4	$-4 - 2y = -8$	2

x-intercept: (–8, 0), y-intercept: (0, 4)

$f(x) = \frac{1}{2}x + 4$

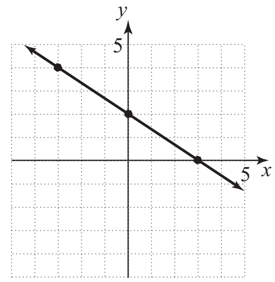


20. $2x + 3y = 6$

x	$2x + 3y = 6$	y
0	$2(0) + 3y = 6$	2
3	$2x + 3(0) = 6$	0
–3	$2(-3) + 3y = 6$	4

x-intercept: (3, 0), y-intercept: (0, 2)

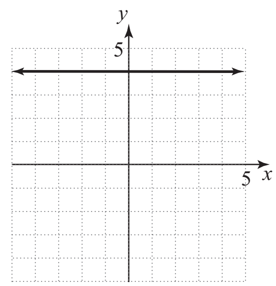
$f(x) = -\frac{2}{3}x + 2$



22. Answers may vary; it's a good way to check one's work.

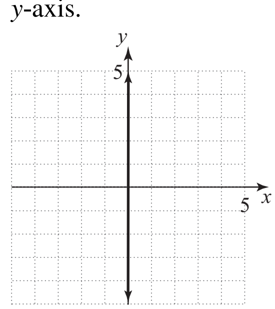
24. $y = 5$

Horizontal line with y-intercept at 5



26. $x = 0$

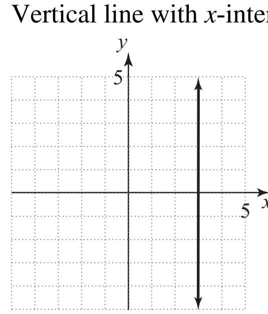
Vertical line with x-intercept at 0; the line is the y-axis.



28. $x - 3 = 0$

$x = 3$

Vertical line with x-intercept at 3

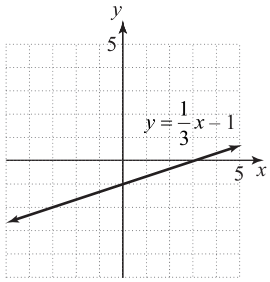


30. The graph of $x = -3$ is a vertical line with x-intercept (–3, 0). The correct graph is D.

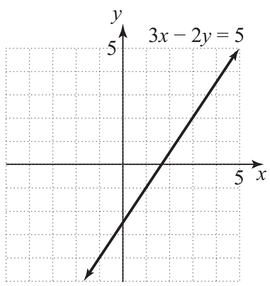
32. The graph of $y + 1 = 0$ or $y = -1$ is a horizontal line with y-intercept $(0, -1)$. The correct graph is B.

34. The horizontal line $y = 0$ has x-intercepts.

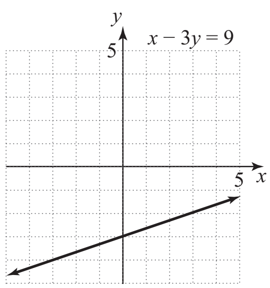
36. $x - 3y = 3$



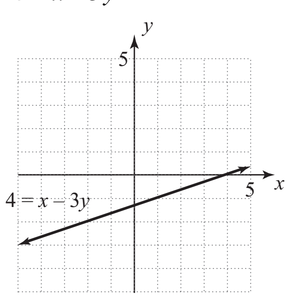
38. $3x - 2y = 5$



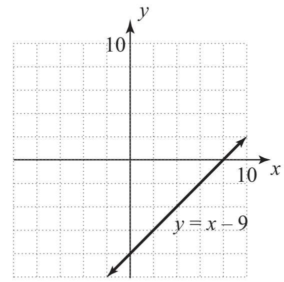
40. $x - 3y = 9$



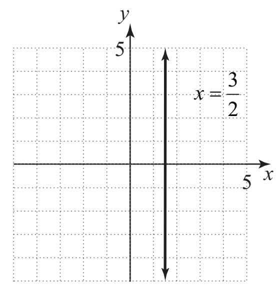
42. $4 = x - 3y$



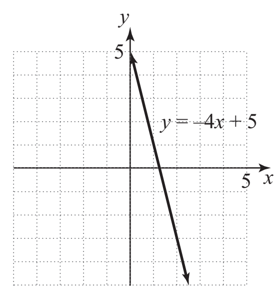
44. $-x + 9 = -y$



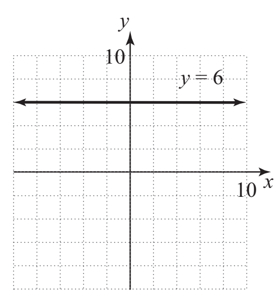
46. $x = \frac{3}{2}$



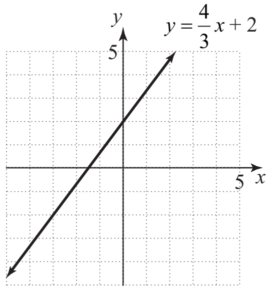
48. $4x + y = 5$



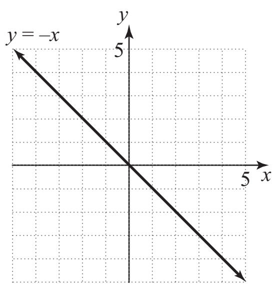
50. $y - 6 = 0$, or $y = 6$



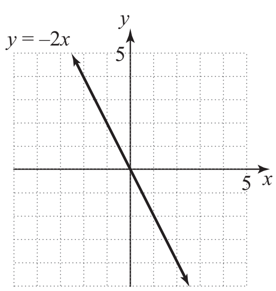
52. $f(x) = \frac{4}{3}x + 2$



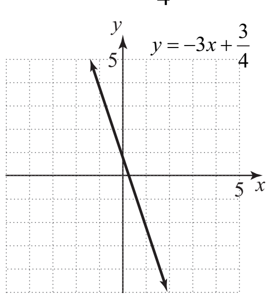
54. $f(x) = -x$



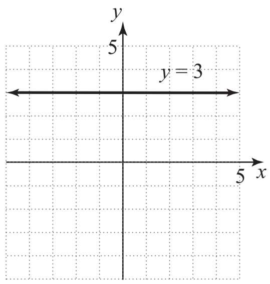
56. $f(x) = -2x$



58. $f(x) = -3x + \frac{3}{4}$

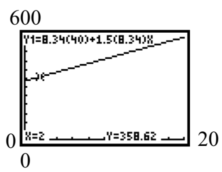


60. $f(x) = 3$



62. The graph shows the x-intercept of (–2, 0), so $g(-2) = 0$. Statements a and c are true.

64.



No. of Overtime Hours	2	10	12.5	15.75
Salary in Dollars	358.62	458.70	489.98	530.63

66. $\frac{4-5}{-1-0} = \frac{-1}{-1} = 1$

68. $\frac{12-3}{10-9} = \frac{9}{1} = 9$

70. $\frac{2-2}{3-5} = \frac{0}{-2} = 0$

72. $55x + 75y = 33,000$

a. $55(0) + 75y = 33,000$
$75y = 33,000$
$y = 440$
(0, 440); If no basic models are produced, 440 deluxe models can be produced.

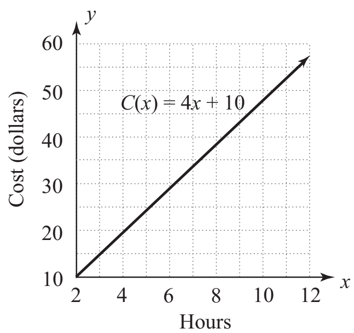
b. $55x + 75(0) = 33,000$
$55x = 33,000$
$x = 600$
(600, 0); If no deluxe models are produced, 600 basic models can be produced.

c. $55x + 75(350) = 33,000$
$55x + 26,250 = 33,000$
$55x = 6750$
$x = 122.7$
122 basic models

74. $C(x) = 4x + 10$

a. $C(8) = 4(8) + 10 = \$42$

b.



c. The line moves upward from left to right.

76. $f(x) = 291.5x + 2944.05$

a. Since 2015 is 15 years after 2000, find $f(15)$.

$$f(15) = 291.5(15) + 2944.05 = 4372.5 + 2944.05 = 7316.55$$

In 2015, the yearly cost of attending a public four-year college will be approximately \$7316.55.

b. Let $f(x) = 6000$.

$$6000 = 291.5x + 2944.05$$
$$3055.95 = 291.5x$$
$$10.48 \approx x$$

Round up to 11. The yearly cost of attending a public four-year college will first exceed \$6000 in 2011, 11 years after 2000.

c. Answers may vary.

78. The graph shows the graph of $y = |x|$ shifted up 3 units. Its equation is $y = |x| + 3$. The correct answer is d.

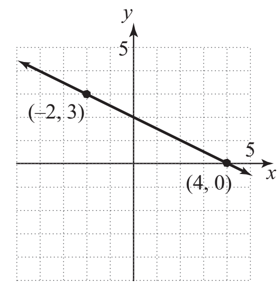
80. The graph shows the graph of $y = |x|$ shifted down 3 units. Its equation is $y = |x| - 3$. The correct answer is c.

Section 2.4

Practice Exercises

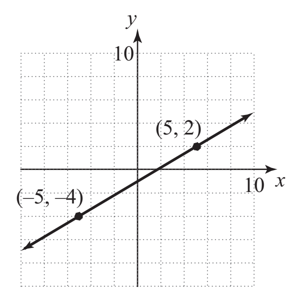
1. Let $(x_1, y_1) = (4, 0)$ and $(x_2, y_2) = (-2, 3)$.

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{3 - 0}{-2 - 4} = \frac{3}{-6} = -\frac{1}{2}$$



2. Let $(x_1, y_1) = (-5, -4)$ and $(x_2, y_2) = (5, 2)$.

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



3. $2x - 3y = 9$

Write the equation in slope-intercept form by solving for y.

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

The coefficient of x, $\frac{2}{3}$, is the slope, and the y-intercept is $(0, -3)$.

4. $f(x) = 2.7x + 38.64$
The year 2012 corresponds to $x = 16$.
$$\begin{aligned} f(16) &= 2.7(16) + 38.64 \\ &= 43.2 + 38.64 \\ &= 81.84 \end{aligned}$$
We predict that in 2012 the price of an adult one-day pass will be about $81.84.

5. $x = 4$
The graph of $x = 4$ is a vertical line. We choose two points on the line, (4, 0) and (4, 3). Let $(x_1, y_1) = (4, 0)$ and $(x_2, y_2) = (4, 3)$.
$$\begin{aligned} m &= \frac{y_2 - y_1}{x_2 - x_1} \\ &= \frac{3-0}{4-4} \\ &= \frac{3}{0} \end{aligned}$$
Since $\frac{3}{0}$ is undefined, the slope of the vertical line $x = 4$ is undefined.

6. $y = -3$
The graph of $y = -3$ is a horizontal line. We choose two points on the line, $(0, -3)$ and $(4, -3)$. Let $(x_1, y_1) = (0, -3)$ and $(x_2, y_2) = (4, -3)$.
$$\begin{aligned} m &= \frac{y_2 - y_1}{x_2 - x_1} \\ &= \frac{-3-(-3)}{4-0} \\ &= \frac{0}{4} \\ &= 0 \end{aligned}$$
The slope of the horizontal line $y = -3$ is 0.

7. **a.** Find the slope of each line.
$$\begin{aligned} x - 2y &= 3 \\ -2y &= -x + 3 \\ \frac{-2y}{-2} &= \frac{-x}{-2} + \frac{3}{-2} \\ y &= \frac{1}{2}x - \frac{3}{2} \end{aligned}$$
The slope is $\frac{1}{2}$.
$$\begin{aligned} 2x + y &= 3 \\ y &= -2x + 3 \end{aligned}$$
The slope is -2. The product of the slopes is -1 $\left[\frac{1}{2}(-2) = -1\right]$. The lines are perpendicular.

b. Find the slope of each line.
$$\begin{aligned} 4x - 3y &= 2 \\ -3y &= -4x + 2 \\ \frac{-3y}{-3} &= \frac{-4x}{-3} + \frac{2}{-3} \\ y &= \frac{4}{3}x - \frac{2}{3} \end{aligned}$$
The slope is $\frac{4}{3}$. The y-intercept is $\left(0, -\frac{2}{3}\right)$.
$$\begin{aligned} -8x + 6y &= -6 \\ 6y &= 8x - 6 \\ \frac{6y}{6} &= \frac{8x}{6} - \frac{6}{6} \\ y &= \frac{4}{3}x - 1 \end{aligned}$$
The slope is $\frac{4}{3}$. The y-intercept is $(0, -1)$.

The slopes of both lines are $\frac{4}{3}$. The y-intercepts are different, so the lines are not the same. Therefore, the lines are parallel.

Vocabulary and Readiness Check

1. The measure of the steepness or tilt of a line is called <u>slope</u>.

2. The slope of a line through two points is measured by the ratio of <u>vertical</u> change to <u>horizontal</u> change.

3. If a linear equation is in the form $y = mx + b$, or $f(x) = mx + b$, the slope of the line is <u>m</u> and the y-intercept is <u>$(0, b)$</u>.

4. The form $y = mx + b$ or $f(x) = mx + b$ is the <u>slope-intercept</u> form.

5. The slope of a <u>horizontal</u> line is 0.

6. The slope of a <u>vertical</u> line is undefined.

7. Two perpendicular lines have slopes whose product is <u>-1</u>.

8. Two non-vertical lines are parallel if they have <u>the same</u> slope and different <u>y-intercepts</u>.

9. $m = \frac{7}{6}$ slants upward.

10. $m = -3$ slants downward.

11. Since $m = 0$, the line is horizontal.

12. Since the slope is undefined, the line is vertical.

Exercise Set 2.4

2. $m = \frac{11-6}{7-1} = \frac{5}{6}$

4. $m = \frac{11-7}{-2-3} = \frac{4}{-5} = -\frac{4}{5}$

6. $m = \frac{6-(-4)}{-1-(-3)} = \frac{10}{2} = 5$

8. $m = \frac{0-2}{4-4} = \frac{-2}{0}$; undefined slope

10. $m = \frac{-5-(-5)}{3-(-2)} = \frac{0}{5} = 0$

12. $m = \frac{-6-(-2)}{-1-3} = \frac{-4}{-4} = 1$

14. $m = \frac{11-(-17)}{2-(-5)} = \frac{28}{7} = 4$

16. Use (0, –6) and (5, 4).
$m = \frac{4-(-6)}{5-0} = \frac{10}{5} = 2$

18. Use (0, 2) and (2, –6).
$m = \frac{-6-2}{2-0} = \frac{-8}{2} = -4$

20. The slope of l_1 is negative, and the slope of l_2 is positive. Since a positive number is greater than any negative number, l_2 has the greater slope.

22. The slope of l_1 is 0, and the slope of l_2 is positive. Since 0 is less than any positive number, l_2 has the greater slope.

24. Both lines have positive slope. Since l_1 is steeper, it has the greater slope.

26. $f(x) = -2x + 6$ or $y = -2x + 6$
$m = -2$, $b = 6$ so y-intercept is (0, 6).

28. $-5x + y = 10$
$y = 5x + 10$
$m = 5$, $b = 10$ so y-intercept is (0, 10).

30. $-3x - 4y = 6$
$-4y = 3x + 6$
$y = -\frac{3}{4}x - \frac{3}{2}$
$m = -\frac{3}{4}$, $b = -\frac{3}{2}$ so y-intercept is $\left(0, -\frac{3}{2}\right)$.

32. $f(x) = -\frac{1}{4}x$ or $y = -\frac{1}{4}x + 0$
$m = -\frac{1}{4}$, $b = 0$ so y-intercept is (0, 0).

34. $f(x) = 2x - 3$
The slope is 2, and the y-intercept is (0, –3). The correct graph is D.

36. $f(x) = -2x - 3$
The slope is –2, and the y-intercept is (0, –3). The correct graph is C.

38. $y = -2$ is a horizontal line.
$m = 0$

40. $x = 4$ is a vertical line. m is undefined.

42. $y - 7 = 0$
$y = 7$
This is a horizontal line.
$m = 0$

44. Answers may vary

46. $f(x) = x + 2$ or $y = x + 2$
$m = 1$, $b = 2$ so y-intercept is (0, 2).

48. $4x - 7y = 28$
$y = \frac{4}{7}x - 4$
$m = \frac{4}{7}$, $b = -4$ so y-intercept is (0, –4).

50. $2y-7=x$

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

$m=\frac{1}{2}, b=\frac{7}{2}$ so y-intercept is $\left(0, \frac{7}{2}\right)$.

52. $x=7$

m is undefined, no y-intercept

54. $f(x)=\frac{1}{7}x$ or $y=\frac{1}{7}x+0$

$m=\frac{1}{7},\ b=0$ so y-intercept is (0, 0).

56. $x-7=0$

$x=7$

m is undefined, no y-intercept

58. $2y+4=-7$

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

$m=0, b=-\frac{11}{2}$ so y-intercept is $\left(0, -\frac{11}{2}\right)$.

60. $f(x) = 5x - 6$ $\quad$ $g(x) = 5x + 2$

$m = 5$ $\quad$ $m = 5$

Parallel, since their slopes are equal.

62. $2x-y=-10$ $\quad$ $2x+4y=2$

$-y=-2x-10$ $\quad$ $4y=-2x+2$

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

$m=2$ $\quad$ $m=-\frac{1}{2}$

Perpendicular, since slopes are negative reciprocals.

64. $x+4y=7$ $\quad$ $2x-5y=0$

$4y=-x+7$ $\quad$ $-5y=-2x$

$y=-\frac{1}{4}x+\frac{7}{4}$ $\quad$ $y=\frac{2}{5}x$

Neither since their slopes are not equal and their product is not −1.

66. Answers may vary

68. Two points on the line: (0, 3), (1, 0)

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

70. Two points on the line: (–3, –1), (2, 4)

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

72. $m=\frac{3\text{ miles}}{25\text{ miles}}=\frac{3}{25}$

74. $m=\frac{15\text{ ft}}{100\text{ ft}}=\frac{3}{20}$

76. $y=1059.6x+36,827.4$

a. The year 2009 corresponds to $x = 9$.

$y=1059.6(9)+36,827.4$

$=9536.4+36,827.4$

$=46,363.8$

We predict that in 2009 an American woman with a bachelor's degree will earn \$46,363.80.

b. The slope is 1059.6. The annual average income increases \$1059.60 every year.

c. The y-intercept is (0, 36,827.4). When $x = 0$, or in 2000, the average annual income was \$36,827.40.

78. $-266x+10y=27,409$

a. Solve for y.

$-266x+10y=27,409$

$10y=266x+27,409$

$\frac{10y}{10}=\frac{266x}{10}+\frac{27,409}{10}$

$y=26.6x+2740.9$

The slope is 26.6, and the y-intercept is (0, 2740.9).

b. The number of people employed as nurses increases 26.6 thousand for every 1 year.

c. There were 2740.9 thousand nurses employed in 2000.

80. $f(x)=107.3x+1245.62$

a. The slope is 107.3. The yearly cost of tuition increases \$107.30 every 1 year.

b. The y-intercept is (0, 1245.62). The yearly cost of tuition when $x = 0$, or in 2000, was \$1245.62.

82. $y-0=-3[x-(-10)]$
$y=-3[x+10]$
$y=-3x-30$

84. $y-9=-8[x-(-4)]$
$y-9=-8[x+4]$
$y-9=-8x-32$
$y=-8x-23$

86. The denominator in the first fraction should be $-3-(-1)$.
$m=\frac{9-4}{-3-(-1)}=\frac{5}{-2}=-\frac{5}{2}$

88. The numerator and the denominator should be switched.
$m=\frac{-4-(-6)}{0-(-6)}=\frac{2}{6}=\frac{1}{3}$

90. $f(x)=x$
$m=1$
The slope of a parallel line is 1.

92. $f(x)=x$
$m=1$
The slope of a perpendicular line is -1.

94. $-3x+4y=10 \Rightarrow y=\frac{3}{4}x-\frac{5}{2}$
$m=\frac{3}{4}$
The slope of a parallel line is $\frac{3}{4}$.

96. Since $\frac{4}{2}=2,$ the lines are parallel.

98. $\frac{8}{2}=4$
Since $4(-0.25)=-1$, the lines are perpendicular.

100. a. $m_1=\frac{-2-4}{2-(-1)}=\frac{-6}{3}=-2$
$m_2=\frac{2-6}{-4-(-8)}=\frac{-4}{4}=-1$
$m_3=\frac{0-(-4)}{-6-0}=\frac{4}{-6}=-\frac{2}{3}$
$m_1=-2,\ m_2=-1,\ m_3=-\frac{2}{3}$

b. lesser

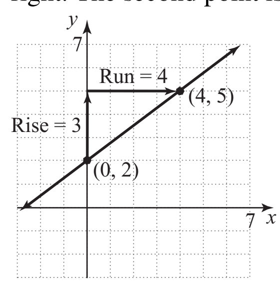
Section 2.5

Practice Exercises

1. We are given the slope, $-\frac{3}{4}$, and the y-intercept, (0, 4).
Let $m=-\frac{3}{4}$ and $b=4$.
$y=mx+b$
$y=-\frac{3}{4}x+4$

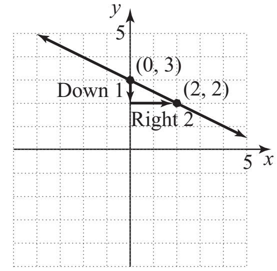
2. $y=\frac{3}{4}x+2$

The slope is $\frac{3}{4}$, and the y-intercept is (0, 2). Plot (0, 2). Then plot a second point by starting at (0, 2), rising 3 units up, and running 4 units to the right. The second point is (4, 5).



3. $x+2y=6$
Solve for y.
$x+2y=6$
$2y=-x+6$
$y=-\frac{1}{2}x+3$

The slope is $-\frac{1}{2}$, and the y-intercept is (0, 3).
Plot (0, 3). Then plot a second point by starting at (0, 3), moving 1 unit down, and moving 2 units to the right. The second point is (2, 2).



4. Use the point-slope form with $m = -4$ and $(x_1, y_1) = (-2, 5)$.

$$\begin{aligned} y - y_1 &= m(x - x_1) \\ y - 5 &= -4[x - (-2)] \\ y - 5 &= -4(x + 2) \\ y - 5 &= -4x - 8 \\ y &= -4x - 3 \end{aligned}$$

5. First find the slope.

$$m = \frac{0-2}{2-(-1)} = \frac{-2}{3} = -\frac{2}{3}$$

Use the slope and one of the points in the point-slope form. We use (2, 0).

$$\begin{aligned} y - y_1 &= m(x - x_1) \\ y - 0 &= -\frac{2}{3}(x - 2) \\ y &= -\frac{2}{3}x + \frac{4}{3} \\ f(x) &= -\frac{2}{3}x + \frac{4}{3} \end{aligned}$$

6. The points on the graph have coordinates (−2, 3) and (1, 1). Find the slope.

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

Use the slope and one of the points in the point-slope form. We use (1, 1).

$$\begin{aligned} y - y_1 &= m(x - x_1) \\ y - 1 &= -\frac{2}{3}(x - 1) \\ 3(y - 1) &= -2(x - 1) \\ 3y - 3 &= -2x + 2 \\ 2x + 3y &= 5 \end{aligned}$$

7. Let x = the number of years after 2000 and y = the number of houses sold in the year corresponding to x. We have two ordered pairs, (2, 7513) and (6, 9198). Find the slope.

$$\begin{aligned} m &= \frac{9198 - 7513}{6 - 2} \\ &= \frac{1685}{4} \\ &= 421.25 \end{aligned}$$

Use the slope and one of the points in the point-slope form. We use (2, 7513).

$$\begin{aligned} y - y_1 &= m(x - x_1) \\ y - 7513 &= 421.25(x - 2) \\ y - 7513 &= 421.25x - 842.5 \\ y &= 421.25x + 6670.5 \end{aligned}$$

The year 2014 corresponds to $x = 14$.

$$\begin{aligned} y &= 421.25(14) + 6670.5 \\ &= 5897.5 + 6670.5 \\ &= 12,568 \end{aligned}$$

We predict that there will 12,568 house sales in 2014.

8. A horizontal line has an equation of the form $y = b$. Since the line contains the point (6, −2), the equation is $y = -2$.

9. Since the line has undefined slope, the line must be vertical. A vertical line has an equation of the form $x = c$. Since the line contains the point (6, −2), the equation is $x = 6$.

10. Solve the given equation for y.

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

The slope of this line is $-\frac{3}{4}$, so the slope of any line parallel to it is also $-\frac{3}{4}$. Use this slope and the point (8, −3) in the point-slope form.

$$\begin{aligned} y - y_1 &= m(x - x_1) \\ y - (-3) &= -\frac{3}{4}(x - 8) \\ 4(y + 3) &= -3(x - 8) \\ 4y + 12 &= -3x + 24 \\ 3x + 4y &= 12 \end{aligned}$$

11. Solve the given equation for y.

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

The slope of this line is $-\frac{3}{4}$, so the slope of any line perpendicular to it is the negative reciprocal of $-\frac{3}{4}$, or $\frac{4}{3}$. Use this slope and the point (8, −3) in the point-slope form.

$$y - y_1 = m(x - x_1)$$
$$y - (-3) = \frac{4}{3}(x - 8)$$
$$3(y + 3) = 4(x - 8)$$
$$3y + 9 = 4x - 32$$
$$3y = 4x - 41$$
$$y = \frac{4}{3}x - \frac{41}{3}$$
$$f(x) = \frac{4}{3}x - \frac{41}{3}$$

Vocabulary and Readiness Check

1. $m = -4$, $b = 12$ so y-intercept is (0, 12).

2. $m = \frac{2}{3}$, $b = -\frac{7}{2}$ so y-intercept is $\left(0, -\frac{7}{2}\right)$.

3. $m = 5$, $b = 0$ so y-intercept is (0, 0).

4. $m = -1$, $b = 0$ so y-intercept is (0, 0).

5. $m = \frac{1}{2}$, $b = 6$ so y-intercept is (0, 6).

6. $m = -\frac{2}{3}$, $b = 5$ so y-intercept is (0, 5).

7. The lines both have slope 12 and they have different y-intercepts, (0, 6) and (0, −2), so they are parallel.

8. The lines both have slope −5 and they have different y-intercepts, (0, 8) and (0, −8), so they are parallel.

9. The line have slopes −9 and $\frac{3}{2}$. The slopes are not equal and their product is not −1, so the lines are neither parallel nor perpendicular.

10. The line have slopes 2 and $\frac{1}{2}$. The slopes are not equal and their product is not −1, so the lines are neither parallel nor perpendicular.

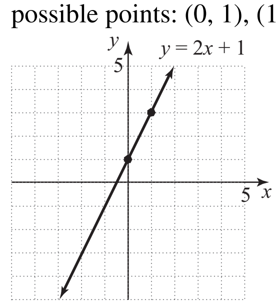
Exercise Set 2.5

2. $m = \frac{1}{2}$, $b = -6$
$$y = mx + b$$
$$y = \frac{1}{2}x - 6$$

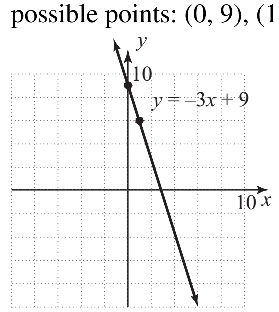
4. $m = -3$, $b = -\frac{1}{5}$
$$y = mx + b$$
$$y = -3x - \frac{1}{5}$$

6. $m = -\frac{4}{5}$, $b = 0$
$$y = mx + b$$
$$y = -\frac{4}{5}x + 0$$
$$y = -\frac{4}{5}x$$

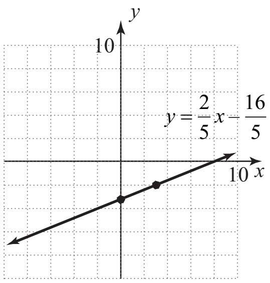
8. $y = 2x + 1$
possible points: (0, 1), (1, 3)



10. $3x + y = 9$
$$y = -3x + 9$$
possible points: (0, 9), (1, 6)



12. $-2x+5y=-16$
$$5y=2x-16$$
$$y=\frac{2}{5}x-\frac{16}{5}$$
possible points: $\left(0,-\frac{16}{5}\right),\left(5,-\frac{6}{5}\right)$



14. $y-y_1=m(x-x_1)$
$$y-1=4(x-5)$$
$$y-1=4x-20$$
$$y=4x-19$$

16. $y-y_1=m(x-x_1)$
$$y-(-4)=-4(x-2)$$
$$y+4=-4x+8$$
$$y=-4x+4$$

18. $y-y_1=m(x-x_1)$
$$y-4=\frac{2}{3}[x-(-9)]$$
$$y-4=\frac{2}{3}(x+9)$$
$$y-4=\frac{2}{3}x+6$$
$$y=\frac{2}{3}x+10$$

20. $y-y_1=m(x-x_1)$
$$y-(-6)=-\frac{1}{5}(x-4)$$
$$y+6=-\frac{1}{5}x+\frac{4}{5}$$
$$y=-\frac{1}{5}x-\frac{26}{5}$$

22. $m=\frac{8-0}{7-3}=\frac{8}{4}=2$
$$y-0=2(x-3)$$
$$y=2x-6$$
$$f(x)=2x-6$$

24. $m=\frac{6-(-4)}{2-7}=\frac{10}{-5}=-2$
$$y-6=-2(x-2)$$
$$y-6=-2x+4$$
$$y=-2x+10$$
$$f(x)=-2x+10$$

26. $m=\frac{10-(-2)}{-3-(-9)}=\frac{12}{6}=2$
$$y-10=2[x-(-3)]$$
$$y-10=2(x+3)$$
$$y-10=2x+6$$
$$y=2x+16$$
$$f(x)=2x+16$$

28. $m=\frac{-8-(-3)}{4-8}=\frac{-5}{-4}=\frac{5}{4}$
$$y-(-3)=\frac{5}{4}(x-8)$$
$$y+3=\frac{5}{4}x-10$$
$$y=\frac{5}{4}x-13$$
$$f(x)=\frac{5}{4}x-13$$

30. $m=\frac{\frac{3}{4}-\left(-\frac{1}{4}\right)}{\frac{3}{2}-\frac{1}{2}}=\frac{1}{1}=1$
$$y-\frac{3}{4}=1\left(x-\frac{3}{2}\right)$$
$$y-\frac{3}{4}=x-\frac{3}{2}$$
$$y=x-\frac{3}{4}$$
$$f(x)=x-\frac{3}{4}$$

32. (0, –2), (2, 2)
$$m=\frac{2-(-2)}{2-0}=\frac{4}{2}=2 \text{ and } b=-2$$
$$y=2x-2$$
$$2x-y=2$$

34. (–4, 0), (3, –1)

$m = \frac{-1-0}{3-(-4)} = -\frac{1}{7}$ and

$y - 0 = -\frac{1}{7}(x+4)$

$7y = -x - 4$

$x + 7y = -4$

36. $f(-1) = -4$

38. $f(1) = 0$

40. $f(x) = 4$

$f(3) = 4$

$x = 3$

42. Every horizontal line is in the form $y = c$. Since the line passes through the point (–3, 1), its equation is $y = 1$.

44. Every vertical line is in the form $x = c$. Since the line passes through (2, 6), its equation is $x = 2$.

46. Lines with undefined slopes are vertical. Vertical lines have the form $x = c$. Since the line passes through (0, 5), its equation is $x = 0$.

48. $y = 3x - 4$ so $m = 3$

$y - 5 = 3(x-1)$

$y - 5 = 3x - 3$

$y = 3x + 2$

$f(x) = 3x + 2$

50. $2x - 3y = 1$ or $y = \frac{2}{3}x - \frac{1}{3}$ so

$m = \frac{2}{3}$ and $m_{\perp} = -\frac{3}{2}$

$y - 8 = -\frac{3}{2}(x+4)$

$y - 8 = -\frac{3}{2}x - 6$

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

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

52. $3x + 2y = 5$

$2y = -3x + 5$

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

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

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

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

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

54. $y - 2 = 3[x - (-4)]$

$y - 2 = 3(x+4)$

$y - 2 = 3x + 12$

$3x - y = -14$

56. $m = \frac{6-9}{8-2} = \frac{-3}{6} = -\frac{1}{2}$

$y - 9 = -\frac{1}{2}(x-2)$

$2y - 18 = -x + 2$

$x + 2y = 20$

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

$f(x) = -4x + \frac{2}{9}$

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

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

$6y + 48 = -5x + 10$

$5x + 6y = -38$

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

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

$3x + 5y = 7$

64. Every horizontal line is in the form $y = c$. Since the line passes through the point (1, 0), its equation is $y = 0$.

66. $6x+2y=5$

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

$y+3=-3(x-8)$

$y+3=-3x+24$

$3x+y=21$

68. Lines with undefined slope are vertical lines. Every vertical line is in the form $x = c$. Since the line passes through the point (10, –8), its equation is $x = 10$.

70. $2x-y=8$

$y=2x-8$ so $m=2$ and $m_{\perp}=-\frac{1}{2}$

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

$2y-10=-x+3$

$x+2y=13$

72. A line parallel to $y = 9$ will have the form $y = c$. Since the line passes through (–3, –5), its equation is $y = –5$.

74. $m=\frac{5-(-2)}{-6-(-4)}=\frac{7}{-2}=-\frac{7}{2}$

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

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

$y=-\frac{7}{2}x-16$

$f(x)=-\frac{7}{2}x-16$

76. a. We have two ordered pairs, (2, 2000) and (4, 800). Find the slope.

$m=\frac{800-2000}{4-2}=\frac{-1200}{2}=-600$

Use the slope and one of the ordered pairs, (2, 2000), to write the equation.

$y-2000=-600(x-2)$

$y-2000=-600x+1200$

$y=-600x+3200$

b. The year 2008 corresponds to $x = 5$.

$y=-600(5)+3200$

$=-3000+3200$

$=200$

We estimate that the computer was worth $200 in 2008.

78. a. (7, 165,000), (12, 180,000)

$m=\frac{180,000-165,000}{12-7}=3000$

$y-165,000=3000(x-7)$

$y-165,000=3000x-21,000$

$y=3000x+144,000$

b. $x = 2010 – 1990 = 20$

$y = 3000(20) + 144,000 = \$204,000$

80. a. (4, 4116), (0, 4060)

$m=\frac{4060-4116}{0-4}=14$

$y-4060=14(x-0)$

$y=14x+4060$

b. $x = 2013 – 2000 = 13$

$y=14(13)+4060$

$= 4242$ thousand births

c. The number of births increases by 14 thousand every year

82. a. (0, 487), (10, 640)

$m=\frac{640-487}{10-0}=\frac{153}{10}=15.3$

$y-487=15.3(x-0)$

$y=15.3x+487$

b. $x = 2012 – 2004 = 8$

$y=15.3(8)+487$

$= 609.4$ thousand people

84. $-3x+1=0$

$-3x=-1$

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

86. $-2(x+1)=-x+10$

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

$-x=12$

$x=-12$

88. $\frac{x}{5}-\frac{3}{10}=\frac{x}{2}-1$

$2x-3=5x-10$

$-3x=-7$

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

90. Since two distinct vertical lines will never intersect, they are parallel. The statement is true.

92. $m = \frac{-1-(-3)}{-8-(-6)} = \frac{2}{-2} = -1$ so $m_{\perp} = 1$

$M((-6, -3), (-8, -1)) = \left(\frac{-14}{2}, \frac{-4}{2}\right) = (-7, -2)$

$y + 2 = 1(x + 7)$
$y + 2 = x + 7$
$x - y = -5$

94. $m = \frac{2-8}{7-5} = \frac{-6}{2} = -3$ so $m_{\perp} = \frac{1}{3}$

$M((5, 8), (7, 2)) = \left(\frac{12}{2}, \frac{10}{2}\right) = (6, 5)$

$y - 5 = \frac{1}{3}(x - 6)$
$3y - 15 = x - 6$
$x - 3y = -9$

96. $m = \frac{-2-8}{-4-(-6)} = \frac{-10}{2} = -5$ so $m_{\perp} = \frac{1}{5}$

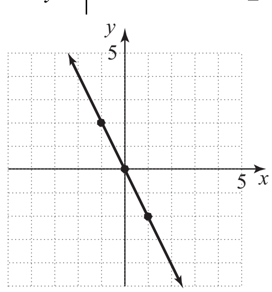
$M((-6, 8), (-4, -2)) = \left(\frac{-10}{2}, \frac{6}{2}\right) = (-5, 3)$

$y - 3 = \frac{1}{5}(x + 5)$
$5y - 15 = x + 5$
$x - 5y = -20$

Integrated Review

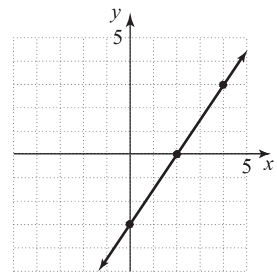
1. $y = -2x$

x	-1	0	1
y	2	0	-2

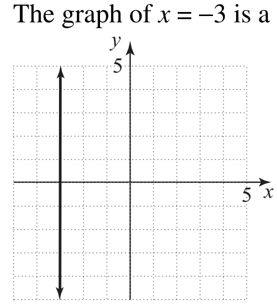


2. $3x - 2y = 6$

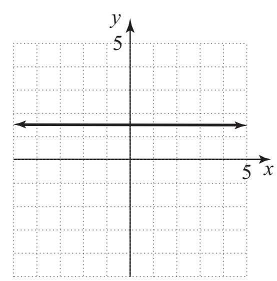
x	0	2	4
y	-3	0	3



3. $x = -3$
The graph of $x = -3$ is a vertical line.



4. $y = 1.5$



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

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

7. $y = 3x - 5$
$m = 3$; $(0, -5)$

8. $5x - 2y = 7$
$-2y = -5x + 7$
$y = \frac{5}{2}x - \frac{7}{2}$
$m = \frac{5}{2};\ \left(0, -\frac{7}{2}\right)$

9. $y = 8x - 6 \quad y = 8x + 6$
$m = 8 \qquad m = 8$
Parallel, since their slopes are equal.

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

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

Perpendicular, since the product of their slopes is -1.

11. $m = \frac{2-6}{5-1} = \frac{-4}{4} = -1$
$y - 6 = -1(x - 1)$
$y - 6 = -x + 1$
$y = -x + 7$

12. Every vertical line is in the form $x = c$. Since the line passes through the point $(-2, -10)$, its equation is $x = -2$.

13. Every horizontal line is in the form $y = c$. Since the line passes through the point $(1, 0)$, its equation is $y = 0$.

14. $m = \frac{-5-(-9)}{-6-2} = \frac{4}{-8} = -\frac{1}{2}$
$y - (-9) = -\frac{1}{2}(x - 2)$
$2(y + 9) = -1(x - 2)$
$2y + 18 = -x + 2$
$2y = -x - 16$
$y = -\frac{1}{2}x - 8$
$f(x) = -\frac{1}{2}x - 8$

15. $y - 4 = -5[x - (-2)]$
$y - 4 = -5(x + 2)$
$y - 4 = -5x - 10$
$y = -5x - 6$
$f(x) = -5x - 6$

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

17. $y = \frac{1}{2}x - 1$
$f(x) = \frac{1}{2}x - 1$

18. $y - 0 = 3\left(x - \frac{1}{2}\right)$
$y = 3x - \frac{3}{2}$

19. $3x - y = 5$
$y = 3x - 5$
$m = 3$
$y - (-5) = 3[x - (-1)]$
$y + 5 = 3(x + 1)$
$y + 5 = 3x + 3$
$y = 3x - 2$

20. $4x - 5y = 10$
$-5y = -4x + 10$
$y = \frac{4}{5}x - 2;\ \ m = \frac{4}{5}$ so $m_{\perp} = -\frac{5}{4}$

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

21. $4x + y = \frac{2}{3}$
$y = -4x + \frac{2}{3};\ \ m = -4$ so $m_{\perp} = \frac{1}{4}$
$y - (-3) = \frac{1}{4}(x - 2)$
$4(y + 3) = x - 2$
$4y + 12 = x - 2$
$4y = x - 14$
$y = \frac{1}{4}x - \frac{7}{2}$

22. $5x+2y=2$

$$2y=-5x+2$$
$$y=-\frac{5}{2}x+1$$
$$m=-\frac{5}{2}$$
$$y-0=-\frac{5}{2}[x-(-1)]$$
$$y=-\frac{5}{2}(x+1)$$
$$2y=-5(x+1)$$
$$2y=-5x-5$$
$$y=-\frac{5}{2}x-\frac{5}{2}$$

23. A line having undefined slope is vertical. Therefore, the equation is $x=-1$.

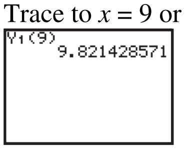
24. $y-3=0[x-(-1)]$

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

Section 2.6

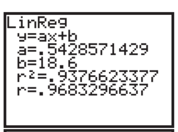
Practice Exercises

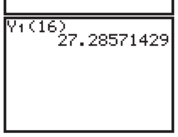
1. 2004 − 1995 = 9
Trace to $x = 9$ or evaluate the function for $x = 9$.



There were approximately 9.28 billion passengers in 2004.

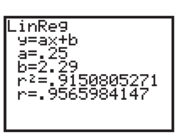
2.





The amount that will be spent in 2016 is predicted to be $27.29 per customer. The average increase in the amount spent for these services was $0.54 per year between 2001 and 2006.

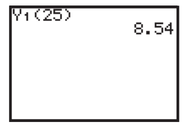
3. b.



If *a* and *b* are rounded to two decimal places, the regression equation is $y = 0.25x + 2.29$. Since the slope (0.25) is positive, the line is increasing.

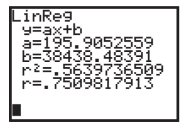
c. The number of sick or injured workers is increasing at a rate of 0.25 per 100 workers per year.

d.



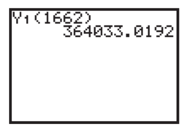
Y1(25) is equal to 8.54 or approximately 8.54 workers per 100 in the year 2015.

4. a.



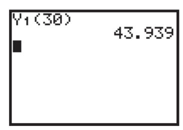
The regression equation is $y = 195.91x + 38{,}438.48$.

b.



A home with 1662 square feet of living area is expected to sell for $364,040.02.

5.



It is expected that 43.94% of workers will be 55 or older in 2020.

Vocabulary and Readiness Check

1. <u>Regression analysis</u> is the process of fitting a line or a curve to a set of data points.

2. Enter the <u>data</u> into the calculator using <u>lists</u>.

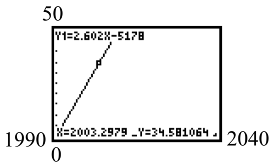
3. Use the <u>Stat Plot</u> feature to indicate the <u>scatter plot</u> as the type of graph.

4. When finding an appropriate window, make sure the <u>domain</u> and <u>range</u> are both included in your choice.

5. Use a <u>linear regression equation</u> to find the line of best fit.

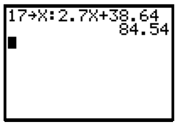
Exercise Set 2.6

2.



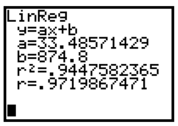
\$34.9 billion was spent in 2003.

4.



The price will be \$84.54 in 2013.

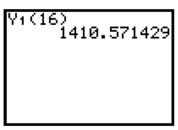
6. a.



The regression equation is $y = 33.486x + 874.8$.

b. The expenditures are increasing at the rate of \$33.49 per year.

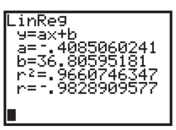
c.



The expenditures are expected to be \$1410.57 in 2016.

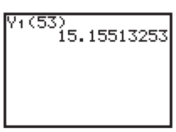
d. In the year 2000, the average annual expenditure for phone services was \$874.80.

8. a.



The regression equation is $y = -0.409x + 36.806$.

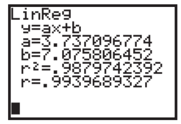
b.



The percent of female smokers is predicted to be 15.2% in 2013.

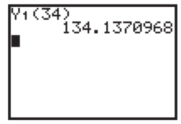
c. The percent of female smokers is decreasing at the rate of 0.409% per year.

10. a.



The regression equation is $y = 3.737x + 7.076$.

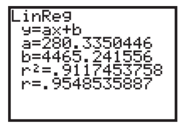
b.



There are predicted to be 134 thousand or 134,000 female prisoners in 2014.

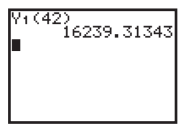
c. The number of female prisoners is increasing at the rate of 4 thousand or 4000 per year.

12. a.



The regression equation is $y = 280.335x + 4465.242$.

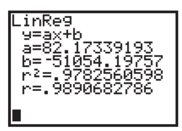
b.



There are predicted to be 16,239 teams in 2012.

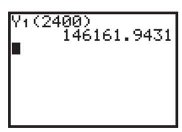
c. The number of teams is increasing at the rate of about 280 per year.

14.



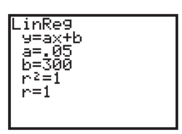
The regression equation is $y = 82.173x - 51{,}054.198$.

16.

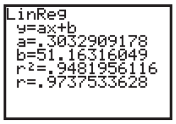


A home with 2400 square feet is predicted to sell for \$146,161.

18.

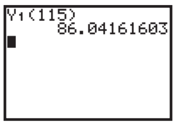


The regression equation is $y = 0.05x + 300$.

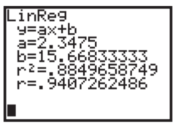
20. a. 

The regression equation is
$y = 0.303x + 51.163$.

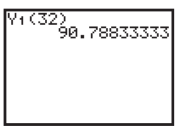
b. The life expectancy at birth of females is increasing at the rate of 0.303 years annually.

c. 

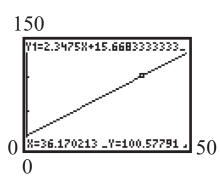
The life expectancy at birth of a female born in 2015 is predicted to be 86.0 years.

22. a. 

The regression equation is
$y = 2.348x + 15.668$.

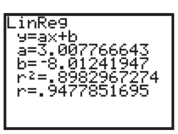
b. 

It is predicted that there will be 90.788 million HMO members in 2012.

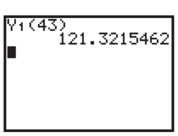
c. 

There will be over 100 million HMO members in 2016.

d. The number of HMO members is increasing at the rate of 2.348 million per year.

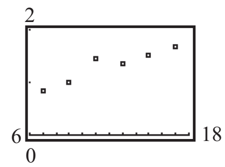
24. a. 

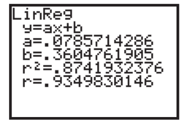
The regression equation is
$y = 3.008x - 8.012$.

b. 

The average top ticket price is predicted to be $121.33 per ticket in 2013.

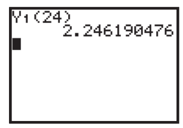
c. The cost is rising at the rate of about $3.01 per year.

26. a. 

b. 

The regression equation is
$y = 0.079x + 0.360$.

c. The cost is increasing at the rate of $0.079 million or $79,000 per year.

d. 

The cost is expected to be $2.246 million or $2,246,000 in 2014.

28.
$$\begin{aligned}5(x-2) &= 4(x+7)\\ 5x-10 &= 4x+28\\ x-10 &= 28\\ x &= 38\end{aligned}$$

30.
$$\begin{aligned}y+0.8 &= 0.3(y-2)\\ y+0.8 &= 0.3y-0.6\\ 10y+8 &= 3y-6\\ 7y+8 &= -6\\ 7y &= -14\\ y &= -2\end{aligned}$$

32. Answers may vary

Section 2.7

Practice Exercises

1. $f(x) = \begin{cases} -4x-2 & \text{if } x \le 0 \\ x+1 & \text{if } x > 0 \end{cases}$

Since $4 > 0$, $f(4) = 4+1 = 5$.

Since $-2 \le 0$, $f(-2) = -4(-2) - 2 = 8 - 2 = 6$.

Since $0 \le 0$, $f(0) = -4(0) - 2 = 0 - 2 = -2$.

2. $f(x) = \begin{cases} -4x-2 & \text{if } x \le 0 \\ x+1 & \text{if } x > 0 \end{cases}$

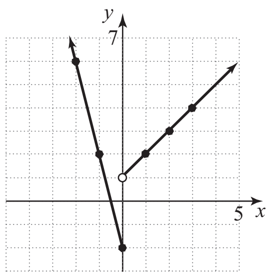
For $x \le 0$:

x	$f(x)$
–2	6
–1	2
0	–2

For $x > 0$:

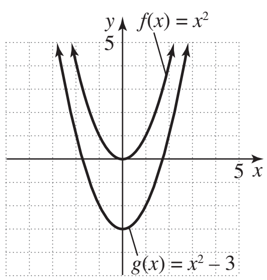
x	$f(x)$
1	2
2	3
3	4

Graph a closed circle at (0, −2). Graph an open circle at (0, 1), which is found by substituting 0 for x in $f(x) = x+1$.



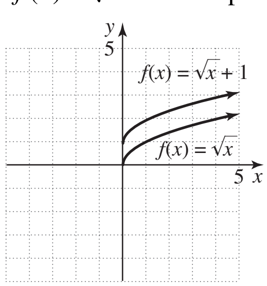
3. $f(x) = x^2$ and $g(x) = x^2 - 3$

The graph of $g(x) = x^2 - 3$ is the graph of $f(x) = x^2$ moved downward 3 units.



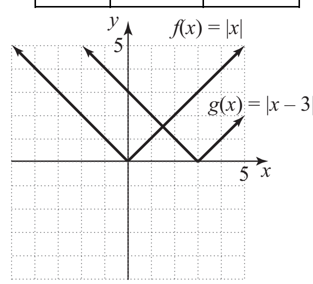
4. $f(x) = \sqrt{x}$ and $g(x) = \sqrt{x}+1$

The graph of $g(x) = \sqrt{x}+1$ is the graph of $f(x) = \sqrt{x}$ moved upward 1 unit.



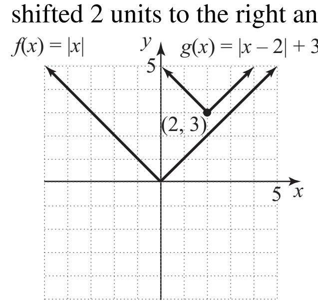
5. $f(x) = |x|$ and $g(x) = |x-3|$

x	$f(x)$	$g(x)$
–2	2	5
–1	1	4
0	0	3
1	1	2
2	2	1
3	3	0
4	4	1
5	5	2



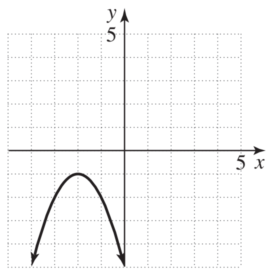
6. $f(x) = |x|$ and $g(x) = |x-2|+3$

The graph of $g(x)$ is the same as the graph of $f(x)$ shifted 2 units to the right and 3 units up.



7. $h(x) = -(x+2)^2 - 1$

The graph of $h(x) = -(x+2)^2 - 1$ is the same as the graph of $f(x) = x^2$ reflected about the x-axis, then moved 2 units to the left and 1 unit downward.



Vocabulary and Readiness Check

1. The graph that corresponds to $y=\sqrt{x}$ is C.

2. The graph that corresponds to $y=x^2$ is B.

3. The graph that corresponds to $y=x$ is D.

4. The graph that corresponds to $y=|x|$ is A.

Exercise Set 2.7

2. $f(x)=\begin{cases} 3x & \text{if } x<0 \\ x+2 & \text{if } x\ge 0 \end{cases}$

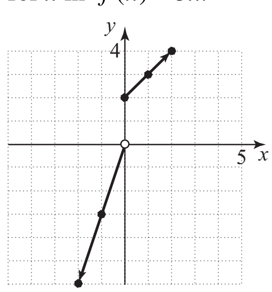
For $x<0$:

x	$f(x)$
−2	−6
−1	−3

For $x\ge 0$:

x	$f(x)$
0	2
1	3
2	4

Graph a closed circle at (0, 2). Graph an open circle at (0, 0), which is found by substituting 0 for x in $f(x)=3x$.



4. $f(x)=\begin{cases} 5x+4 & \text{if } x\le 0 \\ \frac{1}{3}x-1 & \text{if } x>0 \end{cases}$

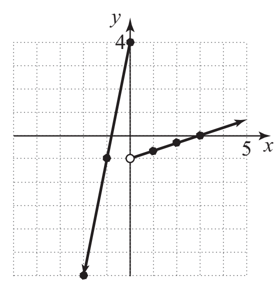
For $x\le 0$:

x	$f(x)$
−2	−6
−1	−1
0	4

For $x>0$:

x	$f(x)$
1	$-\frac{2}{3}$
2	$-\frac{1}{3}$
3	0

Graph a closed circle at (0, 4). Graph an open circle at (0, −1), which is found by substituting 0 for x in $f(x)=\frac{1}{3}x-1$.



6. $g(x)=\begin{cases} 3x-1 & \text{if } x\le 2 \\ -x & \text{if } x>2 \end{cases}$

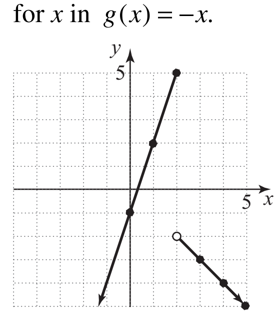
For $x\le 2$:

x	$g(x)$
0	−1
1	2
2	5

For $x>2$:

x	$g(x)$
3	−3
4	−4
5	−5

Graph a closed circle at (2, 5). Graph an open circle at (2, −2), which is found by substituting 2 for x in $g(x)=-x$.



8. $f(x) = \begin{cases} 4 & \text{if } x < -3 \\ -2 & \text{if } x \geq -3 \end{cases}$

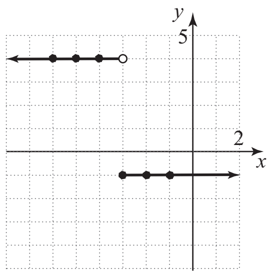
For $x < -3$:

x	$f(x)$
–6	4
–5	4
–4	4

For $x \geq -3$:

x	$f(x)$
–3	–2
–2	–2
–1	–2

Graph a closed circle at (–3, –2). Graph an open circle at (–3, 4), which is found by substituting -3 for x in $f(x) = 4$.



10. $f(x) = \begin{cases} -3x & \text{if } x \leq 0 \\ 3x + 2 & \text{if } x > 0 \end{cases}$

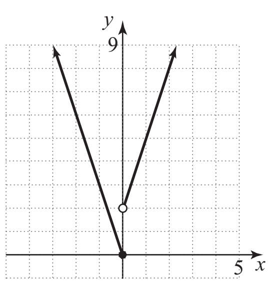
For $x \leq 0$:

x	$f(x)$
–1	3
0	0

For $x > 0$:

x	$f(x)$
1	5
2	8

Graph a closed circle at (0, 0). Graph an open circle at (0, 2), which is found by substituting 0 for x in $f(x) = 3x + 2$.



The function is defined for all real numbers, so the domain is all real numbers. The function takes on all y-values greater than or equal to 0, so the range is $\{y | y \geq 0\}$.

12. $f(x) = \begin{cases} 4x - 4 & \text{if } x < 2 \\ -x + 1 & \text{if } x \geq 2 \end{cases}$

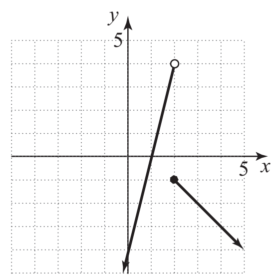
For $x < 2$:

x	$f(x)$
0	–4
1	0

For $x \geq 2$:

x	$f(x)$
2	–1
3	–2

Graph a closed circle at (2, –1). Graph an open circle at (2, 4), which is found by substituting 2 for x in $f(x) = 4x - 4$.



The function is defined for all real numbers, so the domain is all real numbers. The function takes on all y-values less than 4, so the range is $\{y | y < 4\}$.

14. $h(x) = \begin{cases} x + 2 & \text{if } x < 1 \\ 2x + 1 & \text{if } x \geq 1 \end{cases}$

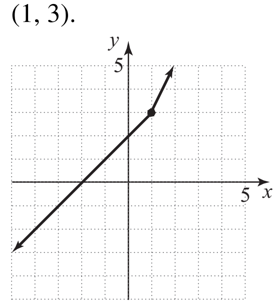
For $x < 1$:

x	$h(x)$
–2	0
–1	1
0	2

For $x \geq 1$:

x	$h(x)$
1	3
2	5
3	7

Graph a closed circle at (1, 3). The graph of $h(x) = x + 2$ for $x < 1$ also approaches the point (1, 3).



The function is defined for all real numbers, so the domain is all real numbers. The function takes on all y-values, so the range is all real numbers.

16. $f(x)=\begin{cases}-1 & \text{if } x\le 0\\ -3 & \text{if } x\ge 2\end{cases}$

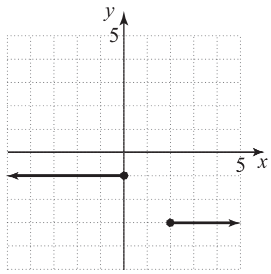
For $x \le 0$:

x	$f(x)$
–2	–1
–1	–1
0	–1

For $x \ge 2$:

x	$f(x)$
2	–3
3	–3
4	–3

Graph closed circles at (0, −1) and (2, −3).



The function is defined for $x \le 0$ or $x \ge 2$, so the domain is $\{x|x \le 0 \text{ or } x \ge 2\}$. The function takes on two y-values, −1 and −3, so the range is $\{-3, -1\}$.

18. $f(x)=|x|-2$ is graph D.

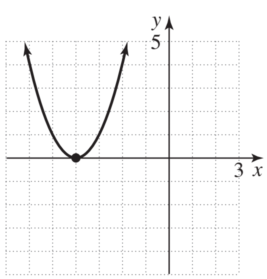
20. $f(x)=\sqrt{x}+3$ is graph C.

22. $f(x)=|x+3|$ is graph D.

24. $f(x)=\sqrt{x-2}$ is graph B.

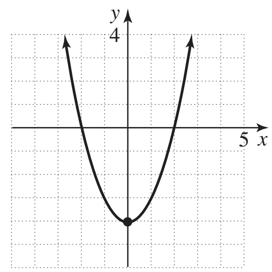
26. $y=(x+4)^2$

The graph of $y=(x+4)^2$ is the same as the graph of $y=x^2$ shifted left 4 units.



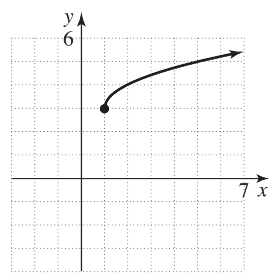
28. $f(x)=x^2-4$

The graph of $f(x)=x^2-4$ is the same as the graph of $y=x^2$ shifted down 4 units.



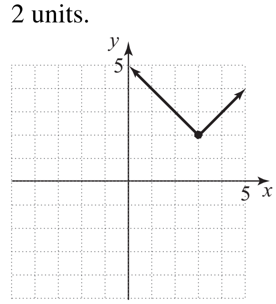
30. $f(x)=\sqrt{x-1}+3$

The graph of $f(x)=\sqrt{x-1}+3$ is the same as the graph of $y=\sqrt{x}$ shifted right 1 unit and up 3 units.



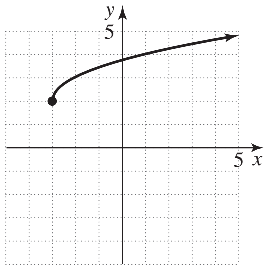
32. $f(x)=|x-3|+2$

The graph of $f(x)=|x-3|+2$ is the same as the graph of $y=|x|$ shifted right 3 units and up 2 units.



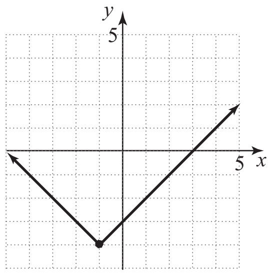
34. $f(x)=\sqrt{x+3}+2$

The graph of $f(x)=\sqrt{x+3}+2$ is the same as the graph of $y=\sqrt{x}$ shifted left 3 units and up 2 units.



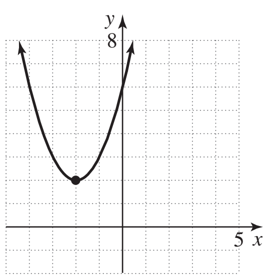
36. $f(x) = |x+1| - 4$

The graph of $f(x) = |x+1| - 4$ is the same as the graph of $y = |x|$ shifted left 1 unit and down 4 units.



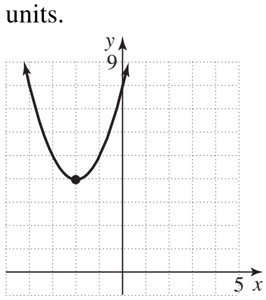
38. $h(x) = (x+2)^2 + 2$

The graph of $h(x) = (x+2)^2 + 2$ is the same as the graph of $y = x^2$ shifted left 2 units and up 2 units.



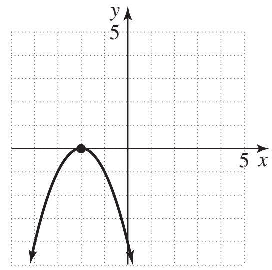
40. $f(x) = (x+2)^2 + 4$

The graph of $f(x) = (x+2)^2 + 4$ is the same as the graph of $y = x^2$ shifted left 2 units and up 4 units.



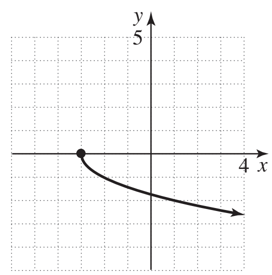
42. $g(x) = -(x+2)^2$

The graph of $g(x) = -(x+2)^2$ is the same as the graph of $y = x^2$ reflected about the *x*-axis and then shifted left 2 units.



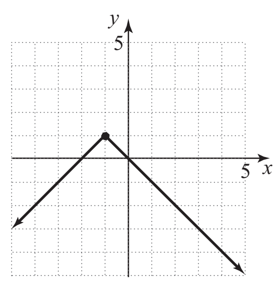
44. $f(x) = -\sqrt{x+3}$

The graph of $f(x) = -\sqrt{x+3}$ is the same as the graph of $y = \sqrt{x}$ reflected about the *x*-axis and then shifted left 3 units.



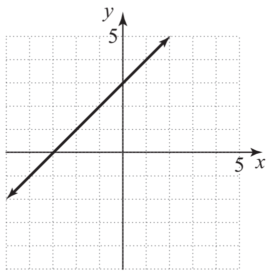
46. $g(x) = -|x+1| + 1$

The graph of $g(x) = -|x+1| + 1$ is the same as the graph of $y = |x|$ reflected about the *x*-axis and then shifted left 1 unit and up 1 unit.



48. $f(x) = (x-1) + 4$

Since the function can be simplified to $f(x) = x + 3$, we see that its graph is a line with slope $m = 1$ and *y*-intercept (0, 3).



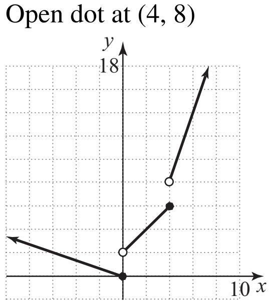
50. The graph of $x = -1$ is a vertical line with *x*-intercept (−1, 0). The correct graph is C.

52. The graph of $y = 3$ is a horizontal line with *y*-intercept (0, 3). The correct graph is B.

54. Answers may vary

56. $f(x) = \begin{cases} -\frac{1}{3}x & \text{if } x \le 0 \\ x+2 & \text{if } 0 < x \le 4 \\ 3x-4 & \text{if } x > 4 \end{cases}$

Some points for $x \le 0$: (−6, 2), (−3, 1), (0, 0)
Closed dot at (0, 0)
Some points for $0 < x \le 4$: (1, 3), (2, 4), (4, 6)
Open dot at (0, 2), closed dot at (4, 6)
Some points for $x > 4$: (5, 11), (6, 14)
Open dot at (4, 8)



58. $f(x) = \sqrt{x-1} + 3$
The function is defined when $x - 1 \ge 0$, or $x \ge 1$, so the domain is $\{x | x \ge 1\}$. The function takes on all *y*-values greater than or equal to 3, so the range is $\{y | y \ge 3\}$.

60. $g(x) = -|x+1| + 1$
The function is defined for all real numbers, so the domain is all real numbers. The function takes on all *y*-values less than or equal to 1, so the range is $\{y | y \le 1\}$.

62. $g(x) = -3\sqrt{x+5}$
The function is defined when $x + 5 \ge 0$, or $x \ge -5$, so the domain is $\{x | x \ge -5\}$.

64. $f(x) = -3|x + 5.7|$
The function is defined for all real numbers, so the domain is all real numbers.

66. $h(x) = \sqrt{x-17} - 3$
The function is defined when $x - 17 \ge 0$, or $x \ge 17$, so the domain is $\{x | x \ge 17\}$.

68. $f(x) = \begin{cases} x^2 & \text{if } x < 0 \\ \sqrt{x} & \text{if } x \ge 0 \end{cases}$

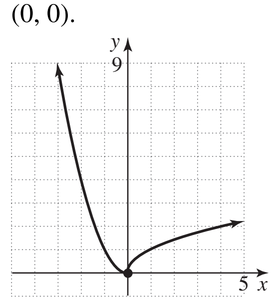
For $x < 0$:

x	*f*(*x*)
−3	9
−2	4
−1	1

For $x \ge 0$:

x	*f*(*x*)
0	0
1	1
4	2

Graph a closed circle at (0, 0). The graph of $f(x) = x^2$ for $x < 0$ also approaches the point (0, 0).



The function is defined for all real numbers, so the domain is all real numbers. The function takes on all *y*-values greater than or equal to 0, so the range is $\{y | y \ge 0\}$.

70. $g(x) = \begin{cases} -|x+1| - 1 & \text{if } x < -2 \\ \sqrt{x+2} - 4 & \text{if } x \ge -2 \end{cases}$

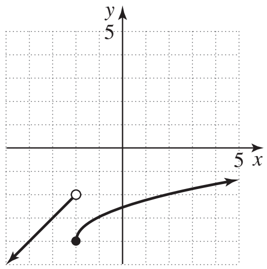
For $x < -2$:

x	*g*(*x*)
−5	−5
−4	−4
−3	−3

For $x \ge -2$:

x	*g*(*x*)
−2	−4
−1	−3
2	−2

Graph an open circle at (−2, −2). Graph a closed circle at (−2, −4).



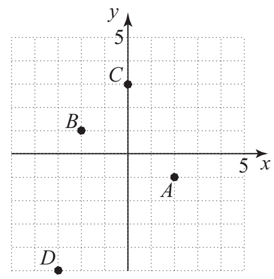
The function is defined for all real numbers, so the domain is all real numbers. The function takes on all y-values, so the range is all real numbers.

Chapter 2 Vocabulary Check

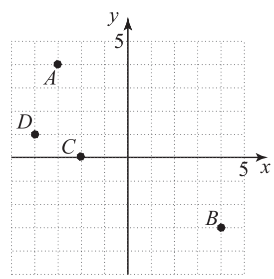
1. A relation is a set of ordered pairs.
2. The graph of every linear equation in two variables is a line.
3. The equation $y - 8 = -5(x + 1)$ is written in point-slope form.
4. Standard form of linear equation in two variables is $Ax + By = C$.
5. The range of a relation is the set of all second components of the ordered pairs of the relation.
6. Parallel lines have the same slope and different y-intercepts.
7. Slope-intercept form of a linear equation in two variables is $y = mx + b$.
8. A function is a relation in which each first component in the ordered pairs corresponds to exactly one second component.
9. In the equation $y = 4x - 2$, the coefficient of x is the slope of its corresponding graph.
10. Two lines are perpendicular if the product of their slopes is -1.
11. To find the x-intercept of a linear equation, let $y = 0$ and solve for the other variable.
12. The domain of a relation is the set of all first components of the ordered pairs of the relation.
13. A linear function is a function that can be written in the form $f(x) = mx + b$.
14. To find the y-intercept of a linear equation, let $x = 0$ and solve for the other variable.

Chapter 2 Review

1. $A(2, -1)$, quadrant IV
   $B(-2, 1)$, quadrant II
   $C(0, 3)$, y-axis
   $D(-3, -5)$, quadrant III



2. $A(-3, 4)$, quadrant II
   $B(4, -3)$, quadrant IV
   $C(-2, 0)$, x-axis
   $D(-4, 1)$, quadrant II



3. $7x - 8y = 56$
   $(0, 56)$; No
   $7(0) - 8(56) \stackrel{?}{=} 56$
   $-448 = 56$, False
   $(8, 0)$; Yes
   $7(8) - 8(0) \stackrel{?}{=} 56$
   $56 = 56$, True

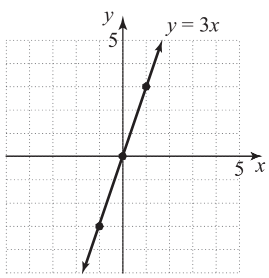
4. $-2x + 5y = 10$
   $(-5, 0)$; Yes
   $-2(-5) + 5(0) \stackrel{?}{=} 10$
   $10 = 10$, True
   $(1, 1)$, No
   $-2(1) + 5(1) \stackrel{?}{=} 10$
   $3 = 10$, False

5. $x = 13$
   $(13, 5)$; Yes
   $13 = 13$, True
   $(13, 13)$; Yes
   $13 = 13$, True

6. $y = 2$
(7, 2); Yes
$2 = 2$, True
(2, 7); No
$7 = 2$, False

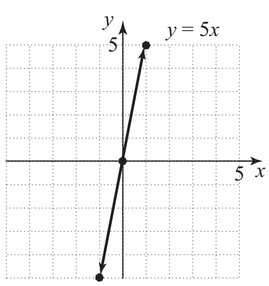
7. $y = 3x$; Linear

x	-1	0	1
y	-3	0	3

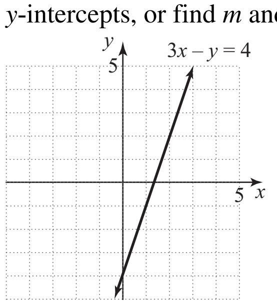


8. $y = 5x$; Linear

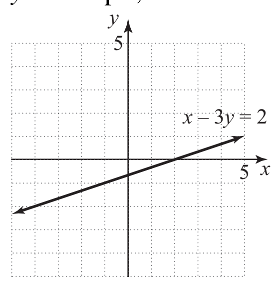
x	-1	0	1
y	-5	0	5



9. $3x - y = 4$; Linear
Find three ordered pair solutions, or find x- and y-intercepts, or find m and b.

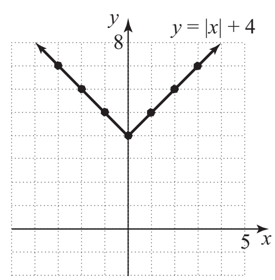


10. $x - 3y = 2$; Linear
Find three ordered pair solutions, or find x- and y-intercepts, or find m and b.



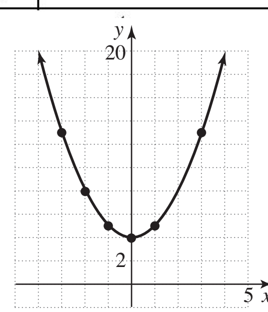
11. $y = |x| + 4$; Nonlinear

x	-3	-2	-1	0	1	2	3
y	7	6	5	4	5	6	7

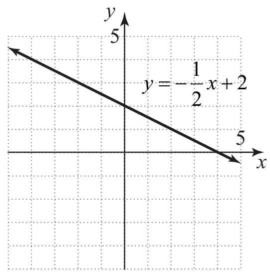


12. $y = x^2 + 4$; Nonlinear

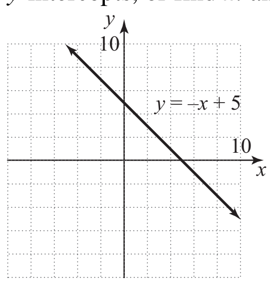
x	-3	-2	-1	0	1	2	3
y	13	8	5	4	5	8	13



13. $y = -\frac{1}{2}x + 2$; Linear
Find three ordered pair solutions, or find x- and y-intercepts, or find m and b.



14. $y = -x + 5$; Linear
Find three ordered pair solutions, or find x- and y-intercepts, or find m and b.



15. The graph shown is the graph of $y = x^2 + 2$; d.

16. The graph shown is the graph of $y = x^2 - 4$; a.

17. The graph shown is the graph of $y = |x| + 2$; c.

18. The graph shown is the graph of $y = -|x| + 2$; b.

19. The domain is the set of all first coordinates (or inputs) and the range is the set of all second coordinates (or outputs).
Domain: $\left\{-\frac{1}{2}, 6, 0, 25\right\}$
Range: $\left\{\frac{3}{4}, -12, 25\right\}$
Function since each x-value corresponds to exactly one y-value.

20. The domain is the set of all first coordinates (or inputs) and the range is the set of all second coordinates (or outputs).
Domain: $\left\{\frac{3}{4}, -12, 25\right\}$
Range: $\left\{-\frac{1}{2}, 6, 0, 25\right\}$
Not a function since $\frac{3}{4}$ (or 0.75) is paired with both $-\frac{1}{2}$ and 6.

21. The domain is the set of all first coordinates (or inputs) and the range is the set of all second coordinates (or outputs).
Domain: {2, 4, 6, 8}
Range: {2, 4, 5, 6}
Not a function since 2 is paired with both 2 and 4.

22. The domain is the set of all first coordinates (or inputs) and the range is the set of all second coordinates (or outputs).
Domain:
{Triangle, Square, Rectangle, Parallelogram}
Range: {3, 4}
Function since each input is paired with exactly one output.

23. Domain: all real numbers
Range: $\{y | y \le -1 \text{ or } y \ge 1\}$
Not a function since it fails the vertical line test.

24. Domain: {–3}
Range: all real numbers
Not a function since it fails the vertical line test.

25. Domain: all real numbers
Range: {4}
Function since it passes the vertical line test.

26. Domain: $\{x | -1 \le x \le 1\}$
Range: $\{y | -1 \le y \le 1\}$
Not a function since it fails the vertical line test.

27. $f(x) = x - 5$
$f(2) = (2) - 5 = -3$

28. $g(x) = -3x$
$g(0) = -3(0) = 0$

29. $g(x) = -3x$
$g(-6) = -3(-6) = 18$

30.
$$\begin{aligned} h(x) &= 2x^2 - 6x + 1 \\ h(-1) &= 2(-1)^2 - 6(-1) + 1 \\ &= 2(1) + 6 + 1 \\ &= 9 \end{aligned}$$

31. $h(x) = 2x^2 - 6x + 1$
$h(1) = 2(1)^2 - 6(1) + 1 = 2 - 6 + 1 = -3$

32. $f(x) = x - 5$
$f(5) = (5) - 5 = 0$

33. $J(x) = 2.54x$
$J(150) = 2.54(150) = 381$ pounds

34. $J(x) = 2.54x$
$J(2000) = 2.54(2000) = 5080$ pounds

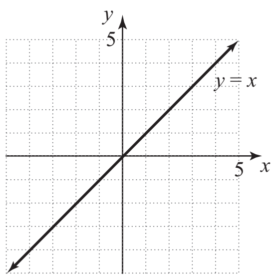
35. The point (–1, 0) is on the graph, so $f(-1) = 0$.

36. The point (1, –2) is on the graph, so $f(1) = -2$.

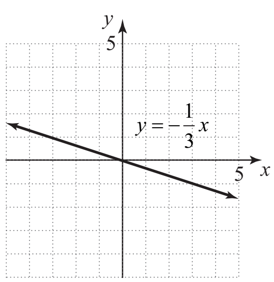
37. $f(x) = 1$
$f(-2) = f(4) = 1$
$x = -2, 4$

38. $f(x) = -1$
$f(0) = f(2) = -1$
$x = 0, 2$

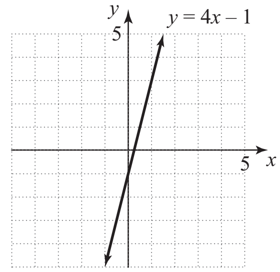
39. $f(x) = x$ or $y = x$
$m = 1, \; b = 0$



40. $f(x) = -\frac{1}{3}x$ or $y = -\frac{1}{3}x$
$m = -\frac{1}{3}, \; b = 0$



41. $g(x) = 4x - 1$ or $y = 4x - 1$
$m = 4, \; b = -1$



42. $f(x) = 3x + 1$
The y-intercept should be (0, 1). The correct graph is C.

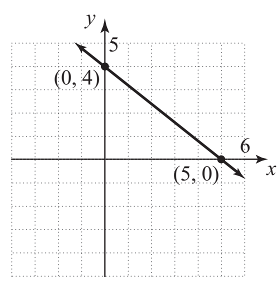
43. $f(x) = 3x - 2$
The y-intercept should be (0, –2). The correct graph is A.

44. $f(x) = 3x + 2$
The y-intercept should be (0, 2). The correct graph is B.

45. $f(x) = 3x - 5$
The y-intercept should be (0, –5). The correct graph is D.

46. $4x + 5y = 20$

Let $x = 0$	Let $y = 0$
$4(0) + 5y = 20$	$4x + 5(0) = 20$
$y = 4$	$x = 5$
$(0, 4)$	$(5, 0)$



47. $3x - 2y = -9$

Let $x = 0$

$3(0) - 2y = -9$

$y = \frac{9}{2}$

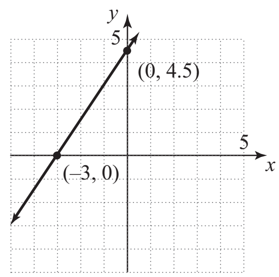
$\left(0, \frac{9}{2}\right)$

Let $y = 0$

$3x - 2(0) = -9$

$x = -3$

$(-3, 0)$



48. $4x - y = 3$

Let $x = 0$

$4(0) - y = 3$

$y = -3$

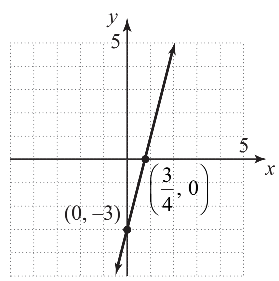
$(0, -3)$

Let $y = 0$

$4x - (0) = 3$

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

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



49. $2x + 6y = 9$

Let $x = 0$

$2(0) + 6y = 9$

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

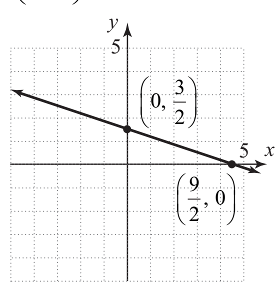
$\left(0, \frac{3}{2}\right)$

Let $y = 0$

$2x + 6(0) = 9$

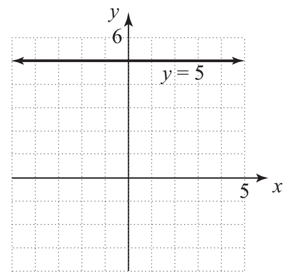
$x = \frac{9}{2}$

$\left(\frac{9}{2}, 0\right)$



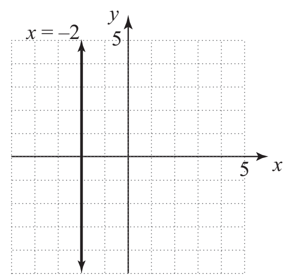
50. $y = 5$

Horizontal line with y-intercept 5.



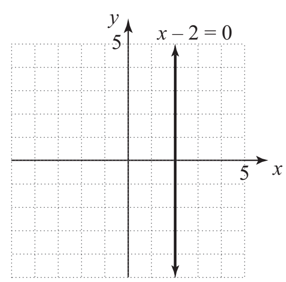
51. $x = -2$

Vertical line with x-intercept –2.



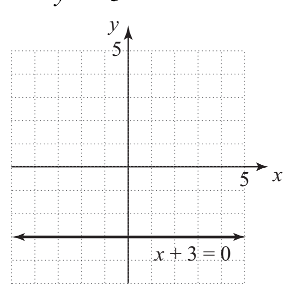
52. $x - 2 = 0$

$x = 2$



53. $y + 3 = 0$

$y = -3$



54. $C(x) = 0.3x + 42$

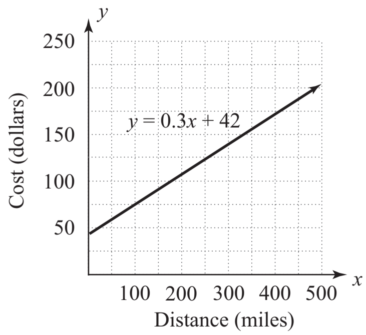
a. $C(150) = 0.3(150) + 42$

$= 45 + 42$

$= 87$

\$87

b. $m = 0.3,\ b = 42$



55. $m = \dfrac{-4-8}{6-2} = \dfrac{-12}{4} = -3$

56. $m = \dfrac{13-9}{5-(-3)} = \dfrac{4}{8} = \dfrac{1}{2}$

57. $m = \dfrac{6-(-4)}{-3-(-7)} = \dfrac{10}{4} = \dfrac{5}{2}$

58. $m = \dfrac{7-(-2)}{-5-7} = \dfrac{9}{-12} = -\dfrac{3}{4}$

59.
$$\begin{aligned} 6x - 15y &= 20 \\ -15y &= -6x + 20 \\ y &= \frac{2}{5}x - \frac{4}{3} \end{aligned}$$
$m = \frac{2}{5},\ b = -\frac{4}{3},\ y\text{-intercept } \left(0, -\frac{4}{3}\right)$

60.
$$\begin{aligned} 4x + 14y &= 21 \\ 14y &= -4x + 21 \\ y &= -\frac{2}{7}x + \frac{3}{2} \end{aligned}$$
$m = -\frac{2}{7},\ b = \frac{3}{2},\ y\text{-intercept } \left(0, \frac{3}{2}\right)$

61. $y - 3 = 0$
$y = 3$; Slope = 0

62. $x = -5$; Vertical line
Slope is undefined.

63. The slope of l_1 is negative, and the slope of l_2 is positive. Since a positive number is greater than any negative number, l_2 has the greater slope.

64. The slope of l_1 is 0, and the slope of l_2 is positive. Since a positive number is greater than 0, l_2 has the greater slope.

65. The slope of l_1 and the slope of l_2 are both positive. Since l_2 is steeper, it has the greater slope.

66. The slope of l_1 is 0, and the slope of l_2 is negative. Since a negative number is less than 0, l_1 has the greater slope.

67. $y = 0.3x + 42$

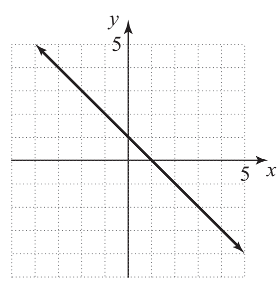
a. $m = 0.3$; the cost increases by \$0.30 for each additional mile driven.

b. $b = 42$; the cost for 0 miles driven is \$42.

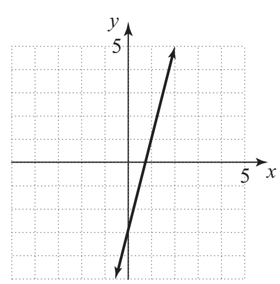
68. $f(x) = -2x + 6$ $\quad$ $g(x) = 2x - 1$
$m = -2$ $\quad$ $m = 2$
Neither; The slopes are not the same and their product is not –1.

69. $-x + 3y = 2$ $\quad$ $6x - 18y = 3$
$y = \frac{1}{3}x + \frac{2}{3}$ $\quad$ $y = \frac{1}{3}x - \frac{1}{6}$
$m = \frac{1}{3}$ $\quad$ $m = \frac{1}{3}$
Parallel, since their slopes are equal.

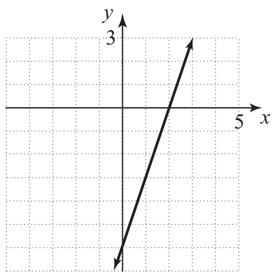
70. $y = -x + 1$
$m = -1,\ b = 1$



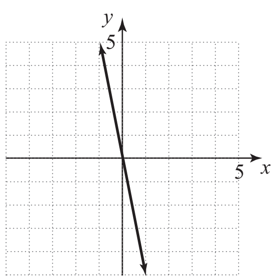
71. $y = 4x - 3$
$m = 4,\ b = -3$



72. $3x - y = 6$
$y = 3x - 6$
$m = 3,\ b = -6$



73. $y = -5x$
$m = -5,\ b = 0$



74. Every horizontal line is in the form $y = c$. Since the line passes through the point (3, –1), its equation is $y = -1$.

75. Every vertical line has the form $x = c$. Since the line passes through the point (–2, –4), its equation is $x = -2$.

76. A line parallel to $x = 6$ has the form $x = c$. Since the line passes through (–4, –3), its equation is $x = -4$.

77. Lines with slope 0 are horizontal, and have the form $y = c$. Since it passes through (2, 5), its equation is $y = 5$.

78. $y - y_1 = m(x - x_1)$
$y - 5 = 3[x - (-3)]$
$y - 5 = 3(x + 3)$
$y - 5 = 3x + 9$
$3x - y = -14$

79. $y - y_1 = m(x - x_1)$
$y - (-2) = 2(x - 5)$
$y + 2 = 2x - 10$
$2x - y = 12$

80. $m = \frac{-2 - (-1)}{-4 - (-6)} = \frac{-1}{2} = -\frac{1}{2}$
$y - y_1 = m(x - x_1)$
$y - (-1) = -\frac{1}{2}[x - (-6)]$
$2(y + 1) = -(x + 6)$
$2y + 2 = -x - 6$
$x + 2y = -8$

81. $m = \frac{-8 - 3}{-4 - (-5)} = \frac{-11}{1} = -11$
$y - y_1 = m(x - x_1)$
$y - 3 = -11[x - (-5)]$
$y - 3 = -11(x + 5)$
$y - 3 = -11x - 55$
$11x + y = -52$

82. $x = 4$ has undefined slope.
A line perpendicular to $x = 4$ has slope = 0 and is therefore horizontal.
$y = 3$

83. $y = 8$ has slope = 0
A line parallel to $y = 8$ has slope = 0.
$y = -5$

84. $y = mx + b$
$y = -\frac{2}{3}x + 4$
$f(x) = -\frac{2}{3}x + 4$

85. $y = mx + b$
$y = -x - 2$
$f(x) = -x - 2$

86. $6x + 3y = 5$
$3y = -6x + 5$
$y = -2x + \frac{5}{3}$ so $m = -2$
$y - y_1 = m(x - x_1)$
$y - (-6) = -2(x - 2)$
$y + 6 = -2x + 4$
$y = -2x - 2$
$f(x) = -2x - 2$

87. $3x+2y=8$

$$2y=-3x+8$$

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

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

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

$$2(y+2)=-3(x+4)$$

$$2y+4=-3x-12$$

$$2y=-3x-16$$

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

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

88. $4x+3y=5$

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

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

so $m=-\frac{4}{3}$ and $m_\perp=\frac{3}{4}$

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

$$y-(-1)=\frac{3}{4}[x-(-6)]$$

$$4(y+1)=3(x+6)$$

$$4y+4=3x+18$$

$$4y=3x+14$$

$$y=\frac{3}{4}x+\frac{7}{2}$$

$$f(x)=\frac{3}{4}x+\frac{7}{2}$$

89. $2x-3y=6$

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

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

so $m=\frac{2}{3}$ and $m_\perp=-\frac{3}{2}$

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

$$y-5=-\frac{3}{2}[x-(-4)]$$

$$2(y-5)=-3(x+4)$$

$$2y-10=-3x-12$$

$$2y=-3x-2$$

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

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

90. a. Use ordered pairs (0, 71) and (5, 82)

$$m=\frac{82-71}{5-0}=\frac{11}{5}=2.2 \text{ and } b=71$$

$y=2.2x+71$

b. $x=2009-2000=9$

$y=2.2(9)+71=90.8$

About 91% of US drivers will be wearing seat belts.

91. a. Use ordered pairs (0, 43) and (22, 60)

$$m=\frac{60-43}{22-0}=\frac{17}{22} \text{ and } b=43$$

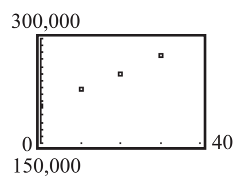
$$y=\frac{17}{22}x+43$$

b. $x=2010-1998=12$

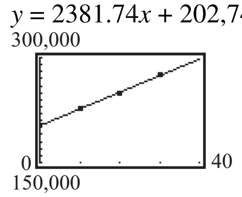
$$y=\frac{17}{22}(12)+43\approx 52.3$$

There will be about 52 million people reporting arthritis.

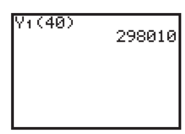
92. a.



b. The regression equation is $y=2381.74x+202{,}740.4$.



c.



The population of the United States is predicted to be 298.010 thousand.

93. $g(x)=\begin{cases} -\frac{1}{5}x & \text{if } x \le -1 \\ -4x+2 & \text{if } x > -1 \end{cases}$

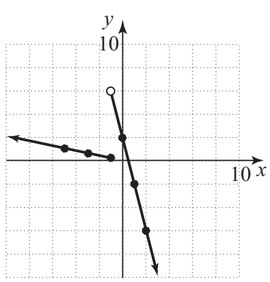
For $x \le -1$:

x	$g(x)$
–5	1
–3	$\frac{3}{5}$
–1	$\frac{1}{5}$

For $x > -1$:

x	$g(x)$
0	2
1	–2
2	–6

Graph a closed circle at $\left(-1, \frac{1}{5}\right)$. Graph an open circle at (–1, 6), which is found by substituting –1 for x in $g(x)=-4x+2$.



94. $f(x)=\begin{cases} -3x & \text{if } x < 0 \\ x-3 & \text{if } x \ge 0 \end{cases}$

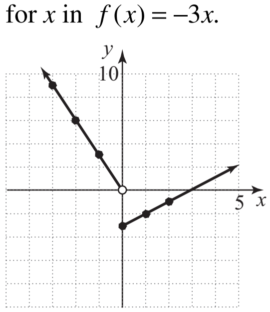
For $x < 0$:

x	$f(x)$
–3	9
–2	6
–1	3

For $x \ge 0$:

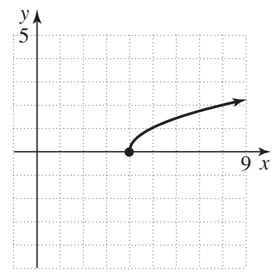
x	$f(x)$
0	–3
1	–2
2	–1

Graph a closed circle at (0, –3). Graph an open circle at (0, 0), which is found by substituting 0 for x in $f(x)=-3x$.



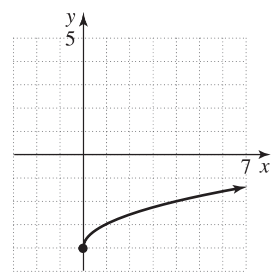
95. $f(x)=\sqrt{x-4}$

The graph of $f(x)=\sqrt{x-4}$ is the same as the graph of $y=\sqrt{x}$ shifted right 4 units.



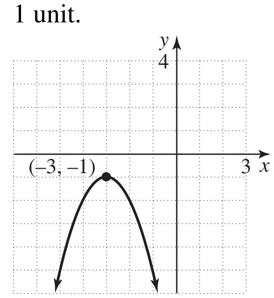
96. $y=\sqrt{x}-4$

The graph of $f(x)=\sqrt{x}-4$ is the same as the graph of $y=\sqrt{x}$ shifted down 4 units.



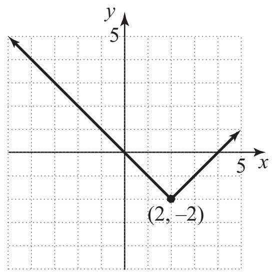
97. $h(x)=-(x+3)^2-1$

The graph of $h(x)=-(x+3)^2-1$ is the same as the graph of $y=x^2$ reflected about the x-axis and then shifted left 3 units and down 1 unit.



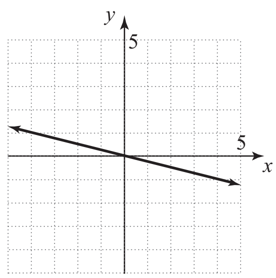
98. $g(x)=|x-2|-2$

The graph of $g(x)=|x-2|-2$ is the same as the graph of $y=|x|$ shifted right 2 units and down 2 units.



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

The slope is $-\frac{1}{4}$, and the y-intercept is (0, 0).



100. $3x - 2y = -9$

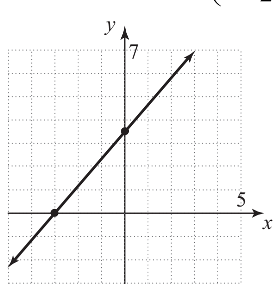
Let $x = 0$.

$$\begin{aligned} 3x - 2y &= -9 \\ 3(0) - 2y &= -9 \\ -2y &= -9 \\ y &= \frac{9}{2} \end{aligned}$$

Let $y = 0$.

$$\begin{aligned} 3x - 2y &= -9 \\ 3x - 2(0) &= -9 \\ 3x &= -9 \\ x &= -3 \end{aligned}$$

The intercepts are $\left(0, \frac{9}{2}\right)$ and (–3, 0).



101. Vertical; through $\left(-7, -\frac{1}{2}\right)$

A vertical line has an equation of the form $x = a$, where a is the x-coordinate of any point on the line. The equation is $x = -7$.

102. Slope 0; through $\left(-4, \frac{9}{2}\right)$

A line with slope 0 is horizontal, and a horizontal line has an equation of the form $y = b$, where b is the y-coordinate of any point on the line. The equation is $y = \frac{9}{2}$.

103. Slope $\frac{3}{4}$; through (–8, –4)

$$\begin{aligned} y - y_1 &= m(x - x_1) \\ y - (-4) &= \frac{3}{4}(x - (-8)) \\ y + 4 &= \frac{3}{4}(x + 8) \\ 4(y + 4) &= 3(x + 8) \\ 4y + 16 &= 3x + 24 \\ 4y &= 3x + 8 \\ y &= \frac{3}{4}x + 2 \end{aligned}$$

104. Through (–3, 8) and (–2, 3)

Find the slope.

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

Use the slope and one of the points in the point-slope form. We use (–2, 3).

$$\begin{aligned} y - y_1 &= m(x - x_1) \\ y - 3 &= -5(x - (-2)) \\ y - 3 &= -5(x + 2) \\ y - 3 &= -5x - 10 \\ y &= -5x - 7 \end{aligned}$$

105. Through (–6, 1); parallel to $y = -\frac{3}{2}x + 11$

The slope of a line parallel to $y = -\frac{3}{2}x + 11$ will have the same slope, $-\frac{3}{2}$.

$$\begin{aligned} y - y_1 &= m(x - x_1) \\ y - 1 &= -\frac{3}{2}(x - (-6)) \\ y - 1 &= -\frac{3}{2}(x + 6) \\ 2(y - 1) &= -3(x + 6) \\ 2y - 2 &= -3x - 18 \\ 2y &= -3x - 16 \\ y &= -\frac{3}{2}x - 8 \end{aligned}$$

106. Through (−5, 7); perpendicular to $5x-4y=10$

Find the slope of $5x-4y=10$.

$$5x-4y=10$$
$$-4y=-5x+10$$
$$y=\frac{5}{4}x-\frac{5}{2}$$

The slope is $\frac{5}{4}$. The slope of any line perpendicular to this line is the negative reciprocal of $\frac{5}{4}$, or $-\frac{4}{5}$.

$$y-y_1=m(x-x_1)$$
$$y-7=-\frac{4}{5}(x-(-5))$$
$$y-7=-\frac{4}{5}(x+5)$$
$$5(y-7)=-4(x+5)$$
$$5y-35=-4x-20$$
$$5y=-4x+15$$
$$y=-\frac{4}{5}x+3$$

107. $f(x)=\begin{cases} x-2 & \text{if } x\le 0 \\ -\frac{x}{3} & \text{if } x\ge 3 \end{cases}$

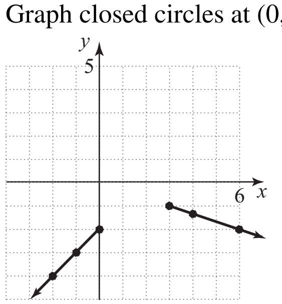
For $x \le 0$:

x	$f(x)$
−2	−4
−1	−3
0	−2

For $x \ge 3$:

x	$f(x)$
3	−1
4	$-\frac{4}{3}$
6	−2

Graph closed circles at (0, –2) and (3, −1).



108. $g(x)=\begin{cases} 4x-3 & \text{if } x\le 1 \\ 2x & \text{if } x>1 \end{cases}$

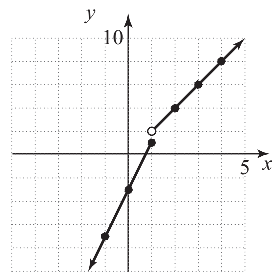
For $x \le 1$:

x	$g(x)$
−1	−7
0	−3
1	1

For $x > 1$:

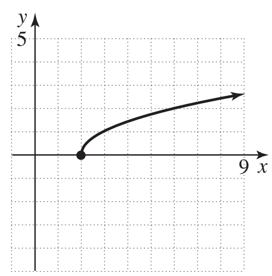
x	$g(x)$
2	4
3	6
4	8

Graph a closed circle at (1, 1). Graph an open circle at (1, 2), which is found by substituting 1 for x in $g(x)=2x$.



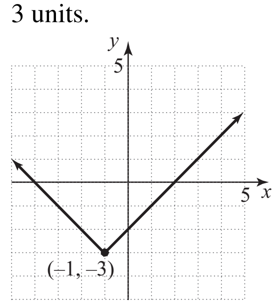
109. $f(x)=\sqrt{x-2}$

The graph of $f(x)=\sqrt{x-2}$ is the same as the graph of $y=\sqrt{x}$ shifted right 2 units.



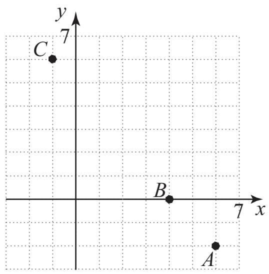
110. $f(x)=|x+1|-3$

The graph of $f(x)=|x+1|-3$ is the same as the graph of $y=|x|$ shifted left 1 unit and down 3 units.



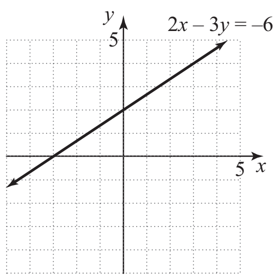
Chapter 2 Test

1.

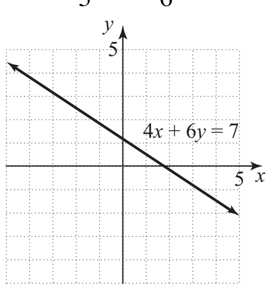


A is in quadrant IV.
B is on the x-axis, no quadrant.
C is in quadrant II.

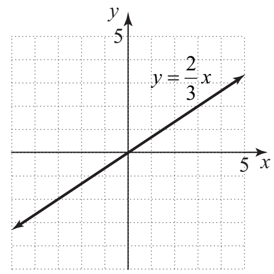
2. $2x-3y=-6$
$-3y=-2x-6$
$y=\frac{2}{3}x+2$
$m=\frac{2}{3},\ b=2$



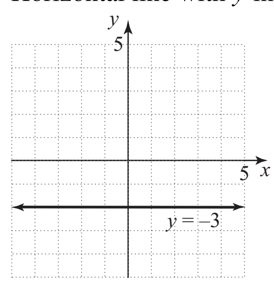
3. $4x+6y=7$
$6y=-4x+7$
$y=-\frac{2}{3}x+\frac{7}{6}$
$m=-\frac{2}{3},\ b=\frac{7}{6}$



4. $f(x)=\frac{2}{3}x$ or $y=\frac{2}{3}x$



5. $y=-3$
Horizontal line with y-intercept at –3.



6. $m=\frac{10-(-8)}{-7-5}=\frac{18}{-12}=-\frac{3}{2}$

7. $3x+12y=8$
$12y=-3x+8$
$y=-\frac{1}{4}x+\frac{2}{3}$
$m=-\frac{1}{4},\ b=\frac{2}{3},$ so y-intercept is $\left(0,\ \frac{2}{3}\right)$.

8. Horizontal; through (2, −8)
A horizontal line has an equation of the form $y = b$, where b is the y-coordinate of any point on the line. The equation is $y = -8$.

9. Vertical; through (−4, −3)
A vertical line has an equation of the form $x = a$, where a is the x-coordinate of any point on the line. The equation is $x = -4$.

10. Perpendicular to $x = 5$; through (3, −2)
The line $x = 5$ is vertical, so any line perpendicular to it is horizontal. A horizontal line has an equation of the form $y = b$, where b is the y-coordinate of any point on the line. The equation is $y = -2$.

11. $y - y_1 = m(x - x_1)$
$y - (-1) = -3(x - 4)$
$y + 1 = -3x + 12$
$3x + y = 11$

12. $y - y_1 = m(x - x_1)$
$y - (-2) = 5(x - 0)$
$y + 2 = 5x$
$5x - y = 2$

13. $m = \frac{-3 - (-2)}{6 - 4} = \frac{-1}{2} = -\frac{1}{2}$
$y - y_1 = m(x - x_1)$
$y - (-2) = -\frac{1}{2}(x - 4)$
$2(y + 2) = -(x - 4)$
$2y + 4 = -x + 4$
$2y = -x$
$y = -\frac{1}{2}x$
$f(x) = -\frac{1}{2}x$

14. $3x - y = 4$
$y = 3x - 4$
$m = 3$ so $m_\perp = -\frac{1}{3}$
$y - y_1 = m(x - x_1)$
$y - 2 = -\frac{1}{3}[x - (-1)]$
$3(y - 2) = -(x + 1)$
$3y - 6 = -x - 1$
$3y = -x + 5$
$y = -\frac{1}{3}x + \frac{5}{3}$
$f(x) = -\frac{1}{3}x + \frac{5}{3}$

15. $2y + x = 3$
$2y = -x + 3$
$y = -\frac{1}{2}x + 3$ so $m = -\frac{1}{2}$
$y - y_1 = m(x - x_1)$
$y - (-2) = -\frac{1}{2}(x - 3)$
$2(y + 2) = -(x - 3)$
$2y + 4 = -x + 3$
$2y = -x - 1$
$y = -\frac{1}{2}x - \frac{1}{2}$
$f(x) = -\frac{1}{2}x - \frac{1}{2}$

16. $2x - 5y = 8$
$-5y = -2x + 8$
$y = \frac{2}{5}x - \frac{8}{5}$ so $m_1 = \frac{2}{5}$
$m_2 = \frac{-1 - 4}{-1 - 1} = \frac{-5}{-2} = \frac{5}{2}$
Therefore, lines L_1 and L_2 are neither parallel nor perpendicular since their slopes are not equal and the product of their slopes is not –1.

17. The graph shown is a parabola. It is the graph of $y = x^2 + 2x + 3$; B.

18. The graph shown is V-shaped. It is the graph of $y = 2|x - 1| + 3$; A.

19. The graph shown is linear. It is the graph of $y = 2x + 3$; D.

20. The graph shown is cubic. It is the graph of $y = 2(x - 1)^3 + 3$; C.

21. Domain: all real numbers
Range: {5}
Function since it passes the vertical line test.

22. Domain: {–2}
Range: all real numbers
Not a function since it fails the vertical line test.

23. Domain: all real numbers
Range: $\{y | y \ge 0\}$
Function since it passes the vertical line test.

24. Domain: all real numbers
Range: all real numbers
Function since it passes the vertical line test.

25. $f(x) = 1031x + 25{,}193$

a. $x = 0$
$f(0) = 1031(0) + 25{,}193 = 25{,}193$
The average earnings in 2000 were $25,193.

b. $x = 2007 - 2000 = 7$
$f(7) = 1031(7) + 25{,}193 = 32{,}410$
The average earnings in 2007 were $32,410.

c. $40{,}000 \le 1031x + 25{,}193$
$14{,}807 \le 1031x$
$14.4 \le x$
$2000 + 15 = 2015$
The average earnings will be greater than $40,000 in 2015.

d. slope = 1031; the yearly earnings for high school graduates increases $1031 per year.

e. (0, 25,193); the yearly earnings for a high school graduate in 2000 were $25,193.

26. $f(x) = \begin{cases} -\frac{1}{2}x & \text{if } x \le 0 \\ 2x - 3 & \text{if } x > 0 \end{cases}$

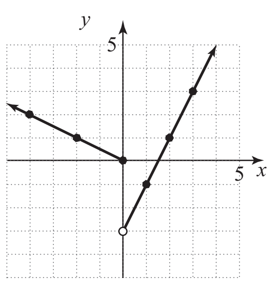
For $x \le 0$:

x	$f(x)$
–4	2
–2	1
0	0

For $x > 0$:

x	$f(x)$
1	–1
2	1
3	3

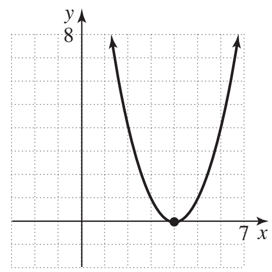
Graph a closed circle at (0, 0). Graph an open circle at (0, –3), which is found by substituting 0 for x in $f(x) = 2x - 3$.



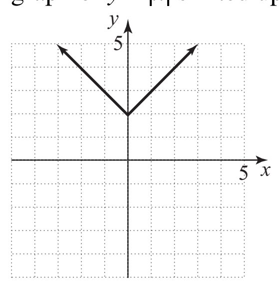
The domain is all real numbers.
The range is $\{y|y > -3\}$.

27. $f(x) = (x-4)^2$

The graph of $f(x) = (x-4)^2$ is the same as the graph of $y = x^2$ shifted right 4 units.

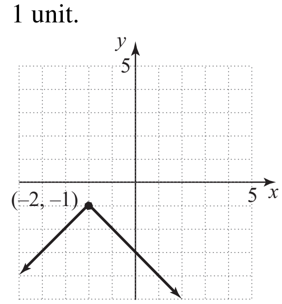


28. $g(x) = |x| + 2$
The graph of $g(x) = |x| + 2$ is the same as the graph of $y = |x|$ shifted up 2 units.



29. $g(x) = -|x+2| - 1$

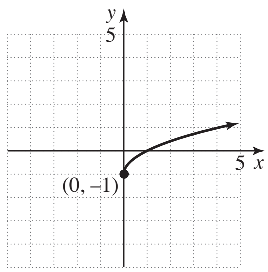
The graph of $g(x) = -|x+2| - 1$ is the same as the graph of $y = |x|$ reflected about the x-axis and then shifted left 2 units and down 1 unit.



The domain is all real numbers.
The range is $\{y|y \le -1\}$.

30. $h(x) = \sqrt{x} - 1$

The graph of $h(x) = \sqrt{x} - 1$ is the same as the graph of $y = \sqrt{x}$ shifted down 1 unit.



Chapter 2 Cumulative Review

1. $3x - y = 3(15) - (4) = 45 - 4 = 41$

2. **a.** $-4 + (-3) = -7$

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

c. $7 - 20 = -13$

3. **a.** True, 3 is a real number

b. False, $\frac{1}{5}$ is not an irrational number.

c. False, every rational number is not an integer, for example, $\frac{2}{3}$.

d. False, since 1 is not in the second set.

4. **a.** The opposite of –7 is 7.

b. The opposite of 0 is 0.

c. The opposite of $\frac{1}{4}$ is $-\frac{1}{4}$.

5. **a.** $2 - 8 = -6$

b. $-8 - (-1) = -8 + 1 = -7$

c. $-11 - 5 = -16$

d. $10.7 - (-9.8) = 10.7 + 9.8 = 20.5$

e. $\frac{2}{3} - \frac{1}{2} = \frac{4}{6} - \frac{3}{6} = \frac{1}{6}$

f. $1 - 0.06 = 0.94$

g. $4 - 7 = -3$

6. **a.** $\frac{-42}{-6} = 7$

b. $\frac{0}{14} = 0$

c. $-1(-5)(-2) = 5(-2) = -10$

7. **a.** $3^2 = 3 \cdot 3 = 9$

b. $\left(\frac{1}{2}\right)^4 = \frac{1}{2^4} = \frac{1}{16}$

c. $-5^2 = -(5 \cdot 5) = -25$

d. $(-5)^2 = (-5)(-5) = 25$

e. $-5^3 = -(5 \cdot 5 \cdot 5) = -125$

f. $(-5)^3 = (-5)(-5)(-5) = -125$

8. **a.** Distributive Property

b. Commutative Property of Addition

9. **a.** $-1 > -2$ since –1 is to the right of –2 on the number line.

b. $\frac{12}{4} = 3$

c. $-5 < 0$ since –5 is to the left of 0 on the number line.

d. $-3.5 \le -3.05$ since –3.5 is to the left of –3.05 on the number line.

10. $2x^2$

a. $2(7)^2 = 2(49) = 98$

b. $2(-7)^2 = 2(49) = 98$

11. **a.** The reciprocal of 11 is $\frac{1}{11}$.

b. The reciprocal of –9 is $-\frac{1}{9}$.

c. The reciprocal of $\frac{7}{4}$ is $\frac{4}{7}$.

12. $$\begin{aligned}-2+3[5-(7-10)] &= -2+3[5-(-3)]\\ &= -2+3(8)\\ &= -2+24\\ &= 22\end{aligned}$$

13. $$\begin{aligned}0.6 &= 2-3.5c\\ -1.4 &= -3.5c\\ \frac{-1.4}{-3.5} &= \frac{-3.5c}{-3.5}\\ 0.4 &= c\end{aligned}$$

14. $$\begin{aligned}2(x-3) &= -40\\ 2x-6 &= -40\\ 2x &= -34\\ x &= -17\end{aligned}$$

15. $$\begin{aligned}3x+5 &= 3(x+2)\\ 3x+5 &= 3x+6\\ 5 &= 6 \text{ False}\end{aligned}$$

The solution is $\varnothing$.

16. $$\begin{aligned}5(x-7) &= 4x-35+x\\ 5x-35 &= 5x-35\\ -35 &= -35 \text{ True for any number}\end{aligned}$$

The solution is all real numbers.

17. a. If x is the first integer, then the next two consecutive integers are $x + 1$ and $x + 2$. The sum is $x + (x + 1) + (x + 2) = 3x + 3$.

b. The perimeter is found by adding the lengths of the sides.
$x + 5x + (6x - 3) = 12x - 3$

18. 25% of $16 = 0.25(16) = 4$

19. Let x = the lowest of the scores. Then the other two scores are $x + 2$ and $x + 4$.

$$\begin{aligned}x+(x+2)+(x+4) &= 264\\ 3x+6 &= 264\\ 3x &= 258\\ x &= 86\end{aligned}$$

$x + 2 = 86 + 2 = 88$
$x + 4 = 86 + 4 = 90$
The scores are 86, 88, and 90.

20. Let x = first odd integer, then
$x + 2$ = next odd integer and
$x + 4$ = third odd integer.

$$\begin{aligned}x+(x+2)+(x+4) &= 213\\ 3x+6 &= 213\\ 3x &= 207\\ x &= 69\end{aligned}$$

$x+2 = 69+2 = 71$
$x+4 = 69+4 = 73$
The integers are 69, 71, and 73.

21. $$\begin{aligned}V &= lwh\\ \frac{V}{lw} &= \frac{lwh}{lw}\\ \frac{V}{lw} &= h\end{aligned}$$

22. $$\begin{aligned}7x+3y &= 21\\ 3y &= -7x+21\\ y &= -\frac{7}{3}x+7\end{aligned}$$

23. a. $(2, -1)$ is in quadrant IV.

b. $(0, 5)$ is not in any quadrant, it is on the y-axis.

c. $(-3, 5)$ is in quadrant II.

d. $(-2, 0)$ is not in any quadrant, it is on the x-axis.

e. $\left(-\frac{1}{2}, -4\right)$ is in quadrant III.

f. $(1.5, 1.5)$ is in quadrant I.

24. a. $(0, -2)$ is on the y-axis.

b. $(-1, -2.5)$ is in quadrant III.

c. $\left(\frac{1}{2}, 0\right)$ is on the x-axis.

d. $(4, -0.5)$ is in quadrant IV.

25. $3x - y = 12$
$3(0) - (-12) \stackrel{?}{=} 12$
$12 = 12$ True
(0, –12) is a solution.
$3(1) - 9 \stackrel{?}{=} 12$
$-6 = 12$ False
(1, 9) is not a solution.
$3(2) - (-6) \stackrel{?}{=} 12$
$6 + 6 \stackrel{?}{=} 12$
$12 = 12$ True
(2, –6) is a solution.

26. $7x + 2y = 10$
$2y = -7x + 10$
$y = -\frac{7}{2}x + 5$
$m = -\frac{7}{2}$, y-intercept = (0, 5)

27. Yes, $y = 2x + 1$ is a function (graph the function and use the vertical line test).

28. No, it is not a function (by the vertical line test).

29. a. $f(x) = \frac{1}{2}x + \frac{3}{7}$
$y = mx + b$
$b = \frac{3}{7}$
y-intercept = $\left(0, \frac{3}{7}\right)$

b. $y = -2.5x - 3.2$
$y = mx + b$
$b = -3.2$
y-intercept = (0, –3.2)

30. $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{9-6}{0-(-1)} = \frac{3}{1} = 3$

31. $f(x) = \frac{2}{3}x + 4$
$y = mx + b$
The slope of the line is m, the coefficient of x, $\frac{2}{3}$.

32. Vertical; through $\left(-2, -\frac{3}{4}\right)$
A vertical line has an equation of the form $x = a$, where a is the x-coordinate of any point on the line. The equation is $x = -2$.

33. y-intercept = (0, –3) means that $b = -3$. Using the equation $y = mx + b$, we have $y = \frac{1}{4}x - 3$.

34. Horizontal; through $\left(-2, -\frac{3}{4}\right)$
A horizontal line has an equation of the form $y = b$, where b is the y-coordinate of any point on the line. The equation is $y = -\frac{3}{4}$.