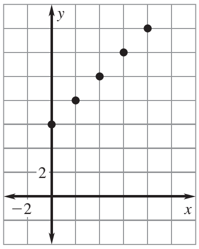
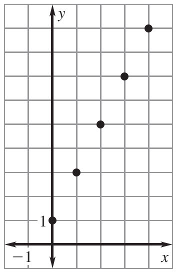
Chapter 3 Graphing Linear Equations and Functions

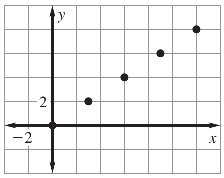
Prerequisite Skills for the chapter "Graphing Linear Equations and Functions"

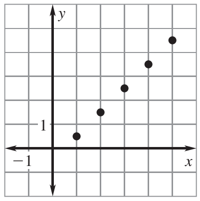
1. The set of inputs of a function is called the *domain* of the function. The set of outputs of a function is called the *range* of the function.

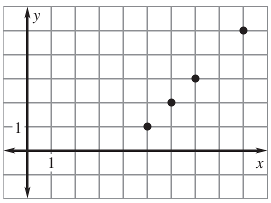
2. A *ratio* uses division to compare two quanties.

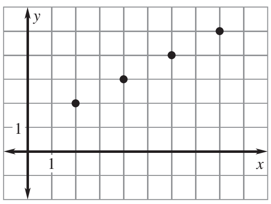
3. 

4. 

5. 

6. 

7. 

8. 

9. $6x + 4y = 16$

$4y = -6x + 16$

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

10. $x + 2y = 5$

$2y = -x + 5$

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

11. $-12x + 6y = -12$

$6y = 12x - 12$

$y = 2x - 2$

Lesson 3.1 Plot Points in a Coordinate Plane

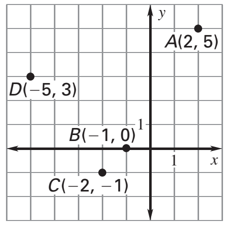
Guided Practice for the lesson "Plot Points in a Coordinate Plane"

1. $C(0, 2)$

$D(3, 1)$

$E(-2, -3)$

2. 0

3–6. 

3. Begin at the origin. First move 2 units to the right, then 5 units up. Point *A* is in Quadrant I.

4. Begin at the origin and move 1 unit to the left. Point *B* is on the *x*-axis.

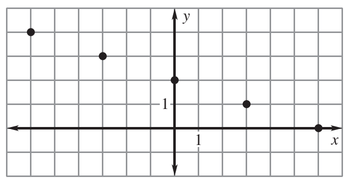
5. Begin at the origin. First move 2 units to the left, then 1 unit down. Point *C* is in Quadrant III.

6. Begin at the origin. First move 5 units to the left, then 3 units up. Point *D* is in Quandrant II.

7.

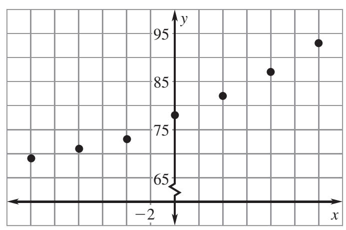
x	$y = -\frac{1}{3}x + 2$
-6	$y = -\frac{1}{3}(-6) + 2 = 4$
-3	$y = -\frac{1}{3}(-3) + 2 = 3$
0	$y = -\frac{1}{3}(0) + 2 = 2$
3	$y = -\frac{1}{3}(3) + 2 = 1$
6	$y = -\frac{1}{3}(6) + 2 = 0$

$(-6, 4), (-3, 3), (0, 2), (3, 1), (6, 0)$



Range: 4, 3, 2, 1, 0

8. a. The table represents a function because each input has exactly one output.

b. 

c. *Sample answer:* Before 1972 the number of voters increased by 2 million every 4 years. In 1972 the number increased by 5 million and continued to increase by more than 2 million every 4 years since 1972.

Exercises for the lesson "Plot Points in a Coordinate Plane"

Skill Practice

1. The x-coordinate is 5. The y-coordinate is -3.

2. You cannot determine specifically which quadrant the point is in because you don't know if the x- or y-coordinate is negative. If the x-coordinate is negative, the point is in Quadrant II. If the y-coordinate is negative, the point is in Quadrant IV.

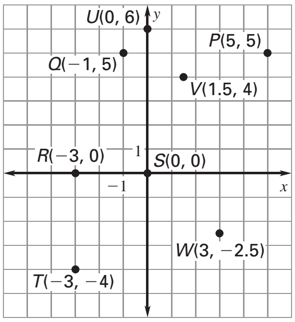
3. $(3, -2)$ **4.** $(0, -1)$ **5.** $(4, 4)$

6. $(-4, 3)$ **7.** $(4, -1)$ **8.** $(3, 0)$

9. $(-5, 4)$ **10.** $(-3, -2)$ **11.** $(-4, -1)$

12. $(-1, 2)$ **13.** B; $(-3, 6)$

14–21.



14. Point $P(5, 5)$ is 5 units to the right of the origin and 5 units up. Point P is in Quadrant I.

15. Point $Q(-1, 5)$ is 1 unit to the left of the origin and 5 units up. Point Q is in Quadrant II.

16. Point $R(-3, 0)$ is 3 units to the left of the origin and on the x-axis.

17. Point $S(0, 0)$ is at the origin.

18. Point $T(-3, -4)$ is 3 units to the left of the origin and 4 units down. Point T is in Quadrant III.

19. Point $U(0, 6)$ is 6 units up from the origin on the y-axis.

20. Point $V(1.5, 4)$ is 1.5 units to the right of the origin and 4 units up. Point V is in Quadrant I.

21. Point $W(3, -2.5)$ is 3 units to the right of the origin and 2.5 units down. Point W is in Quadrant IV.

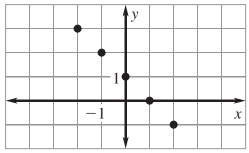
22. Point $W(6, -6)$ is 6 units to the right of the origin, not to the left, and 6 units down, not up.

23. B; -1

24.

x	$y = -x + 1$
-2	$y = -(-2) + 1 = 3$
-1	$y = -(-1) + 1 = 2$
0	$y = -(0) + 1 = 1$
1	$y = -1 + 1 = 0$
2	$y = -2 + 1 = -1$

$(-2, 3), (-1, 2), (0, 1), (1, 0), (2, -1)$

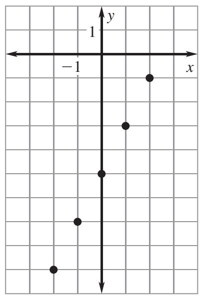


Range: 3, 2, 1, 0, -1

25.

x	$y = 2x - 5$
-2	$y = 2(-2) - 5 = -9$
-1	$y = 2(-1) - 5 = -7$
0	$y = 2(0) - 5 = -5$
1	$y = 2(1) - 5 = -3$
2	$y = 2(2) - 5 = -1$

$(-2, -9), (-1, -7), (0, -5), (1, -3), (2, -1)$

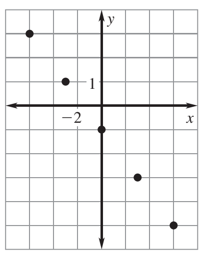


Range: $-9, -7, -5, -3, -1$

26.

x	$y = -\frac{2}{3}x - 1$
-6	$y = -\frac{2}{3}(-6) - 1 = 3$
-3	$y = -\frac{2}{3}(-3) - 1 = 1$
0	$y = -\frac{2}{3}(0) - 1 = -1$
3	$y = -\frac{2}{3}(3) - 1 = -3$
6	$y = -\frac{2}{3}(6) - 1 = -5$

$(-6, 3), (-3, 1), (0, -1), (3, -3), (6, -5)$

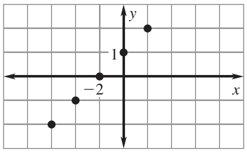


Range: 3, 1, -1, -3, -5

27.

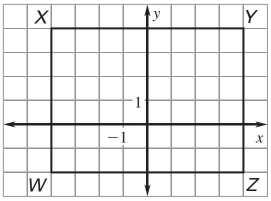
x	$y = \frac{1}{2}x + 1$
-6	$y = \frac{1}{2}(-6) + 1 = -2$
-4	$y = \frac{1}{2}(-4) + 1 = -1$
-2	$y = \frac{1}{2}(-2) + 1 = 0$
0	$y = \frac{1}{2}(0) + 1 = 1$
2	$y = \frac{1}{2}(2) + 1 = 2$

$(-6, -2), (-4, -1), (-2, 0), (0, 1), (2, 2)$



Range: $-2, -1, 0, 1, 2$

28.



The resulting figure is a rectangle.

$P = 2\ell + 2w = 2(8) + 2(6) = 28$ units

$A = \ell w = 8(6) = 48$ square units

29. The point $(4, -11)$ is in Quadrant IV because it has a positive x-coordinate and a negative y-coordinate.

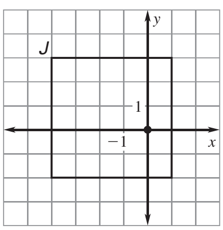
30. The point $(40, -40)$ is in Quadrant IV because it has a positive x-coordinate and a negative y-coordinate.

31. The point $(-18, 15)$ is in Quadrant II because it has a negative x-coordinate and a positive y-coordinate.

32. The point $(-32, -22)$ is in Quadrant III because it has a negative x-coordinate and a negative y-coordinate.

33. If a point has a y-coordinate of zero, it is on the x-axis. If a point has an x-coordinate of zero, it is on the y-axis.

34. *Sample answer*:



The side length of the resulting square must be greater than 4 units, like 5, for one of the points to be in each quadrant. Add 5 to the x-coordinate of J, -4, to find the point $(1, 3)$ in Quadrant I. Then subtract 5 from the y-coordinate of J to find the point $(-4, -2)$ in Quadrant III. Then add 5 to the x-coordinate of $(-4, -2)$ to find the point $(1, -2)$ in Quadrant IV. The points chosen create a square with a side length of 5 units.

35. Since the point (a, b) lies in Quadrant IV, (b, a) would lie in Quadrant II because the b coordinate is negative and the a coordinate is positive. The point $(2a, -2b)$ lies in Quadrant I because 2 times a positive number a is still positive, and -2 times a negative number b is positive. the point $(-b, -a)$ is in Quadrant IV because opposite a negative number b is positive and opposite a positive number a is negative.

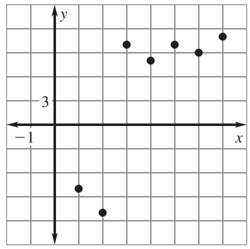
Problem Solving

36. **a.** Asia **b.** North America

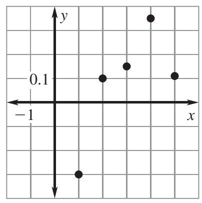
c. Asia **d.** South America

e. North America **f.** Europe

37. The table represents a function because exactly one record low temperature (output) corresponds to each day in February (input).

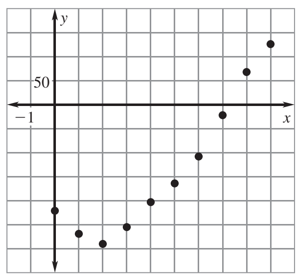


38. **a.** The table represents a function because only one change in value (output) is paired with each day (input).



b. The change in value of the stock went up for 4 days, then down for 1 day.

39. **a.**

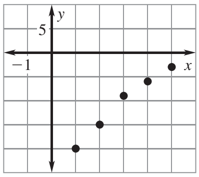


b. The deficit increased for 2 years since 1990 and decreased for the following 5 years, until in 1998 and 1999 there was a federal surplus.

40. **a.**

Years Since 1999	1	2	3	4	5
Annual changes in LDL (mg/dL)	-20	-15	-9	-6	-3

b.



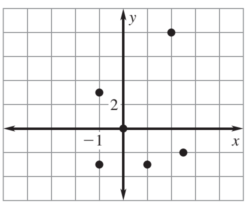
c. The diet was very effective in the beginning and continued to lower LDL levels, but by gradually smaller amounts.

41. a.

Height (inches)		
Reported	**Measured**	**Difference**
70	68	$70 - 68 = 2$
70	67.5	$70 - 67.5 = 2.5$
78.5	77.5	$78.5 - 77.5 = 1$
68	69	$68 - 69 = -1$
71	72	$71 - 72 = -1$
70	70	$70 - 70 = 0$

Weight (pounds)		
Reported	**Measured**	**Difference**
154	146	$154 - 146 = 8$
141	143	$141 - 143 = -2$
165	168	$165 - 168 = -3$
146	143	$146 - 143 = 3$
220	223	$220 - 223 = -3$
176	176	$176 - 176 = 0$

b. $(2, 8), (2.5, -2), (1, -3), (-1, 3), (-1, -3), (0, 0)$



c. In this situation, the origin represents a man whose reported height and weight were the same as his measured height and weight.

d. Quadrant IV has the greatest number of points. If a point is in that quadrant, it means that a man reported his height to be more than his actual height and his weight to be less than his actual weight.

Lesson 3.2 Graph Linear Equations

Guided Practice for the lesson "Graph Linear Equations"

1. $x + 2y = 5, \left(4, -\frac{1}{2}\right)$

$4 + 2\left(-\frac{1}{2}\right) \stackrel{?}{=} 5$

$4 + (-1) \stackrel{?}{=} 5$

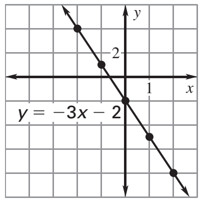
$3 \neq 5$

$\left(4, -\frac{1}{2}\right)$ is not a solution to $x + 2y = 5$.

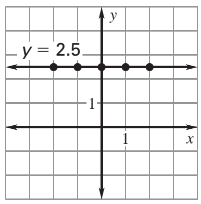
2. $y + 3x = -2$

$y = -3x - 2$

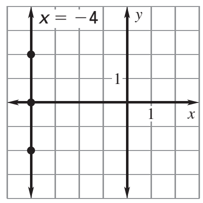
x	−2	−1	0	1	2
y	4	1	−2	−5	−8



3. $y = 2.5$



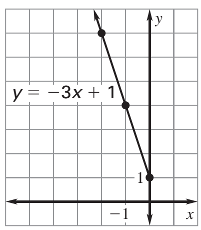
4. $x = -4$



5. $y = -3x + 1, x \le 0$

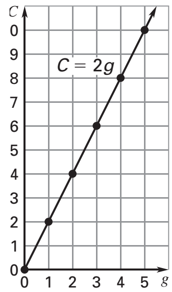
x	0	−1	−2	−3	−4
y	1	4	7	10	13

The range of the function is $y \geq 1$.



6. $C = 2g$

g **(gallons)**	0	2.5	5
C **(dollars)**	0	5	10



Domain: $0 \leq g \leq 5$

Range: $0 \leq C \leq 10$

Exercises for the lesson "Graph Linear Equations"

Skill Practice

1. The equation $Ax + By = C$ represents a linear function provided by $B \neq 0$.

2. The equation $y = 6x + 4$ is not in standard form. In order to be in standard form, the variables would have to be on one side of the equation with the constant on the other. The equation would then take the form $6x - y = -4$.

3. $2y + x = 4; (-2, 3)$

$2(3) + (-2) \stackrel{?}{=} 4$

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

$4 = 4$

Yes, $(-2, 3)$ is a solution.

4. $3x - 2y = -5; (-1, 1)$

$3(-1) - 2(1) \stackrel{?}{=} -5$

$-3 - 2 \stackrel{?}{=} -5$

$-5 = -5$

Yes $(-1, 1)$ is a solution.

5. $x = 9; (9, 6)$

$9 = 9$

Yes $(9, 6)$ is a solution.

6. $y = -7; (-7, 0)$

$0 \neq -7$

No, $(-7, 0)$ is not a solution.

7. $-7x - 4y = 1; (-3, -5)$

$-7(-3) - 4(-5) \stackrel{?}{=} 1$

$21 + 20 \stackrel{?}{=} 1$

$41 \neq 1$

No, $(-3, -5)$ is not a solution.

8. $-5y - 6x = 0; (-6, 5)$

$-5(5) - 6(-6) \stackrel{?}{=} 0$

$-25 + 36 \stackrel{?}{=} 0$

$11 \neq 0$

No, $(-6, 5)$ is not a solution.

9. 11 needs to be substituted for y and 8 needs to be substituted for x, not the other way around.

$y - x = -3$

$11 - 8 \stackrel{?}{=} -3$

$3 \neq -3$

No, $(8, 11)$ is not a solution.

10. B; $(-2, 10)$

$6x + 3y = 18$

$6(-2) + 3(-10) \stackrel{?}{=} 18$

$-42 \neq 18$

$6(-2) + 3(10) \stackrel{?}{=} 18$

$-12 + 30 \stackrel{?}{=} 18$

$18 = 18$

$6(2) + 3(10) \stackrel{?}{=} 18$

$42 \neq 18$

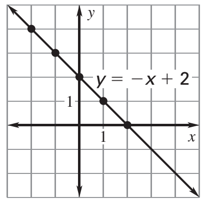
$6(10) + 3(-2) \stackrel{?}{=} 18$

$54 \neq 18$

11. $y + x = 2$

$y = -x + 2$

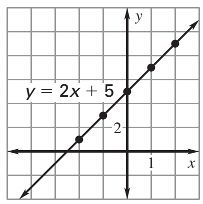
x	-2	-1	0	1	2
y	4	3	2	1	0



12. $y - 2x = 5$

$y = 2x + 5$

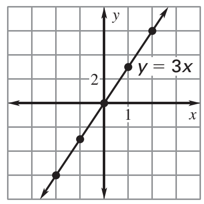
x	-2	-1	0	1	2
y	1	3	5	7	9



13. $y - 3x = 0$

$y = 3x$

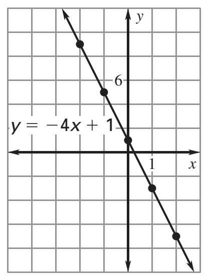
x	-2	-1	0	1	2
y	-6	-3	0	3	6



14. $y + 4x = 1$

$y = -4x + 1$

x	-2	-1	0	1	2
y	9	5	1	-3	-7

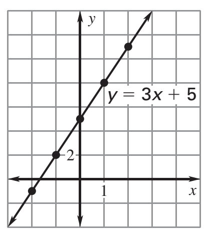


15. $2y - 6x = 10$

$2y = 6x + 10$

$y = 3x + 5$

x	-2	-1	0	1	2
y	-1	2	5	8	11

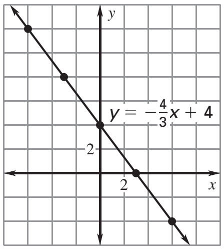


16. $3y + 4x = 12$

$3y = -4x + 12$

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

x	−6	−3	0	3	6
y	12	8	4	0	−4

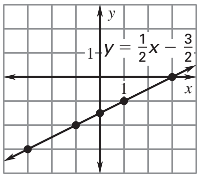


17. $x - 2y = 3$

$-2y = -x + 3$

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

x	−3	−1	0	1	3
y	−3	−2	$-\frac{3}{2}$	−1	0

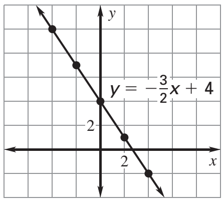


18. $3x + 2y = 8$

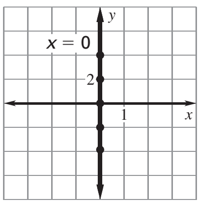
$2y = -3x + 8$

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

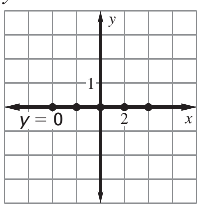
x	−4	−2	0	2	4
y	10	7	4	1	−2



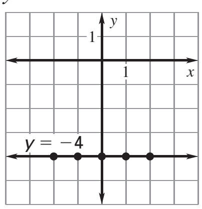
19. $x = 0$



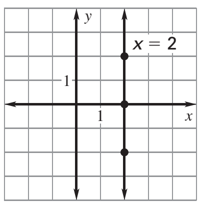
20. $y = 0$



21. $y = -4$



22. $x = 2$



23. $y - x = 0$

$y = x$

Matches graph C.

24. $x = -2$

Matches graph A.

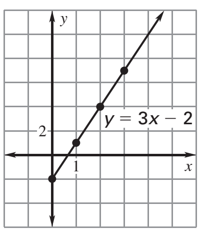
25. $y = -1$

Matches graph B.

26. $y = 3x - 2$; domain: $x \geq 0$

x	0	1	2	3
y	−2	1	4	7

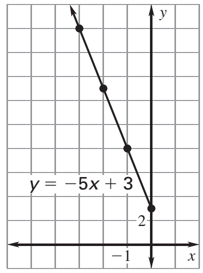
Range: $y \geq -2$



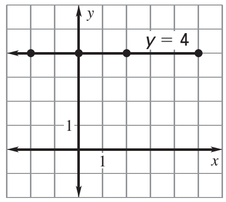
27. $y = -5x + 3$; domain: $x \leq 0$

x	−3	−2	−1	0
y	18	13	8	3

Range: $y \geq 3$

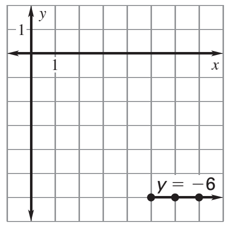


28. $y = 4$; domain: $x \leq 5$



Range: $y = 4$

29. $y = -6$; domain: $x \geq 5$

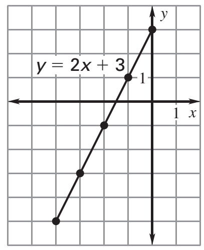


Range: $y = -6$

30. $y = 2x + 3$; domain: $-4 \leq x \leq 0$

x	−4	−3	−2	−1	0
y	−5	−3	−1	1	3

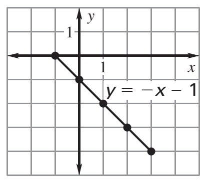
Range: $-5 \leq y \leq 3$



31. $y = -x - 1$; domain: $-1 \leq x \leq 3$

x	−1	0	1	2	3
y	0	−1	−2	−3	−4

Range: $-4 \leq y \leq 0$



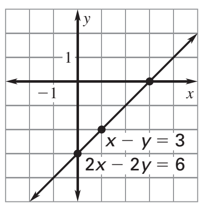
32. $x - y = 3$

$y = x - 3$

$2x - 2y = 6$

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

x	−2	−1	0	1	2
y	−5	−4	−3	−2	−1



The equations produce the same graph because they have the same ordered pairs. When you simplify $2x - 2y = 6$, you get $x - y = 3$.

Sample answer: $3x - 3y = 9$

33. D; the range is $y \geq -2$.

34. $Ax + 3y = 6$; $(3, n)$

$A(3) + 3n = 6$

$5x + y = 20$; $(n, 5)$

$5n + 5 = 20$

$5n = 15$

$n = 3$

$3A + 3(3) = 6$

$3A + 9 = 6$

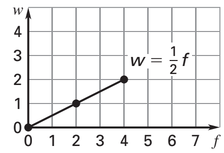
$3A = -3$

$A = -1$

Problem Solving

35. $w = \frac{1}{2}f$

f	0	1	2	3	4
w	0	$\frac{1}{2}$	1	$\frac{3}{2}$	2



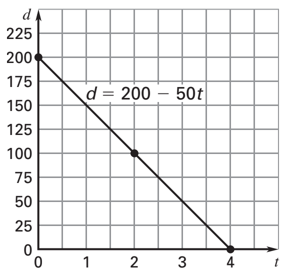
Domain: $0 \le f \le 4$

Range: $0 \le w \le 2$

The largest loaf of bread you can make weighs 2 pounds.

36. $d = 200 - 50t$

t	0	0.5	1	1.5
d	200	175	150	125



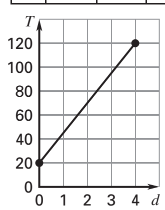
Domain: $0 \le t \le 4$

Range: $0 \le d \le 200$

After 1.5 hours you are 125 miles from home.

37. a. $T = 20 + 25d$

d	0	1	2	3	4
T	20	45	70	95	120



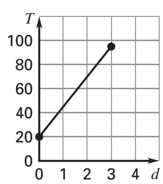
Domain: $0 \le d \le 4$

Range: $20 \le T \le 120$

The temperature at the deepest part is 120°C.

b.

d	0	1	2	3
T	20	45	70	95



Domain: $0 \le d \le 3$

Range: $20 \le T \le 95$

The section is 3 kilometers deep.

38. a. $C = 30f + 100 = 30(3) + 100 = 90 + 100 = 190$

The fabric costs \$190. This result was obtained by substituting 3 for *f* and solving for *C*, where *C* represents the cost in dollars.

b. $500 = 30f + 100$

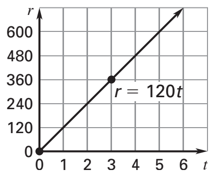
$400 = 30f$

$13.33 = f$

The designer can buy 13.33 yards of fabric. By sustituting 500 for *C* and solving the equation for *f*, you find how many yards of fabric the designer can buy.

39. a. $r = 120t$

t	0	1	2	3	4
r	0	120	240	360	480



Domain: $t \ge 0$

Range: $r \ge 0$

b. Domain: $0 \le t \le 4$

Range: $0 \le r \le 480$

The graph would stop at the point (4, 480). This would result in a line segment beginning at (0, 0) and ending at (4, 480).

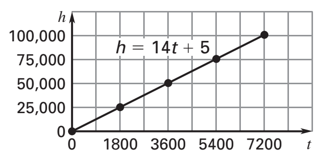
40. a. $h = 14t + 5$

t	0	1	2	3	4	5
h	5	19	33	47	61	75

t	6	7	8	9	10
h	89	103	117	131	145

b. $t = 7200$ seconds

t	0	1800	3600	5400	7200
h	5	25,205	50,405	75,605	100,805

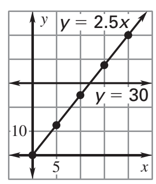


Domain: $0 \le t \le 7200$

Range: $5 \le h \le 100{,}805$

41. a. $y = 30, y = 2.5x$

x	0	5	10	15	20
y	0	12.5	25	37.5	50



b. $30 = 2.5x$

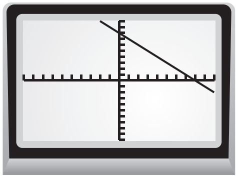
$12 = x$

The point (12, 30) is a solution to both functions. This means that if you buy 12 lunches in a month, it will cost the same amount to pay \$30 per month or \$2.50 per lunch.

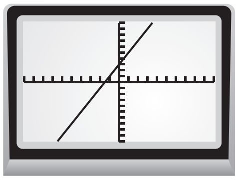
c. The student should pay monthly. By observing the behavior of the graph we see that 15 lunches would cost \$37.50, which exceeds the \$30 monthly lunch payment.

Graphing Calculator Activity for the lesson "Graph Linear Equations"

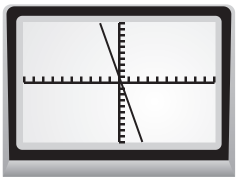
1. $y = 8 - x$; $(2.4, 5.6)$



2. $y = 2x + 3$; $(-1.1, 0.8)$



3. $y = -4.5x + 1$; $(1.4, -5.3)$



4. $s = 331.1 + 0.61T$

Xmin = −50

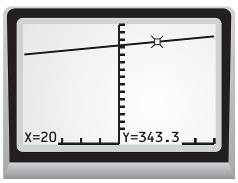
Xmax = 50

Xscl = 10

Ymin = 0

Ymax = 400

Yscl = 10

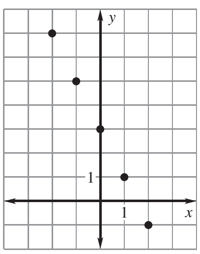


When the temperature is 20°C, the speed of sound is 343.3 meters per second.

Extension for the extension "Identify Discrete and Continuous Functions"

1. $y = -2x + 3$

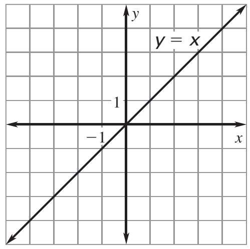
x	−2	−1	0	1	2
y	7	5	3	1	−1



The function is discrete.

2. $y = x$

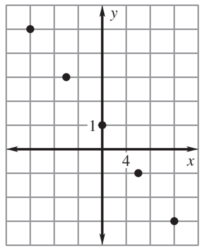
x	−2	−1	0	1	2
y	−2	−1	0	1	2



The function is continuous.

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

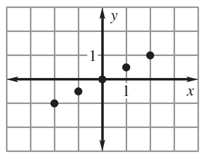
x	−12	−6	0	6	12
y	5	3	1	−1	−3



The function is discrete.

4. $y = 0.5x$

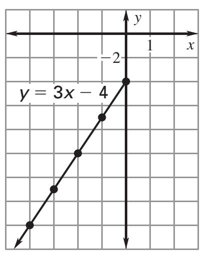
x	−2	−1	0	1	2
y	−1	−0.5	0	0.5	1



The function is discrete.

5. $y = 3x - 4$

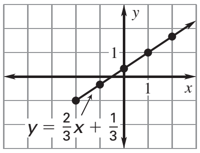
x	−4	−3	−2	−1	0
y	−16	−13	−10	−7	−4



The function is continuous.

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

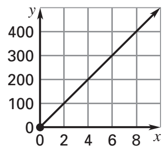
x	-2	-1	0	1	2
y	-1	$-\frac{1}{3}$	$\frac{1}{3}$	1	$\frac{5}{3}$



The function is continuous.

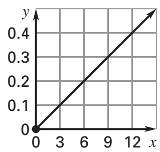
7. The function is discrete. The number of DVD rentals can only be expressed by a whole number value. As a result, cost can only be associated with whole number values.

8. The function is continuous. Since time represents a continuous variable, the distance driven can be given for any increment of time, rather than strictly whole number values.



When $x = 3.5$, $y = 175$.

9. The function is continuous. Volume is a continuous variable and it would make sense to talk about volume in amounts other than whole number values. As a result, weight can be associated with any amount of water.



When $x = 3.5$, $y = 0.12$.

Lesson 3.3 Graph Using Intercepts

Guided Practice for the lesson "Graph Using Intercepts"

1. $3x + 2y = 6$

x-intercept:

$3x + 2(0) = 6$

$3x = 6$

$x = 2$

y-intercept:

$3(0) + 2y = 6$

$2y = 6$

$y = 3$

2. $4x - 2y = 10$

x-intercept:

$4x - 2(0) = 10$

$4x = 10$

$x = 2.5$

y-intercept:

$4(0) - 2y = 10$

$-2y = 10$

$y = -5$

3. $-3x + 5y = -15$

x-intercept

$-3x + 5(0) = -15$

$-3x = -15$

$x = 5$

y-intercept

$-3(0) + 5y = -15$

$5y = -15$

$y = -3$

4. $6x + 7y = 42$

x-intercept: $6x + 7(0) = 42$

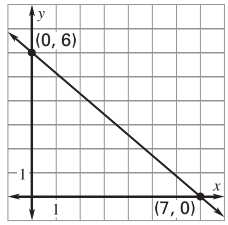
$6x = 42$

$x = 7$

y-intercept: $6(0) + 7y = 42$

$7y = 42$

$y = 6$



5. x-intercept: -4

y-intercept: 2

6. (0, 30)

$0(9) + 30(14) = \$420$

(15, 20)

$15(9) + 20(14) = \$415$

(30, 10)

$30(9) + 10(14) = \$410$

(45, 0)

$45(9) + 0(14) = \$405$

It is least expensive to rent 45 small tables at \$9 each and 0 large tables at \$14 each. This combination costs a total of \$405, which is less than the other combinations.

7. $e = 500t - 10{,}000$

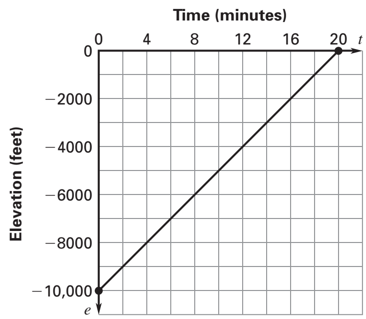
t-intercept: $0 = 500t - 10{,}000$

$10{,}000 = 500t$

$20 = t$

e-intercept: $e = 500(0) - 10{,}000$

$e = -10{,}000$



Domain: $0 \le t \le 20$

Range: $-10{,}000 \le e \le 0$

Exercises for the lesson "Graph Using Intercepts"

Skill Practice

1. The *x-intercept* of the graph of an equation is the value of x when y is zero.

2. The x-intercept is -4, because it is the value of x when y is zero. The y-intercept is 3, because it is the value of y when x is zero.

3. The error is that the x- and y-intercepts have been reversed. The x-intercept is -2 and the y-intercept is 1.

4. $5x - y = 35$

5. $3x - 3y = 9$

x-intercept:

$5x - 0 = 35$

$5x = 35$

$x = 7$

y-intercept:

$5(0) - y = 35$

$-y = 35$

$y = -35$

x-intercept:

$3x - 3(0) = 9$

$3x = 9$

$x = 3$

y-intercept:

$3(0) - 3y = 9$

$-3y = 9$

$y = -3$

6. $-3x + 9y = -18$

x-intercept:

$-3x + 9(0) = -18$

$-3x = -18$

$x = 6$

y-intercept:

$-3(0) + 9y = -18$

$9y = -18$

$y = -2$

7. $4x + y = 4$

x-intercept:

$4x + 0 = 4$

$4x = 4$

$x = 1$

y-intercept:

$4(0) + y = 4$

$y = 4$

8. $2x + y = 10$

x-intercept:

$2x + 0 = 10$

$2x = 10$

$x = 5$

y-intercept:

$2(0) + y = 10$

$y = 10$

9. $2x - 8y = 24$

x-intercept:

$2x - 8(0) = 24$

$2x = 24$

$x = 12$

y-intercept:

$2(0) - 8y = 24$

$-8y = 24$

$y = -3$

10. $3x + 0.5y = 6$

x-intercept:

$3x + 0.5(0) = 6$

$3x = 6$

$x = 2$

y-intercept:

$3(0) + 0.5y = 6$

$0.5y = 6$

$y = 12$

11. $0.2x + 3.2y = 12.8$

x-intercept:

$0.2x + 3.2(0) = 12.8$

$0.2x = 12.8$

$x = 64$

y-intercept:

$0.2(0) + 3.2y = 12.8$

$3.2y = 12.8$

$y = 4$

12. $y = 2x + 24$

x-intercept:

$0 = 2x + 24$

$-24 = 2x$

$-12 = x$

y-intercept:

$y = 2(0) + 24$

$y = 24$

13. $y = -14x + 7$

x-intercept:

$0 = -14x + 7$

$-7 = -14x$

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

y-intercept:

$y = -14(0) + 7$

$y = 7$

14. $y = -4.8x + 1.2$

x-intercept:

$0 = -4.8x + 1.2$

$-1.2 = -4.8x$

$0.25 = x$

y-intercept:

$y = -4.8(0) + 1.2$

$y = 1.2$

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

x-intercept:

$0 = \frac{3}{5}x - 12$

$12 = \frac{3}{5}x$

$20 = x$

y-intercept:

$y = \frac{3}{5}(0) - 12$

$y = -12$

16. $y = x + 3$

x-intercept:

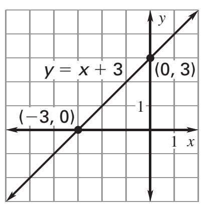
$0 = x + 3$

$-3 = x$

y-intercept:

$y = 0 + 3$

$y = 3$



17. $y = x - 2$

x-intercept:

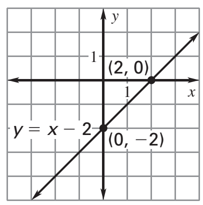
$0 = x - 2$

$2 = x$

y-intercept:

$y = 0 - 2$

$y = -2$



18. $y = 4x - 8$

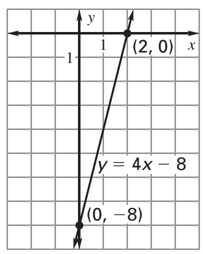
x-intercept: $0 = 4x - 8$

$8 = 4x$

$2 = x$

y-intercept: $y = 4(0) - 8$

$y = -8$



19. $y = 5 + 10x$

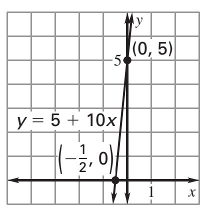
x-intercept: $0 = 5 + 10x$

$-5 = 10x$

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

y-intercept: $y = 5 + 10(0)$

$y = 5$



20. $y = -2 + 8x$

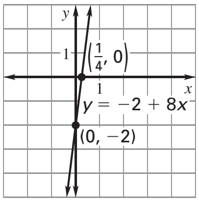
x-intercept: $0 = -2 + 8x$

$2 = 8x$

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

y-intercept: $y = -2 + 8(0)$

$y = -2$



21. $y = -4x + 3$

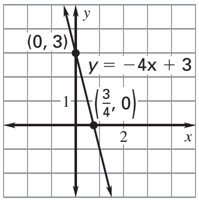
x-intercept: $0 = -4x + 3$

$-3 = -4x$

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

y-intercept: $y = -4x + 3$

$y = 3$



22. $3x + y = 15$

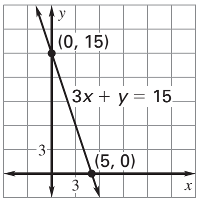
x-intercept: $3x + 0 = 15$

$3x = 15$

$x = 5$

y-intercept: $3(0) + y = 15$

$y = 15$



23. $x - 4y = 18$

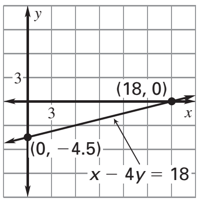
x-intercept: $x - 4(0) = 18$

$x = 18$

y-intercept: $0 - 4y = 18$

$-4y = 18$

$y = -4.5$



24. $8x - 5y = 80$

x-intercept: $8x - 5(0) = 80$

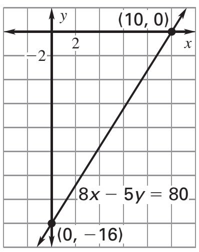
$8x = 80$

$x = 10$

y-intercept: $8(0) - 5y = 80$

$-5y = 80$

$y = -16$



25. $-2x + 5y = 15$

x-intercept: $-2x + 5(0) = 15$

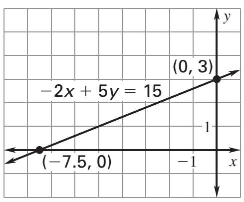
$-2x = 15$

$x = -7.5$

y-intercept: $-2(0) + 5y = 15$

$5y = 15$

$y = 3$



26. $0.5x + 3y = 9$

x-intercept: $0.5x + 3(0) = 9$

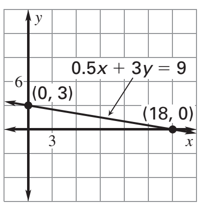
$0.5x = 9$

$x = 18$

y-intercept: $0.5(0) + 3y = 9$

$3y = 9$

$y = 3$



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

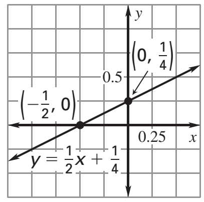
x-intercept: $0 = \frac{1}{2}x + \frac{1}{4}$

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

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

y-intercept: $y = \frac{1}{2}(0) + \frac{1}{4}$

$y = \frac{1}{4}$



28. The x-intercept is 2.

The y-intercept is 1.

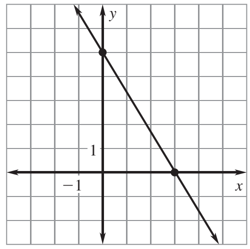
29. The x-intercept is 3.

The y-intercept is -2.

30. The x-intercept is -4.

The y-intercept is 3.

31.



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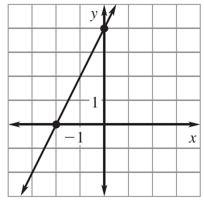

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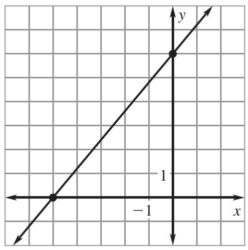
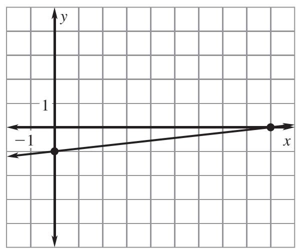


34.



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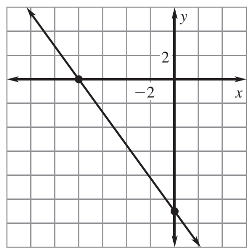
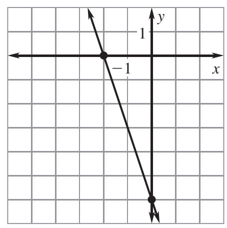


36.



37. D; 10

$Ax + 5y = 20$

$A(2) + 5(0) = 20$

$A(2) = 20$

$A = 10$

38. $2x - 6y = 6$

$2x - 6(0) = 6$

$2x = 6$

$x = 3 \leftarrow x$-intercept

Matches graph C

39. $2x - 6y = -6$

$2x - 6(0) = -6$

$2x = -6$

$x = -3 \leftarrow x$-intercept

Matches graph B

40. $2x - 6y = 12$

$2x - 6(0) = 12$

$2x = 12$

$x = 6 \leftarrow x\text{-intercept}$

Matches graph A

41. A line would not have an x-intercept if it were a horizontal line and $y \neq 0$, because it would be parallel to the x-axis and therefore never cross it. A line would not have a y-intercept if it were a vertical line and $x \neq 0$ because it would be parallel to the y-axis and therefore never cross it.

42. $3x + 5y = k$

For the x- and y-intercepts to be integer values, k would have to be any multiple of both 3 and 5. *Sample answer:* 15 and 30

43. $y = ax + b$

x-intercept: $0 = ax + b$

$-b = ax$

$-\frac{b}{a} = x$

y-intercept: $y = a(0) + b$

$y = b$

Problem Solving

44. a. $72 = 2y + 2x$

b. x-intercept: (36, 0)

$72 = 2(0) + 2x$

$72 = 2x$

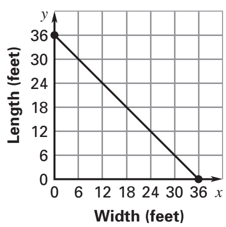
$36 = x$

y-intercept: (0, 36)

$72 = 2y + 2(0)$

$72 = 2y$

$36 = y$



45. a. $4x + 8y = 56$

x-intercept: $4x + 8(0) = 56$

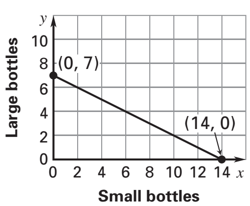
$4x = 56$

$x = 14$

y-intercept: $4(0) + 8y = 56$

$8y = 56$

$y = 7$



b. *Sample answer:* 2 and 6, 4 and 5, 6 and 4

46. a. $2x + y = 128$

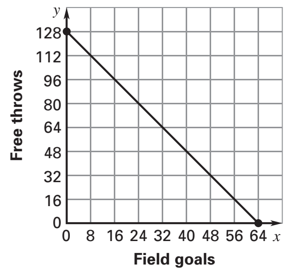
x-intercept: $2x + 0 = 128$

$2x = 128$

$x = 64$

y-intercept: $2(0) + y = 128$

$y = 128$



b. The x-intercept means that the team scored 64 2-point field goals and no 1-point free throws. The y-intercept means that the team scored 128 1-point free throws and no 2-point field goals.

c. *Sample answer:* 40 field goals and 48 free throws, 50 field goals and 28 free throws, 60 field goals and 8 free throws

d. $2x + 24 = 128$

$2x = 104$

$x = 52$

52 field goals were made.

47. a. $f = 180 - 1.5v$

v-intercept: $0 = 180 - 1.5v$

$-180 = -1.5v$

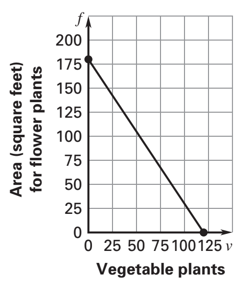
$120 = v$

f-intercept: $f = 180 - 1.5(0)$

$f = 180$

The v-intercept represents the number of vegetable plants the family plants if no flowers are planted. The f-intercept represents the area of the plot for flowers if no vegetable plants are planted.

b.



Domain: $0 \leq v \leq 120$

Range: $0 \leq f \leq 180$

c. $f = 180 - 1.5(80) = 180 - 120 = 60$

If the family plants 80 vegetable plants, 60 square feet are left to plant flowers.

48. *Sample answer:* 1 hour and 76 miles, 2 hours and 64 miles, 3 hours and 52 miles

49. $w = 1.5 - 0.12t$

$0 = 1.5 - 0.12t$

$-1.5 = -0.12t$

$12.5 = t$

You will have to refill the humidifier after 12.5 hours.

50. a. $B = 180 - pn$

The n-intercept is the number of weeks it takes you to pay off the entire balance of the loan. The B-intercept is the principle balance of the loan before any payments.

b. $B = 180 - 20n$

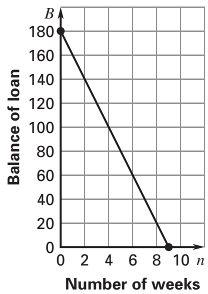
n-intercept: $0 = 180 - 20n$

$-180 = -20n$

$9 = n$

B-intercept: $B = 180 - 20(0)$

$B = 180$



c. Domain: $0 \le n \le 9$

Range: $0 \le B \le 180$

It will take 9 weeks to pay back your friend.

d. The graph would not be one straight line from the n-axis to the B-axis. The graph is two line segments.

$0 = 180 - [20(3) + 15(n - 3)]$

$0 = 180 - (60 + 15n - 45)$

$0 = 180 - (15 + 15n)$

$0 = 180 - 15 - 15n$

$0 = 165 - 15n$

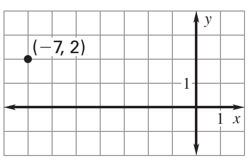
$-165 = -15n$

$11 = n$

You would make 11 payments.

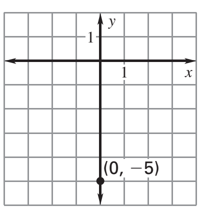
Quiz for the lessons "Plot Points in a Coordinate Plane", "Graph Linear Equations" and "Graph Using Intercepts"

1. $(-7, 2)$



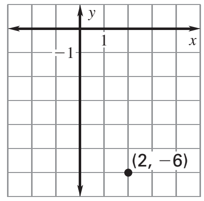
The point $(-7, 2)$ is 7 units to the left of the origin and 2 units up. The point is Quadrant II.

2. $(0, -5)$



The point $(0, -5)$ is 5 units down from the origin on the y-axis.

3. $(2, -6)$



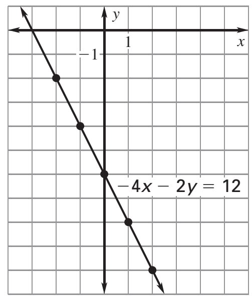
The point $(2, -6)$ is 2 units to the right of the origin and 6 units down. The point is in Quadrant IV.

4. $-4x - 2y = 12$

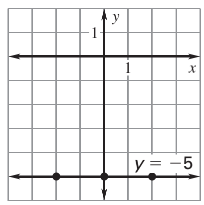
$-2y = 4x + 12$

$y = -2x - 6$

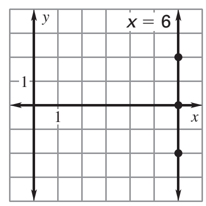
x	−2	−1	0	1	2
y	−2	−4	−6	−8	−10



5. $y = -5$



6. $x = 6$



7. $y = x + 7$

x-intercept:

$0 = x + 7$

$-7 = x$

y-intercept:

$y = 0 + 7$

$y = 7$

8. $y = x - 3$

x-intercept:

$0 = x - 3$

$3 = x$

y-intercept:

$y = 0 - 3$

$y = -3$

9. $y = -5x + 2$

x-intercept: $0 = -5x + 2$

$-2 = -5x$

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

y-intercept: $y = -5(0) + 2$

$y = 2$

10. $x + 3y = 15$

x-intercept: $x + 3(0) = 15$

$x = 15$

y-intercept: $0 + 3y = 15$

$3y = 15$

$y = 5$

11. $3x - 6y = 36$

x-intercept: $3x - 6(0) = 36$

$3x = 36$

$x = 12$

y-intercept: $3(0) - 6y = 36$

$-6y = 36$

$y = -6$

12. $-2x - 5y = 22$

x-intercept: $-2x - 5(0) = 22$

$-2x = 22$

$x = -11$

y-intercept: $-2(0) - 5y = 22$

$-5y = 22$

$y = -4.4$

13. $w = 45{,}000 - 100t$

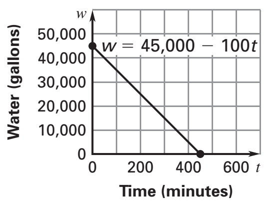
t-intercept: $0 = 45{,}000 - 100t$

$-45{,}000 = -100t$

$450 = t$

w-intercept: $w = 45{,}000 - 100(0)$

$w = 45{,}000$



Domain: $0 \le t \le 450$

Range: $0 \le w \le 45{,}000$

$w = 45{,}000 - 100(60)$

$w = 45{,}000 - 6000$

$w = 39{,}000$

39,000 gallons of water are left in the pool after 60 minutes. It takes 450 minutes to empty the pool.

Mixed Review of Problem Solving for the lessons "Plot Points in a Coordinate Plane", "Graph Linear Equations", and "Graph Using Intercepts"

1. a. $1000 = 20x + 10y$

x-intercept: $1000 = 20x + 10(0)$

$1000 = 20x$

$50 = x$

The x-intercept represents the number of all-day passes sold if no passes were sold after 5 P.M.

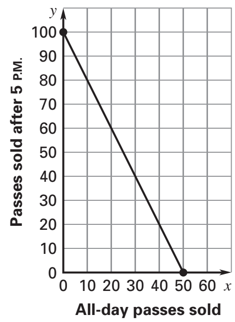
b. y-intercept: $1000 = 20(0) + 10y$

$1000 = 10y$

$100 = y$

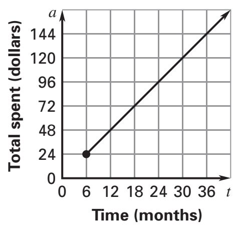
The y-intercpt represents the number of passes sold after 5 P.M. if no all-day passes are sold.

c.



2. a. The table represents a function because each input (t) is paired with only one output (a).

b.

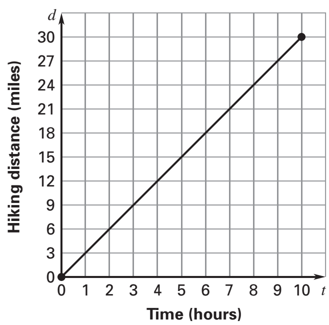


3. Answers will vary.

4. a. The domain is specified in the problem. The domain is the set of values of t, $0 \le t \le 10$.

b.

t	0	2	4	6	8	10
d	0	6	12	18	24	30



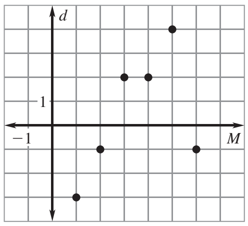
Domain: $0 \le t \le 10$

Range: $0 \le d \le 30$

It takes 2 hours to hike 6 miles.

5. a. The table represents a function because each input (M) is paired with only one output (d).

b.



Domain: 1, 2, 3, 4, 5, 6

Range: −3, −1, 2, 4

c. A point in Quadrant IV means that the average temperature was below normal.

6. If you buy only T-shirts, you can buy 6 of them.

Lesson 3.4 Find Slope and Rate of Change

Investigating Algebra Activity for the lesson "Find Slope and Rate of Change"

1. The slope will be less steep. *Sample answer:* $\frac{1}{4}, \frac{1}{5}, \frac{1}{6}$

2. The slope will be steeper. *Sample answer:* $\frac{1}{5}, \frac{2}{5}, \frac{3}{5}$

3. The rise and run are equal.

4. The rise is greater than the run.

5. The rise is less than the run.

6. Ramp A: slope $= \frac{\text{rise}}{\text{run}} = \frac{6}{2} = 3$

Ramp B: slope $= \frac{\text{rise}}{\text{run}} = \frac{10}{4} = \frac{5}{2}$

Ramp A is steeper because it has a greater slope.

Guided Practice for the lesson "Find Slope and Rate of Change"

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

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

3. $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-3 - 5}{\frac{1}{2} - \frac{9}{2}} = \frac{-8}{-4} = 2$

4. $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-2 - 2}{5 - 5} = \frac{-4}{0}$

The slope is undefined.

5. $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{4 - 4}{-3 - 0} = \frac{0}{-3} = 0$

6. $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-4 - 6}{5 - 0} = \frac{-10}{5} = -2$

7. Rate of change $= \frac{\text{change in distance}}{\text{change in time}}$

$= \frac{3 - 1.5}{60 - 30}$

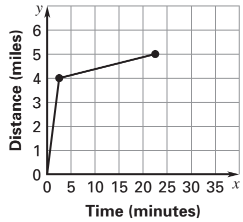
$= \frac{1.5}{30} = 0.05$

The rate of change in distance is 0.05 miles per minute.

8. Weeks 10–12: $\frac{70 - 72}{12 - 10} = \frac{-2}{2} = -1$

It would have to be added that in the last two weeks, attendance decreased only slightly.

9.



Exercises for the lesson "Find Slope and Rate of Change"

Skill Practice

1. The *slope* of a nonvertical line is the ratio of the vertical change to the horizontal change between any two points on the line.

2. The line between the two points rises from left to right.

3. The slope formula is

$m = \frac{y_2 - y_1}{x_2 - x_1}$, and $x_2 = 2$ and $x_1 = 5$.

So, $m = \frac{6 - 3}{2 - 5} = \frac{3}{-3} = -1$.

4. Slope is positive.

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

5. Slope is undefined.

6. Slope is negative.

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

7. The error is that slope is the change in y over the change in x, not the other way around.

$m = \frac{0 - 3}{12 - 6} = \frac{-3}{6} = -\frac{1}{2}$

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

9. $m = \frac{6 - (-2)}{-3 - (-3)} = \frac{8}{0}$

Slope is undefined.

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

11. $m = \frac{-2 - 3}{3 - 1} = -\frac{5}{2}$

12. $m = \frac{1 - 4}{4 - (-3)} = -\frac{3}{7}$

13. $m = \frac{3 - (-3)}{7 - 1} = \frac{6}{6} = 1$

14. $m = \frac{-6 - 0}{0 - 0} = \frac{-6}{0}$

Slope is undefined.

15. $m = \frac{1 - 1}{1 - (-9)} = \frac{0}{10} = 0$

16. $m = \frac{8-(-2)}{-8-(-10)} = \frac{10}{2} = 5$

17. C; zero

$m = \frac{-3-(-3)}{8-(-2)} = \frac{0}{10} = 0$

18. A; $-\frac{3}{20}$

$m = \frac{-6-(-9)}{-13-7} = -\frac{3}{20}$

19. Rate of change $= \frac{\text{change in cost}}{\text{change in time}}$

$= \frac{8.25-6.00}{5-4} = \frac{2.25}{1} = 2.25$

The rate of change in cost with respect to time is \$2.25 per day. This means that each additional day of rental is \$2.25.

20. Rate of change $= \frac{\text{change in cost}}{\text{change in time}} = \frac{34.99-34.99}{5-4} = \frac{0}{1} = 0$

The rate of change means that the cost remains the same regardless of time.

21. $m = \frac{15}{54} \approx 0.3$ **22.** $m = \frac{24}{60} = 0.4$ **23.** $m = \frac{4}{28} \approx 0.1$

24.
$$m = \frac{y_2-y_1}{x_2-x_1}$$
$$\frac{5}{6} = \frac{-1-4}{6-x}$$
$$5(6-x) = 6(-1-4)$$
$$30-5x = -30$$
$$-5x = -60$$
$$x = 12$$

25.
$$m = \frac{y_2-y_1}{x_2-x_1}$$
$$-8 = \frac{1-y}{-2-0}$$
$$-8(-2-0) = 1-y$$
$$16 = 1-y$$
$$15 = -y$$
$$-15 = y$$

26.
$$m = \frac{y_2-y_1}{x_2-x_1}$$
$$-\frac{1}{2} = \frac{7-1}{x-8}$$
$$-1(x-8) = 2(7-1)$$
$$-x+8 = 12$$
$$-x = 4$$
$$x = -4$$

27.
$$m = \frac{y_2-y_1}{x_2-x_1}$$
$$\frac{3}{5} = \frac{y-4}{-5-5}$$
$$3(-5-5) = 5(y-4)$$
$$-30 = 5y-20$$
$$-10 = 5y$$
$$-2 = y$$

28.
$$m = \frac{y_2-y_1}{x_2-x_1}$$
$$-\frac{7}{9} = \frac{-3-y}{0-(-9)}$$
$$-7[0-(-9)] = 9(-3-y)$$
$$-63 = -27-9y$$
$$-36 = -9y$$
$$4 = y$$

29.
$$m = \frac{y_2-y_1}{x_2-x_1}$$
$$5 = \frac{19-9}{-1-x}$$
$$5(-1-x) = 19-9$$
$$-5-5x = 10$$
$$-5x = 15$$
$$x = -3$$

30.
$$m = \frac{y_2-y_1}{x_2-x_1}$$
$$3 = \frac{7y-3}{-6-9}$$
$$3(-6-9) = 7y-3$$
$$-45 = 7y-3$$
$$-42 = 7y$$
$$-6 = y$$

31.
$$m = \frac{y_2-y_1}{x_2-x_1}$$
$$6 = \frac{4-(y+1)}{0-(-3)}$$
$$6[0-(-3)] = 4-(y+1)$$
$$18 = 4-y-1$$
$$18 = 3-y$$
$$15 = -y$$
$$-15 = y$$

32.
$$m = \frac{y_2-y_1}{x_2-x_1}$$
$$4 = \frac{15-7}{-10-\frac{x}{2}}$$
$$4\left(-10-\frac{x}{2}\right) = 15-7$$
$$-40-2x = 8$$
$$-2x = 48$$
$$x = -24$$

33. $m = \frac{y_2-y_1}{x_2-x_1} = \frac{-7-8}{4-(-1)} = \frac{-15}{5} = -3$

The point $(4, -7)$ is on the same line because the slope of the line between $(-1, 8)$ and $(4, -7)$ has the same value of -3.

34. A line with an undefined slope is not a function because it is a vertical line that does not pass the vertical line test.

35. *Sample answer:* $\frac{y_2-y_1}{x_2-x_1} = \frac{(-1)(y_2-y_1)}{(-1)(x_2-x_1)}$

$= \frac{-y_2-y_1}{-x_2-x_1} = \frac{y_1-y_2}{x_1-x_2}$

This result indicates that it doesn't matter which point is chosen for (x_1, y_1) and which for (x_2, y_2) as long as you're consistent in your calculations.

Problem Solving

36. hours 1–3: $\frac{1.4-2}{3-1} = -\frac{0.6}{2} = -0.3$ meters per hour

hours 3–8: $\frac{0.5-1.4}{8-3} = \frac{-0.9}{5} = -0.18$ meters per hour

hours 8–10: $\frac{1-0.5}{10-8} = \frac{0.5}{2} = 0.25$ meters per hour

hours 10–12: $\frac{1.8-1}{12-10} = \frac{0.8}{2} = 0.4$ meters per hour

The water level decreased during the first 3 hours after 12:00 A.M. then continued to decrease for 5 more hours but less rapidly. Then it increased for 2 hours and continued to increase more rapidly for 2 more hours.

37. a. The time interval between 0 and 1.5 hours showed the greatest rate of change because it has the steepest slope.

hours 0–1.5 $= \frac{1000-250}{1.5-0} = \frac{750}{1.5} = 500$

hours 1.5–2.5 $= \frac{1300 - 1000}{2.5 - 1.5} = \frac{300}{1} = 300$

hours 2.5–4.65 $= \frac{1680 - 1300}{4.65 - 2.5} = \frac{380}{2.15} = 176.74$

hours 4.65–8.95 $= \frac{1920 - 1680}{8.95 - 4.65} = \frac{240}{4.3} = 55.81$

b. The time interval between 4.65 and 8.95 hours showed the smallest rate of change because it had the least steep slope.

38. *Sample answer:* The change in altitude of the plane is increasing somewhat slowly for the first hour, then more rapidly for the next hour. For the next $\frac{3}{4}$ hour, the slope is zero, so the plane is not changing in altitude. For the next $\frac{3}{4}$ hour, the plane's elevation is decreasing rapidly, then continuing to decrease, but less rapidly for the last hour.

39. *Sample answer:* The hiker's elevation increases rapidly at first then continues to increase, but slightly less rapidly. Then the hiker's elevation remains steady before decreasing, slowly at first, then more rapidly.

40. a. 1996–1998

$$\text{Rate of change} = \frac{\text{change in number of students}}{\text{change in time}}$$
$$= \frac{58{,}000 - 61{,}000}{1998 - 1996}$$
$$= \frac{-3000}{2} = -1500$$

The number of engineering majors decreased at a rate of 1500 students per year.

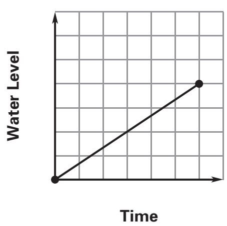
b. 1998–2000

$$\text{Rate of change} = \frac{\text{change in number of students}}{\text{change in time}}$$
$$= \frac{38{,}000 - 35{,}000}{2000 - 1998}$$
$$= \frac{3000}{2} = 1500$$

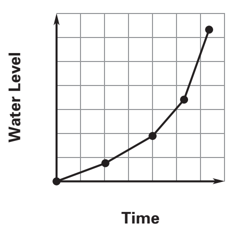
The number of liberal arts majors increased at a rate of 1500 students per year.

c. It increased. *Sample answer:* Although the number of engineering majors decreased, the decrease was offset by the increase in the number of biological science majors and liberal arts majors.

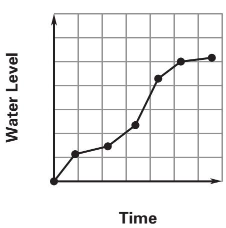
41. a.



b.



c.



Lesson 3.5 Graph Using Slope-Intercept Form

Activity for the lesson "Graph Using Slope-Intercept Form"

Line	$(0, y_1)$	$(2, y_2)$	Slope	y-intercept
$y = 4x + 3$	(0, 3)	(2, 11)	4	3
$y = -2x + 3$	(0, 3)	(2, −1)	−2	3
$y = \frac{1}{2}x + 4$	(0, 4)	(2, 5)	$\frac{1}{2}$	4
$y = -4x - 3$	(0, −3)	(2, −11)	−4	−3
$y = -\frac{1}{4}x - 3$	(0, −3)	$\left(2, -\frac{7}{2}\right)$	$-\frac{1}{4}$	−3

1. The coefficient of x is the same as the slope of the line.

2. The constant on the right side of the equation is the same as the y-intercept.

3. $y = -5x + 1$

slope $= -5$

y-intercept $= 1$

$(0, 1), (2, -9)$

$m = \frac{-9 - 1}{2 - 0} = \frac{-10}{2} = -5$

y-intercept: $y = -5(0) + 1 = 1$

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

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

y-intercept $= 2$

$(0, 2), \left(2, \frac{7}{2}\right)$

$m = \frac{\frac{7}{2} - 2}{2 - 0} = \frac{3}{4}$

y-intercept: $y = \frac{3}{4}(0) + 2 = 2$

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

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

y-intercept $= -1$

$(0, -1), (2, -4)$

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

y-intercept: $y = -\frac{3}{2}(0) - 1 = -1$

6. $y = mx + b$

$(0, y_1) = (0, b)$

$(2, y_2) = (2, 2m + b)$

$\text{slope} = \frac{2m + b - b}{2 - 0} = \frac{2m}{2} = m$

y-intercept: $y = m(0) + b = b$

Guided Practice for the lesson "Graph Using Slope-Intercept Form"

1. $y = 5x - 3$

$m = 5, b = -3$

The line has a slope of 5 and a y-intercept of -3.

2. $3x - 3y = 12$

$-3y = -3x + 12$

$y = x - 4$

$m = 1, b = -4$

The line has a slope of 1 and a y-intercept of -4.

3. $x + 4y = 6$

$4y = -x + 6$

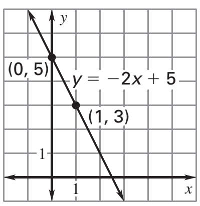
$y = -\frac{1}{4}x + \frac{3}{2}$

$m = -\frac{1}{4}, b = \frac{3}{2}$

The line has a slope of $-\frac{1}{4}$ and a y-intercept of $\frac{3}{2}$.

4. $y = -2x + 5$

$(0, 5), (1, 3)$



5. Stairs: $d = -1.4t + 28$

Escalator: $d = -2t + 28$

$0 = -1.4t + 28$

$-28 = -1.4t$

$20 = t$

$0 = -2t + 28$

$-28 = -2t$

$14 = t$

$20 - 14 = 6$

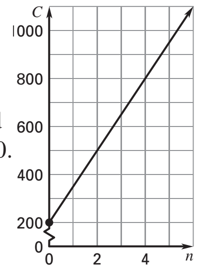
You save 6 seconds by taking the escalator.

6. $C = 150n + 200$

$m = 150, b = 200$

$(0, 200), (2, 500)$

The difference of costs of the second commercial and the third is $200,000.



7. $m_a = \frac{4 - 2}{3 - (-1)} = \frac{2}{4} = \frac{1}{2}$

$m_b = \frac{8 - 2}{5 - 2} = \frac{6}{3} = 2$

$m_c = \frac{1 - (-2)}{-3 - (-9)} = \frac{3}{6} = \frac{1}{2}$

Lines a and c have the same slope, so they are parallel.

Exercises for the lesson "Graph Using Slope-Intercept Form"

Skill Practice

1. Two lines in the same plane are *parallel* if they do not intersect.

2. The slope-intercept form is $y = mx + b$. It is called slope-intercept form because m represents the slope and b represents the y-intercept.

3. $y = 2x + 1$

$m = 2, b = 1$

4. $y = -x$

$m = -1, b = 0$

5. $y = 6 - 3x$

$y = -3x + 6$

$m = -3, b = 6$

6. $y = -7 + 5x$

$y = 5x - 7$

$m = 5, b = -7$

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

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

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

$m = -\frac{1}{4}, b = 8$

9. A; -18

$y = -18x - 9$

$m = -18$

10. C; 4

$x - 3y = -12$

$-3y = -x - 12$

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

11. $4x + y = 1$

$y = -4x + 1$

$m = -4, b = 1$

12. $x - y = 6$

$-y = -x + 6$

$y = x - 6$

$m = 1, b = -6$

13. $6x - 3y = -9$

$-3y = -6x - 9$

$y = 2x + 3$

$m = 2, b = 3$

14. $-12x - 4y = 2$

$-4y = 12x + 2$

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

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

15. $2x + 5y = -10$

$5y = -2x - 10$

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

$m = -\frac{2}{5}, b = -2$

16. $-x - 10y = 20$

$-10y = x + 20$

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

$m = -\frac{1}{10}, b = -2$

17. $2x + 3y = 6$

$3y = -2x + 6$

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

Matches graph B

18. $2x + 3y = -6$

$3y = -2x - 6$

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

Matches graph A

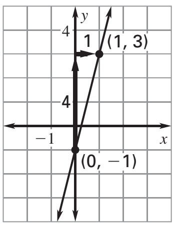
19. $2x - 3y = 6$

$-3y = -2x + 6$

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

Matches graph C

20. The error is that the y-intercept is not 1. It is -1.



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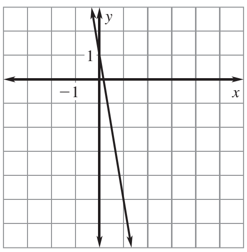

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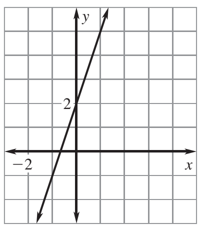

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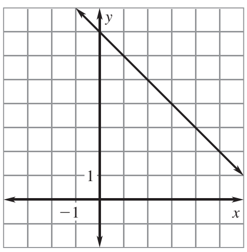

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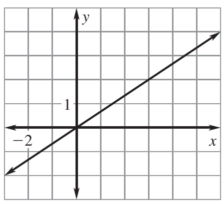

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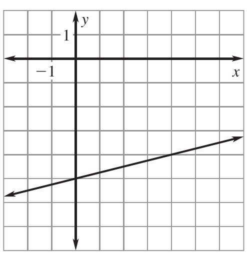

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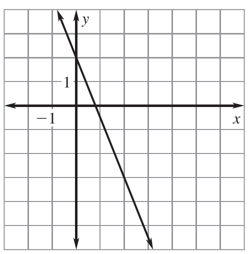
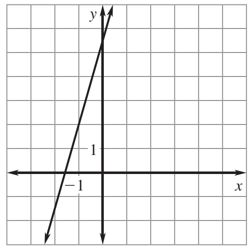


27. $7x - 2y = -11$

$-2y = -7x - 11$

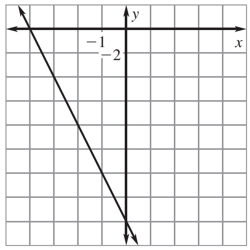
$y = \frac{7}{2}x + \frac{11}{2}$



28. $-8x - 2y = 32$

$-2y = 8x + 32$

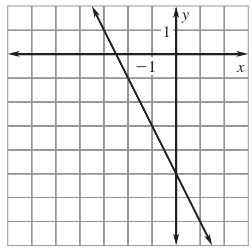
$y = -4x - 16$



29. $-x - 0.5y = 2.5$

$-0.5y = x + 2.5$

$y = -2x - 5$



30. $m_1 = \frac{-1 - 3}{-2 - (-4)} = \frac{-4}{2} = -2$

$m_2 = \frac{-2 - 3}{0 - (-2)} = \frac{-5}{2}$

$m_3 = \frac{0 - 4}{2 - 0} = \frac{-4}{2} = -2$

The line with the points $(-2, -1)$ and $(-4, 3)$ is parallel to the line with the points (2, 0) and (0, 4).

31. $m_1 = \frac{5 - 0}{0 - (-1)} = \frac{5}{1} = 5$

$m_2 = \frac{5 - 0}{1 - 0} = \frac{5}{1} = 5$

$m_3 = \frac{6 - 1}{2 - 1} = \frac{5}{1} = 5$

All 3 lines are parallel.

32. $y = 5x - 7$ $\quad$ $5x + y = 7$

$y = -5x + 7$

The lines are not parallel because the slope of one is 5 and the slope of the other is -5.

33. $y = 3x + 2$ $\quad$ $-7 + 3x = y$

$y = 3x - 7$

The lines are parallel because they both have a slope of 3.

34. $y = -0.5x$ $\quad$ $x + 2y = 18$

$2y = -x + 18$

$y = -0.5x + 9$

The lines are parallel because they both have a slope of -0.5.

35. $4x + y = 3$ $\quad$ $x + 4y = 3$

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

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

The lines are not parallel because one line has a slope of -4 and the other has a slope of $-\frac{1}{4}$.

36. *Sample answer:* $y = -6x + 5$; the equation has the same slope as $6x + y = 24$, but a different y-intercept.

37. $m_1 = \dfrac{0 - (-2)}{0 - (-4)} = \dfrac{2}{4} = \dfrac{1}{2}$

$m_2 = \dfrac{1}{2} = \dfrac{5 - 7}{k - 2}$

$k - 2 = 2(5 - 7)$

$k - 2 = -4$

$k = -2$

38. $m_1 = \dfrac{-6 - 9}{-6 - (-1)} = \dfrac{-15}{-5} = 3$

$m_2 = 3 = \dfrac{-2 - k}{0 - (-7)}$

$21 = -2 - k$

$23 = -k$

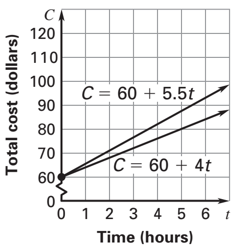
$-23 = k$

39. Because (x_1, y_1) and (x_2, y_2) are on the line $y = mx + b$, $y_1 = mx_1 + b$ *and* $y_2 = mx_2 + b$. Then the slope of the line is $= \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{(mx_2 + b) - (mx_1 + b)}{x_2 - x_1} =$

$\dfrac{mx_2 - mx_1}{x_2 - x_1} = \dfrac{m(x_2 - x_1)}{x_2 - x_1} = m.$

Problem Solving

40. a. $C = 60 + 4t$



b. $C = 60 + 5.5t$

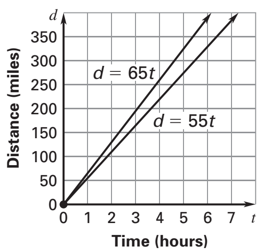
c. $C = 60 + 4(4) = 60 + 16 = 76$

$C = 60 + 5.5(4) = 60 + 22 = 82$

$82 - 76 = 6$

It will cost $6 more after the parking fee is raised.

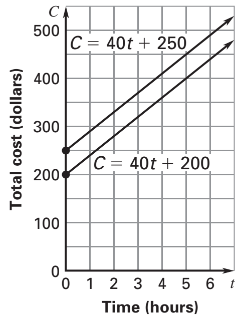
41. a.



b. $195 - 165 = 30$

A person can travel 30 miles farther in 3 hours since the speed limit has been changed.

42. a.



b. Cost if repair takes 3 hours:

Dealership: $370

Warehouse: $320

$370 - 320 = 50$

If the repair takes 3 hours, the difference in cost is $50.

Cost if repair takes 4 hours:

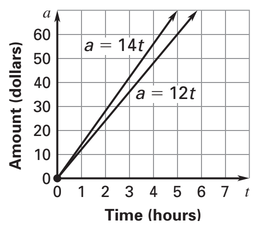
Dealership: $410

Warehouse: $360

$410 - 360 = 50$

If the repair takes 4 hours, the difference in cost is $50. The difference in cost is the same no matter how much time it takes. The lines are parallel, so the distance between them is always the same.

43. a.



The slopes indicate how much money is earned per hour. The a-intercepts represent how much money is earned when zero hours are worked.

b. First shift: $a = 12t$

$a = 12(40) = 480$

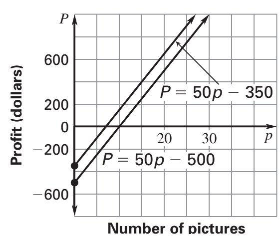
Second shift: $a = 14t$

$a = 14(40) = 560$

$560 - 480 = 80$

A welder earns $80 more in 40 hours working second shift.

44. a–b.

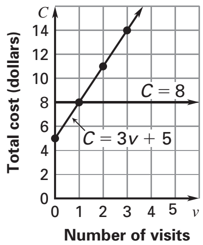


c. Small booth: $P = 50(80) - 350 = 4000 - 350 = 3650$

Large booth: $P = 50(120) - 500 = 5500$

The artist should rent the large booth because the profit from the large booth would be \$5500, while the profit from the small booth would only be \$3650.

45. a.



The lines intersect at (1, 8). This means that after 1 visit the total cost is the same for students who attend the college and for those who do not.

b. A nonstudent will pay more than a student after the first visit. A student pays more than a nonstudent when getting certified.

Quiz for the lessons "Find Slope and Rate of Change" and "Graph Using Slope-Intercept Form"

1. $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{4 - (-11)}{0 - 3} = \frac{15}{-3} = -5$

2. $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{4 - 1}{8 - 2} = \frac{3}{6} = \frac{1}{2}$

3. $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-1 - (-1)}{-1 - (-4)} = \frac{0}{3} = 0$

4. $y = -x + 9$

$m = -1, b = 9$

5. $2x + 9y = -18$

$9y = -2x - 18$

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

$m = -\frac{2}{9}, b = -2$

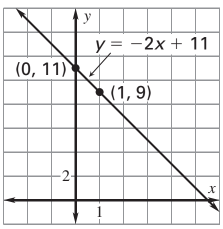
6. $-x + 6y = 21$

$6y = x + 21$

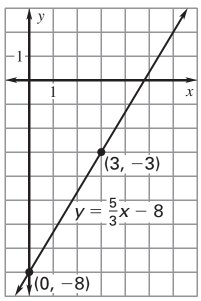
$y = \frac{1}{6}x + \frac{7}{2}$

$m = \frac{1}{6}, b = \frac{7}{2}$

7.



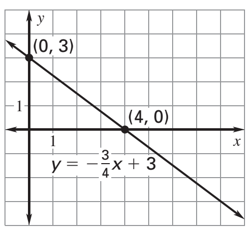
8.



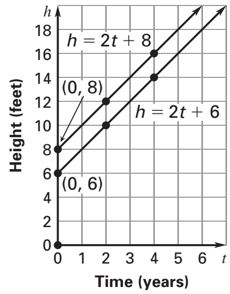
9. $-3x - 4y = -12$

$-4y = 3x - 12$

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



10. a.



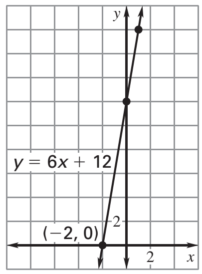
b. After 5 years the difference in heights is 2 feet. After 10 years the difference in heights is 2 feet. The difference is always the same because the lines are parallel.

Extension for the lesson "Graph Using Slope-Intercept Form"

1. $6x + 5 = -7$

$6x + 12 = 0$

$y = 6x + 12$



The x-intercept is -2.

The solution of $6x + 5 = -7$ is -2.

$6(-2) + 5 \stackrel{?}{=} -7$

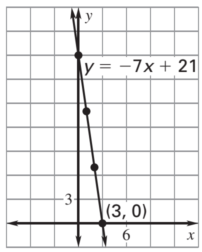
$-12 + 5 \stackrel{?}{=} -7$

$-7 = -7$ ✓

2. $-7x + 18 = -3$

$-7x + 21 = 0$

$y = -7x + 21$



The x-intercept is 3.

The solution of $-7x + 18 = -3$ is 3.

$-7(3) + 18 \stackrel{?}{=} -3$

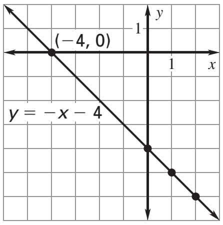
$-21 + 18 \stackrel{?}{=} -3$

$-3 = -3$ ✓

3. $2x - 4 = 3x$

$-x - 4 = 0$

$y = -x - 4$



The x-intercept is -4. The solution of $2x - 4 = 3x$ is -4.

$2(-4) - 4 \stackrel{?}{=} 3(-4)$

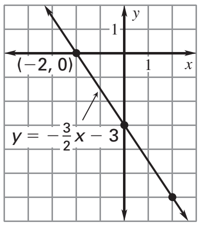
$-8 - 4 \stackrel{?}{=} -12$

$-12 = -12$ ✓

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

$-\frac{3}{2}x - 3 = 0$

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



The x-intercept is -2.

The solution of $\frac{1}{2}x - 3 = 2x$ is -2.

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

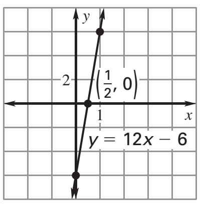
$-1 - 3 \stackrel{?}{=} -4$

$-4 = -4$ ✓

5. $-4 + 9x = -3x + 2$

$-6 + 12x = 0$

$y = 12x - 6$



The x-intercept is $\frac{1}{2}$.

The solution of $-4 + 9x = -3x + 2$ is $\frac{1}{2}$.

$-4 + 9\left(\frac{1}{2}\right) \stackrel{?}{=} -3\left(\frac{1}{2}\right) + 2$

$-4 + \frac{9}{2} \stackrel{?}{=} -\frac{3}{2} + 2$

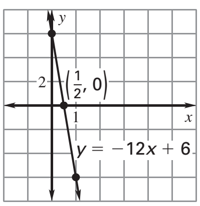
$\frac{1}{2} = \frac{1}{2}$ ✓

6. $10x - 18x = 4x - 6$

$-8x = 4x - 6$

$-12x + 6 = 0$

$y = -12x + 6$



The x-intercept is $\frac{1}{2}$.

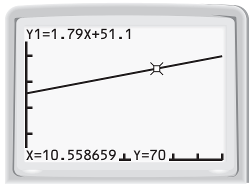
The solution of $10x - 18x = 4x - 6$ is $\frac{1}{2}$.

$10\left(\frac{1}{2}\right) - 18\left(\frac{1}{2}\right) \stackrel{?}{=} 4\left(\frac{1}{2}\right) - 6$

$5 - 9 \stackrel{?}{=} 2 - 6$

$-4 = -4$ ✓

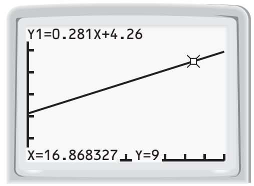
7. $Y_1 = 1.79x + 51.1$



$x \approx 10.6$, $Y = 70$

The number of subscribers was 70 million in about 2000.

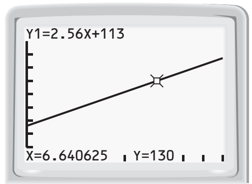
8. $Y_1 = 0.281x + 4.26$



$x \approx 16.9$, $Y = 9$

The number of degrees will be 9000 in $1990 + 16 = 2006$.

9. $Y_1 = 2.56x + 113$



$x \approx 6.6$, $Y = 130$

The number of vehicle miles of travel in New York was 130 billion in 2000.

Lesson 3.6 Model Direct Variation

Guided Practice for the lesson "Model Direct Variation"

1. $-x + y = 1$

$y = x + 1$

Because the equation cannot be rewritten in the form $y = ax$, it does not represent direct variation.

2. $2x + y = 0$

$y = -2x$

Because the equation can be rewritten in the form $y = ax$, it represents direct variation. The constant of variation is -2.

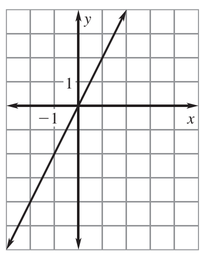
3. $4x - 5y = 0$

$-5y = -4x$

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

Because the equation can be rewritten in the form $y = ax$, it represents direct variation. The constant of variation is $\frac{4}{5}$.

4.



5. $y = ax$

$6 = a(4)$

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

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

$y = \frac{3}{2}(24)$

$y = 36$

6. $s = aw$

$s = 5(25)$

$s = 125$

You should add 125 tablespoons to the tank.

7. No, it is not reasonable to use a direct variation model since the ratios $\frac{c}{s}$ would not be the same for the first 5 songs as it would for later purchases.

Exercises for the lesson "Model Direct Variation"

Skill Practice

1. Two variables x and y show *direct variation* provided $y = ax$ and $a \neq 0$.

2. The line is not a direct variation equation, because it has a y-intercept of 4. Direct variation equations pass through the origin and therefore have a y-intercept of zero.

3. Yes the equation $y = x$ represents direct variation because it is in the form $y = ax$. The constant of variation is 1.

4. No, the equation $y = 5x - 1$ does not represent direct variation because it cannot be rewritten in the form of $y = ax$.

5. $2x + y = 3$

$y = -2x + 3$

No, the equation $2x + y = 3$ does not represent direct variation because it cannot be rewritten in the form $y = ax$.

6. $x - 3y = 0$

$-3y = -x$

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

Yes, $x - 3y = 0$ represents direct variation, because it can be rewritten in the form $y = ax$. The constant of variation is $\frac{1}{3}$.

7. $8x + 2y = 0$

$2y = -8x$

$y = -4x$

Yes, the equation $8x + 2y = 0$ does represent direct variation because it can be rewritten in the form $y = ax$. The constant of variation is -4.

8. $2.4x + 6 = 1.2y$

$-1.2y = -2.4x - 6$

$y = 2x + 5$

No, the equation $2.4x + 6 = 1.2y$ does not represent direct variation because it cannot be written in the form of $y = ax$.

9. C; $3x - 7y = 0$

$3x - 7y = 0$

$-7y = -3x$

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

10. The equation must be in the form $y = ax$ to find the constant of variation.

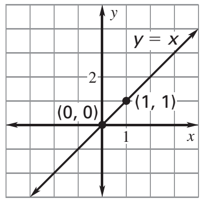
$-5x + 3y = 0$

$3y = 5x$

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

The constant of variation is $\frac{5}{3}$.

11.



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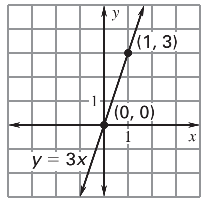

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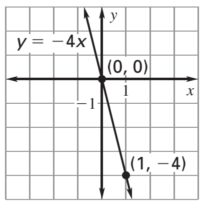

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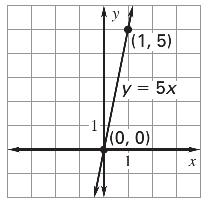

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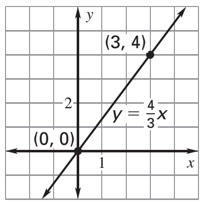

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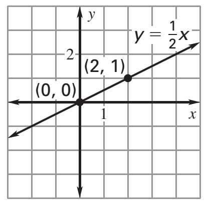

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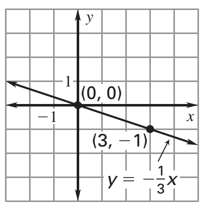

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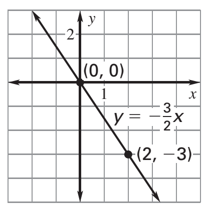
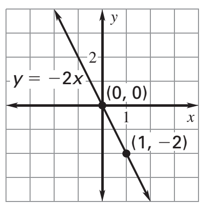


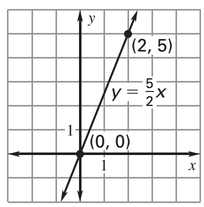
19. $12y = -24x$

$y = -2x$



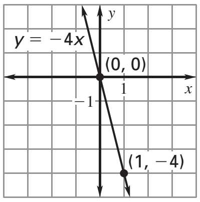
20. $10y = 25x$

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



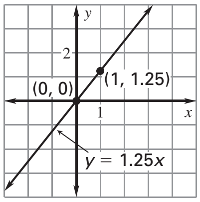
21. $4x + y = 0$

$y = -4x$



22. $y - 1.25x = 0$

$y = 1.25x$



23. $y = ax$

$2 = a(-2)$

$-1 = a$

$y = -x$

$y = -8$

24. $y = ax$

$5 = a(4)$

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

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

$y = \frac{5}{4}(8)$

$y = 10$

25. $y = ax$

$-3 = a(4)$

$-\frac{3}{4} = a$

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

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

$y = -6$

26. Yes, the table represents direct variation. $y = 5x$

27. No, the table does not represent direct variation.

28. For the table to model direct variation, each point must work in the equation $y = ax$ with the same constant of variation.

The first 3 terms fit the equation $y = \frac{1}{2}x$, but the third term does not, $6 \neq \frac{1}{2}(16)$.

29. $x = 3, y = 9$

$y = ax$

$9 = a(3)$

$3 = a$

$y = 3x$

30. $x = 2, y = 26$

$y = ax$

$26 = a(2)$

$13 = a$

$y = 13x$

31. $x = 14, y = 7$

$y = ax$

$7 = a(14)$

$\frac{1}{2} = a$

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

32. $x = 15, y = -5$

$y = ax$

$-5 = a(15)$

$-\frac{1}{3} = a$

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

33. $x = -2, y = -2$

$y = ax$

$-2 = a(-2)$

$1 = a$

$y = x$

34. $x = -18, y = -4$

$y = ax$

$-4 = a(-18)$

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

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

35. $x = \frac{1}{4}, y = 1$

$y = ax$

$1 = a\left(\frac{1}{4}\right)$

$4 = a$

$y = 4x$

36. $x = -6, y = 15$

$y = ax$

$15 = a(-6)$

$-\frac{5}{2} = a$

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

37. $x = -5.2, y = 1.4$

$y = ax$

$1.4 = a(-5.2)$

$-\frac{7}{26} = a$

$y = -\frac{7}{26}x$

38. If y varies directly with x, then x varies directly with y. The constants of variation are reciprocals of each other. For example, if a is a constant,

$y = ax$

$\frac{y}{a} = x$

$\frac{1}{a}y = x.$

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

$-1(-6 - x_1) = 3(2 - y_1)$

$6 + x_1 = 6 - 3y_1$

$x_1 = -3y_1$

$-\frac{1}{3}x_1 = y_1$

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

Yes, the equation of the line represents direct variation.

Problem Solving

40. **a.** $d = 2r$

b. $d = 2(1500) = 3000$

You travel 3000 meters in 1500 tire revolutions.

41. **a.** $v = \frac{3}{2}t$

b. $v = \frac{3}{2}(8) = 12$

An employee earns 12 hours of vacation in 8 weeks.

42. $s = \frac{10}{2}d$

$s = 5d$

$s = 5(3) = 15$

15 bags are needed to spread a layer that is 3 inches deep.

43. a. f varies directly with w because each value for w multiplied by $\frac{1}{4}$ gives you the corresponding value of f.

b. $f = \frac{1}{4}w$; the rate of change, $\frac{1}{4}$, represents the change in cost (in dollars) per pound of weight, or \$.25 per pound

$f = \frac{1}{4}(18) = 4.5$

$f = \frac{1}{4}(10) = 2.5$

$4.5 + 2.5 = 7$

The total fee would be \$7.

44. a. p varies directly with ℓ because each value of ℓ times 1.25 gives you the corresponding value of p.

b. $p = 1.25\ell$; the rate of change, 1.25, represents the change in cost (in dollars) per inch of length, or \$1.25 per inch.

$30 = 1.25\ell$

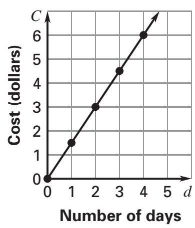
$24 = \ell$

You can buy a chain that is 24 inches long.

45. a.

Days of school, *d*	Cost, *C* (dollars)
1	1.50
2	3.00
3	4.50
4	6.00

b.



c. $C = 1.50d$

Yes, it is a direct variation equation because it fits the equation $y = ax$, where a is the constant of variation.

$C = 1.50\ (22) = 33$

It will cost \$33 to ride the subway to and from school for that month.

46. a. It is reasonable to use a direct variation equation because the number of attempted field goals times 0.4 approximately equals the number of field goals made.

$m = 0.4t$

The constant of variation is about 0.4.

b. $m = 0.4t$

$m = 0.4(66.2)$

$m \approx 26$

About 26 field goals were made that season.

c. No, the data would not show direct variation.

$\frac{m}{t}$ for each season will not be equal to each other.

47. Because $d = 2r$ and r varies directly with p, you can write the equation $r = ap$. When $d = 1.3$ meters, $r = 0.65$. Substitute 0.65 for r when $p = 5$ to get $0.65 = 5a$. Solve to find $a = 0.13$. Substitute ap for r into the equation $d = 2r$, you get $d = 2(0.13)p$, giving the direct variation equation $d = 0.26p$.

Problem Solving Workshop for the lesson "Model Direct Variation"

1. $\frac{20}{100} = \frac{22}{s}$ ← Amount of water (gallons) ← Amount of salt (tablespoons)

$20s = 100(22)$

$20s = 2200$

$s = 110$

110 Tablespoons of salt should be added to a 22 gallon tank. A proportion was used to solve this problem.

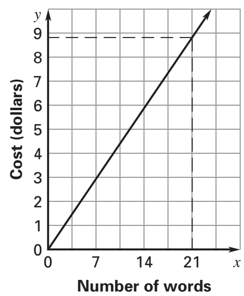
2. $\frac{14}{5.88} = \frac{21}{c}$ ← Number of words ← Cost (dollars)

$14c = 5.88(21)$

$14c = 123.48$

$c = 8.82$

A 21 word ad would cost \$8.82.



3. You can quickly determine the cost of a 7 word ad by dividing the cost of a 14 word ad by 2. Multiplying the cost of a 7 word ad by 3 will give you the cost of a 21 word ad.

4. $\frac{6}{96} = \frac{10}{s}$ ← Size of smoothie (ounces) ← Amount of sodium (mg)

$6s = 96(10)$

$6s = 960$

$s = 160$

A 10 ounce bottle contain 160 milligrams of sodium.

5. The ratios were written incorrectly. The 96 milligrams of sodium corresponds to the 6 ounce bottle, so that ratio should have been written as $\frac{6}{96}$.

$\frac{6}{96} = \frac{10}{x}$

$6x = 960$

$x = 160$

6. $\frac{9}{540} = \frac{8}{c}$ ← Hours of sleep ← Calories burned

Let c = number of calories burned.

$9c = 4320$

$c = 480$

$\frac{9.5}{n} = \frac{9}{540}$

Let n = number of calories burned.

$5130 = 9n$

$570 = n$

$570 - 480 = 90$

You burn 90 more calories by sleeping 9.5 hours than 8 hours.

Lesson 3.7 Graph Linear Functions

Guided Practice for the lesson "Graph Linear Functions"

1. $h(x) = -7x$

$h(7) = -7(7) = -49$

2. $f(x) = 37x + 7$

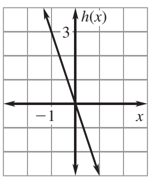
$155 = 37x + 7$

$148 = 37x$

$4 = x$

The solution means that in 1999 the gray wolf population in central Idaho was 155.

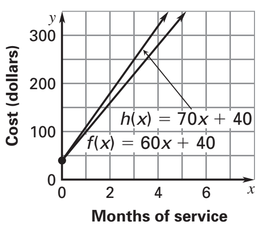
3.



Because the slope of the graph of h is negative, it is a reflection in the x-axis of the graph of f. Also since the numerical value for the slope of h is larger than f, it rises faster from the right to left. The y-intercept for both graphs is 0, so both lines pass through the origin.

4. $f(x) = 60x + 40$

$h(x) = 70x + 40$



Because the slope of the graph of h is greater than the slope of f, the graph of h rises faster from left to right. Both graphs have the same y-intercept so both pass through the point (0, 40).

Exercises for the lesson "Graph Linear Functions"

Skill Practice

1. When you write the function $y = 3x + 12$ as $f(x) = 3x + 12$, you are using *function notation*.

2. Yes, they would be considered a family of functions, because they have similar characteristics including the same slope of -9.

3. $f(x) = 12x + 1$

$f(-2) = 12(-2) + 1$
$= -23$

$f(0) = 12(0) + 1 = 1$

$f(3) = 12(3) + 1 = 37$

4. $g(x) = -3x + 5$

$g(-2) = -3(-2) + 5$
$= 11$

$g(0) = -3(0) + 5 = 5$

$g(3) = -3(3) + 15$
$= -4$

5. $p(x) = -8x - 2$

$p(-2) = -8(-2) - 2$
$= 14$

$p(0) = -8(0) - 2 = -2$

$p(3) = -8(3) - 2$
$= -26$

6. $h(x) = 2.25x$

$h(-2) = 2.25(-2)$
$= -4.5$

$h(0) = 2.25(0) = 0$

$h(3) = 2.25(3)$
$= 6.75$

7. $m(x) = -6.5x$

$m(-2) = -6.5(-2)$
$= 13$

$m(0) = -6.5(0)$
$= 0$

$m(3) = -6.5(3)$
$= -19.5$

8. $f(x) = -0.75x - 1$

$f(-2) = -0.75(-2) - 1$
$= 0.5$

$f(0) = -0.75(0) - 1$
$= -1$

$f(3) = -0.75(3) - 1$
$= -3.25$

9. $s(x) = \frac{2}{5}x + 3$

$s(-2) = \frac{2}{5}(-2) + 3$
$= 2.2$

$s(0) = \frac{2}{5}(0) + 3 = 3$

$s(3) = \frac{2}{5}(3) + 3 = 4.2$

10. $d(x) = -\frac{3}{2}x + 5$

$d(-2) = -\frac{3}{2}(-2) + 5$
$= 8$

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

$d(3) = -\frac{3}{2}(3) + 5 = 0.5$

11. $h(x) = \frac{3}{4}x - 6$

$h(-2) = \frac{3}{4}(-2) - 6 = -7.5$

$h(0) = \frac{3}{4}(0) - 6 = -6$

$h(3) = \frac{3}{4}(3) - 6 = -3.75$

12. In this case, $g(-3)$ means "g of -3" referring to the function g being evaluated at $x = -3$, not a variable g times -3.

$g(-3) = -5(-3) + 3 = 15 + 3 = 18$

13. D; 18.6

$f(x) = -6.8x + 5$

$f(-2) = -6.8(-2) + 5 = 18.6$

14. $f(x) = 6x + 9$

$3 = 6x + 9$

$-6 = 6x$

$-1 = x$

15. $g(x) = -x + 5$

$2 = -x + 5$

$-3 = -x$

$3 = x$

16. $n(x) = -7x + 12$

$-9 = -7x + 12$

$-21 = -7x$

$3 = x$

17. $j(x) = 4x + 11$

$-13 = 4x + 11$

$-24 = 4x$

$-6 = x$

18. $m(x) = 9x - 5$

$-2 = 9x - 5$

$3 = 9x$

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

19. $n(x) = -2x - 21$

$-6 = -2x - 21$

$15 = -2x$

$-7\frac{1}{2} = x$

20. $p(x) = -12x - 36$

$-3 = -12x - 36$

$33 = -12x$

$-2.75 = x$

21. $q(x) = 8x - 32$

$-4 = 8x - 32$

$28 = 8x$

$3.5 = x$

22. C; 10

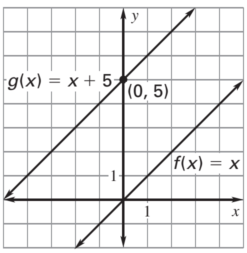
$f(x) = -2x + 25$

$5 = -2x + 25$

$-20 = -2x$

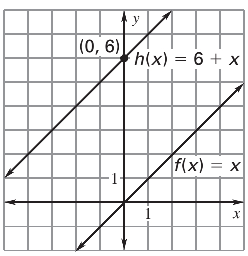
$10 = x$

23.



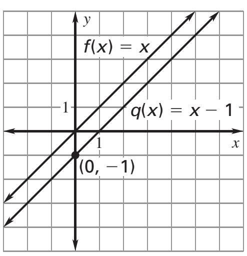
Both graphs have the same slope, but the graph of *g* has a *y*-intercept 5 units higher than that of *f*.

24.



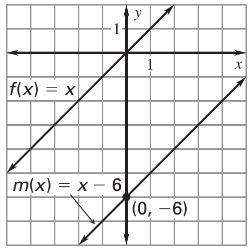
Both graphs have the same slope, but the graph of *h* has a *y*-intercept 6 units higher than that of *f*.

25.



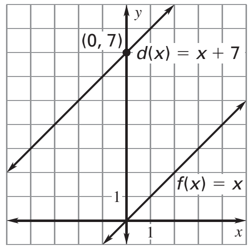
Both graphs have the same slope, but the graph of *q* has a *y*-intercept 1 unit lower than that of *f*.

26.



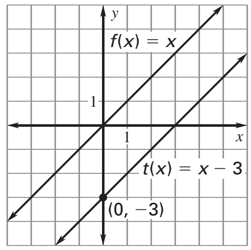
Both graphs have the same slope, but the graph of *m* has a *y*-intercept 6 units lower than that of *f*.

27.



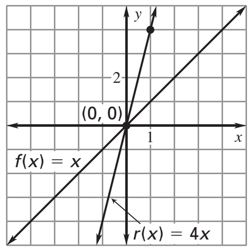
Both graphs have the same slope, but the graph of *d* has a *y*-intercept 7 units higher than that of *f*.

28.



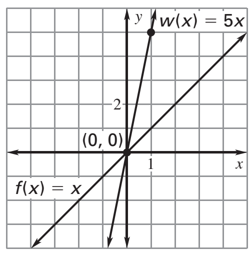
Both graphs have the same slope, but the graph of *t* has a *y*-intercept 3 units lower than that of *f*.

29.



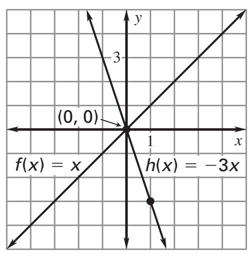
The graph of *r* has a greater slope, so it rises faster from left to right than the graph of *f*. Both graphs pass through the origin.

30.

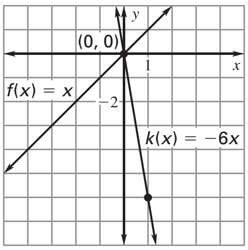


The graph of *w* has a greater slope, so it rises faster from left to right than the graph of *f*. Both graphs pass through the origin.

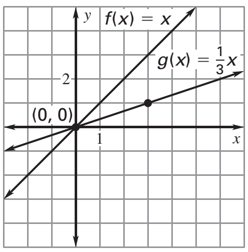
31.



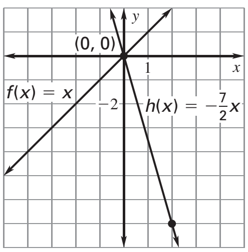
The graph of *h* has a negative slope, so it rises from right to left instead of left to right. Both graphs pass through the origin.

32. 

The graph of k has a negative slope, so it rises from right to left instead of left to right. Both graphs pass through the origin.

33. 

Graph g has a smaller slope than graph f, so it rises more slowly from left to right. Both graphs pass through the origin.

34. 

The slope of h is negative so it rises from right to left instead of left to right. Both graphs pass through the origin.

35. B; $f(x) = 3x - 8$; $(1, -5), (0, -8)$

Try: $f(x) = 3x + 8$

$f(1) = 3(1) + 8 = 11$

Try: $f(x) = 3x - 8$

$f(1) = 3(1) - 8 = -5$

$f(0) = 3(0) - 8 = -8$

36. Answers will vary.

37. The graph of $g(x) = 1$ is a horizontal line passing through (0, 1). The graph of $h(x) = -1$ is a horizontal line passing through (0, −1). The lines are parallel and both have a slope of zero. The y-intercept of the graph of h is 2 less than the y-intercept of the graph of g.

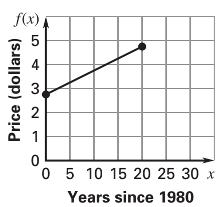
38. $f(x) = 4x + 7$, $g(x) = 2x$

$g(f(x)) = 2(4x + 7) = 8x + 14$

$f(g(x)) = 4(2x) + 7 = 8x + 7$

Problem Solving

39. a. $f(x) = 0.10x + 2.75$



Domain: $0 \le x \le 20$

Range: $2.75 \le y \le 4.75$

b. $f(x) = 0.10x + 2.75$

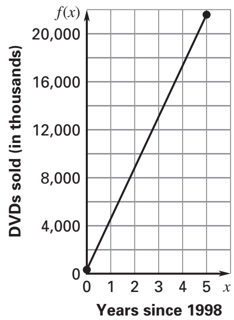
$4.55 = 0.10x + 2.75$

$1.8 = 0.10x$

$18 = x$

This answer means that 18 years since 1980 (1998) the average price of a movie ticket was $4.55.

40. a. $f(x) = 4250x + 330$



Domain: $0 \le x \le 5$

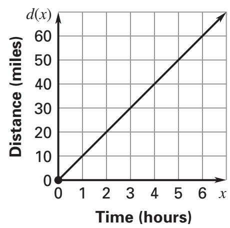
Range: $330 \le y \le 21{,}580$

b. $f(x) = 13{,}080$

$13{,}080 = 4250x + 330$

$3 = x$

The solution means that in 2001, 13,080,000 DVD players were sold.

41. 

Domain: $x \ge 0$

Range: $d(x) \ge 0$

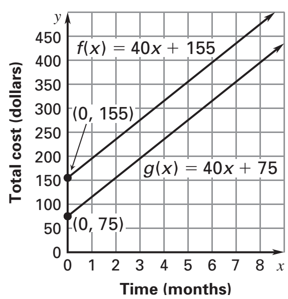
The function $d(x) = 15$ tells us how long it takes the skater to travel 15 miles.

$d(x) = 10x$

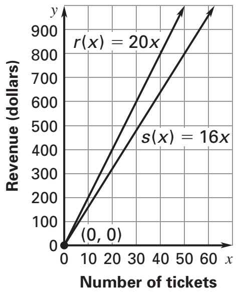
$15 = 10x$

$1.5 = x$

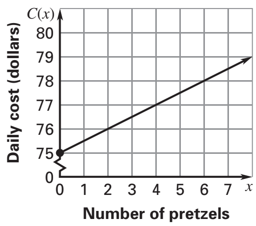
It took the skater 1.5 hours to travel 15 miles.

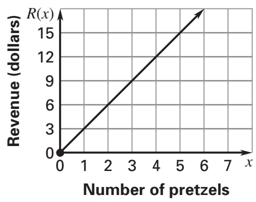
42. 

The graph of g is parallel to the graph of f, because they both have a slope of 40. The y-intercept of the graph of g is 80 less than the y-intercept of the graph of f.

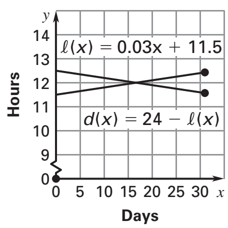
43. 

The graph of r rises faster from left to right than the graph of s, because it has a greater slope. Both graphs have a y-intercept of zero, so both lines pass through the origin.

44. a. 

b. 

c. Subtract the value of $c(x)$ from the value of $R(x)$ at a given value for x, as shown on the graphs.

45. 

a. Domain: $1 \le x \le 31$

Range: $11.53 \le \ell(x) \le 12.43$

b. Domain: $1 \le x \le 31$

Range: $11.57 \le d(x) \le 12.47$

c. The graph of $d(x)$ could have been obtained by reflecting the graph of $\ell(x)$ across the line $y = 12$ (the two graphs intersect at this line).

d. The point where the graphs intersect means that on that day, the hours of daylight and darkness are equal.

Quiz for the lessons "Model Direct Variation" and "Graph Linear Functions"

1. $y = ax$

$10 = a(5)$

$2 = a$

$y = 2x$

2. $y = ax$

$6 = a(4)$

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

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

3. $y = ax$

$-16 = a(2)$

$-8 = a$

$y = -8x$

4. $g(x) = 6x - 5$

$g(4) = 6(4) - 5 = 19$

5. $h(x) = 14x + 7$

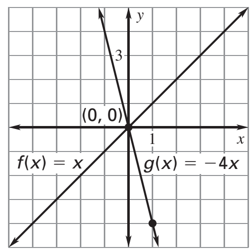
$h(2) = 14(2) + 7 = 35$

6. $j(x) = 0.2x + 12.2$

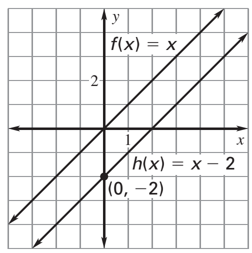
$j(244) = 0.2(244) + 12.2 = 61$

7. $k(x) = \frac{5}{6}x + \frac{1}{3}$

$k(4) = \frac{5}{6}(4) + \frac{1}{3} = 3\frac{2}{3}$

8. 

The graph of g has a negative slope, so it rises from right to left. Both graphs pass through the origin.

9. 

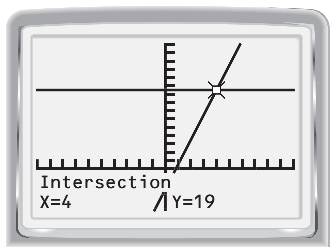
The graphs have the same slope, so they are parallel. The y-intercept of h is 2 units lower than that of f.

10. $\frac{84}{12} = \frac{112}{16} = \frac{98}{14} = 7$

Your hourly wage is \$7 per hour.

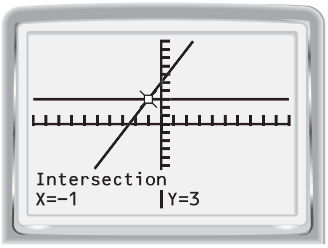
Graphing Calculator Activity for the lesson "Graph Linear Functions"

Practice 1

1. 

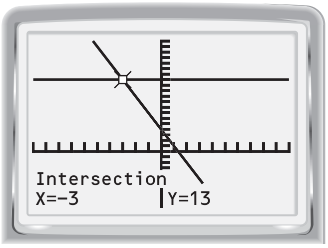
$x = 4$

2.



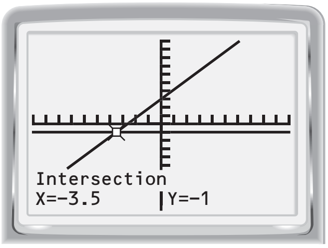
$x = -1$

3.



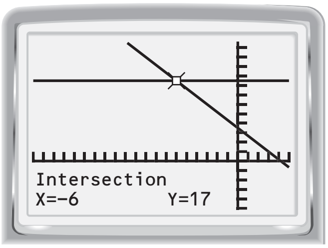
$q = -3$

4.



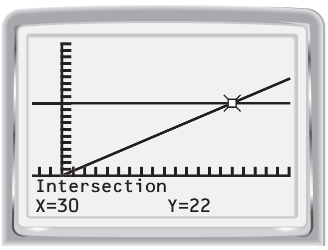
$x = -\frac{7}{2}$

5.



$c = -6$

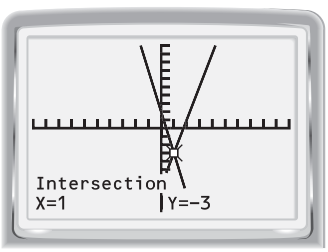
6.



$x = 30$

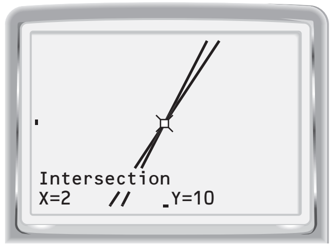
Practice 2

7.



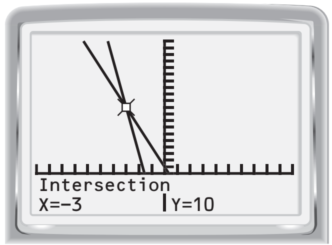
$x = 1$

8.



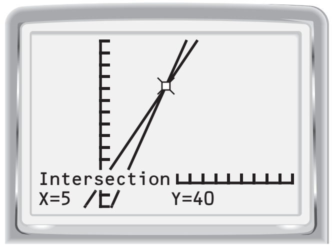
$x = 2$

9.



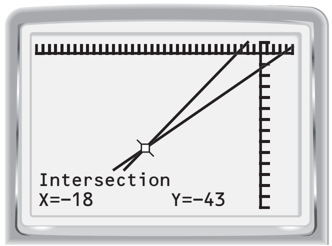
$x = -3$

10.



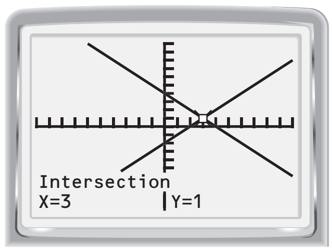
$x = 5$

11.



$x = -18$

12.

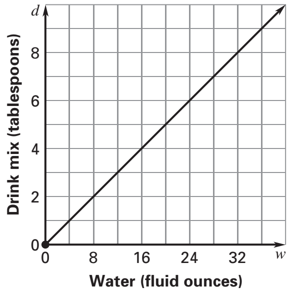


$x = 3$

13. When the equation has one side with no variable, you get a horizontal line that intersects a non-horizontal line. When the equation has a variable on each side, you get two non-horizontal intersecting lines.

Mixed Review of Problem Solving for the lessons "Find Slope and Rate of Change", "Graph Using Slope-Intercept Form", "Model Direct Variation", and "Graph Linear Functions"

1. a.



b. 1 serving (8 fluid ounces) takes 2 tablespoons of drink mix, so 4 servings takes $4(2) = 8$ tablespoons of drink mix.

2. a. $s = 25t$

b. $s = 25(90) = 2250$

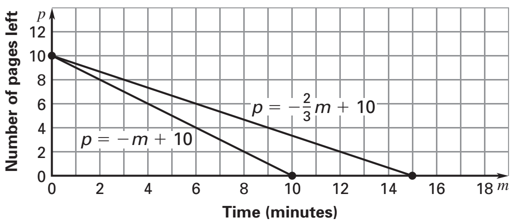
The park earns $2250 if 90 adult tickets are sold.

c. $3325 = 25t$

$133 = t$

The park sold 133 tickets.

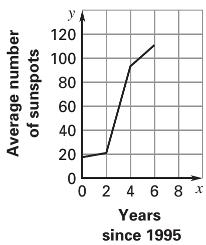
3.



Find where each graph has its m-intercept. This point represents the time it takes to finish reading. The distance between the m-intercepts of each graph tells how many more minutes it took your friend to ready the essay.

4. Answers will vary.

5. a.



b. The increase in sunspots was the greatest between 1997 and 1999.

$$\frac{93.2 - 21.0}{4 - 2} = 36.1$$

The rate of change was 36.1 sunspots per year.

c. The increase in sunspots was the least between 1995 and 1997.

$$\frac{21 - 17.5}{2 - 0} = 1.75$$

The rate of change was 1.75 sunspots per year.

d. Subtract 17.5 from 110.9 and divide by 6 to find 15.6 sunspots per year.

6. The graph of g is a vertical translation of the graph of f by 50 units down.

Chapter Review for the chapter "Graphing Linear Equations and Functions"

1. The *slope* of a nonvertical line is the ratio of vertical change to horizontal change.

2. When you write $y = 2x + 3$ as $f(x) = 2x + 3$, you use *function notation*.

3. *Sample answer:* You could make an x/y chart and connect the points plotted from the chart. You could find the x and y-intercepts and draw a line through them. You could graph by putting the equation into slope-intercept form and connecting the y-intercept to another point found from the slope.

4. a. $3x + y = 6$

Not in slope-intercept form.

$y = -3x + 6$

b. $y = 5x + 2$

Yes, in slope-intercept form.

c. $x = 4y - 1$

Not in slope intercept form.

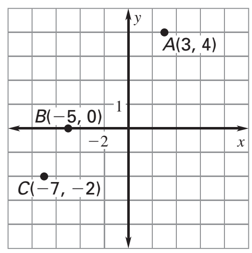
$-4y = -x - 1$

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

d. $y = -x + 6$

Yes, in slope-intercept form.

5–7.



The point $A(3, 4)$ is 3 units to the right of the origin and 4 units up. Point A is in Quadrant I.

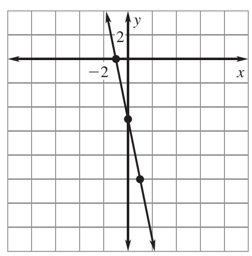
6. The point $B(-5, 0)$ is 5 units to the left of the origin on the x-axis.

7. The point $A(-7, -2)$ is 7 units to the left of the origin and 2 units down. Point C is in Quadrant III.

8. $y + 5x = -5$

$y = -5x - 5$

x	−1	0	1
y	0	−5	−10

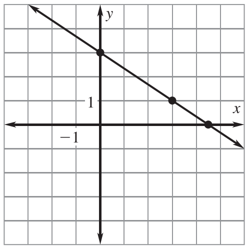


9. $2x + 3y = 9$

$3y = -2x + 9$

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

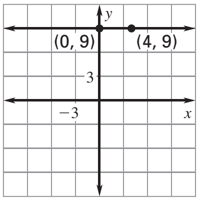
x	3	0	$\frac{9}{2}$
y	1	3	0



10. $2y - 14 = 4$

$2y = 18$

$y = 9$



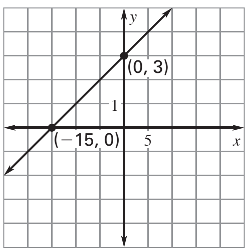
11. $-x + 5y = 15$

$-x + 5(0) = 15$

$x = -15 \leftarrow x\text{-intercept}$

$-0 + 5y = 15$

$y = 3 \leftarrow y\text{-intercept}$



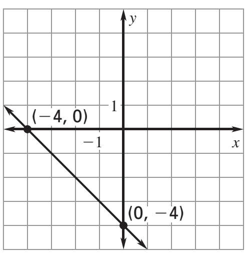
12. $4x + 4y = -16$

$4x + 4(0) = -16$

$x = -4 \leftarrow x\text{-intercept}$

$4(0) + 4y = -16$

$y = -4 \leftarrow y\text{-intercept}$



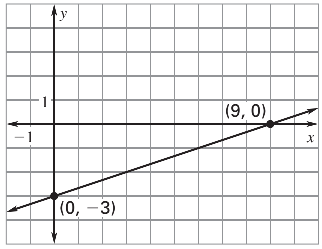
13. $2x - 6y = 18$

$2x - 6(0) = 18$

$x = 9 \leftarrow x\text{-intercept}$

$2(0) - 6y = 18$

$y = -3 \leftarrow y\text{-intercept}$



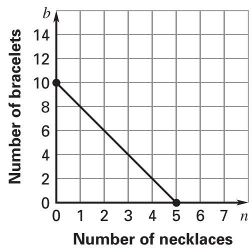
14. $10n + 5b = 50$

$10n + 5(0) = 50$

$n = 5 \leftarrow n\text{-intercept}$

$10(0) + 5b = 50$

$b = 10 \leftarrow b\text{-intercept}$



Sample answer:
0 bracelets, 5 necklaces;
4 bracelets, 3 necklaces;
10 bracelets, 0 necklaces

15. $(-1, 11), (2, 10)$

$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{10 - 11}{2 - (-1)} = -\frac{1}{3}$

16. $(-2, 0), (4, 9)$

$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{9 - 0}{4 - (-2)} = \frac{9}{6} = \frac{3}{2}$

17. $(-5, 4), (1, -8)$

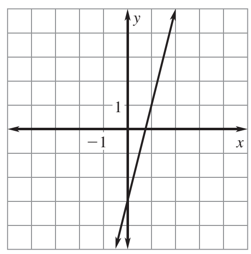
$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-8 - 4}{1 - (-5)} = -\frac{12}{6} = -2$

18. $4x - y = 3$

$-y = -4x + 3$

$y = 4x - 3$

$m = 4, b = -3$

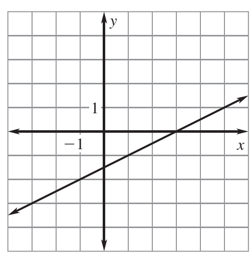


19. $3x - 6y = 9$

$-6y = -3x + 9$

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

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

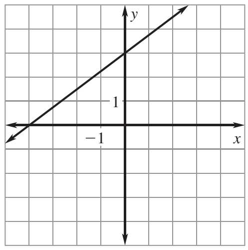


20. $-3x + 4y - 12 = 0$

$4y = 3x + 12$

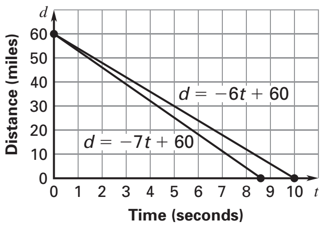
$y = \frac{3}{4}x + 3$

$m = \frac{3}{4}, b = 3$



21. $d = -7t + 60$ $\quad$ $d = -6t + 60$

$m = -7, b = 60$ $\quad$ $m = -6, b = 60$



The first athlete finishes the race 1.4 seconds faster.

22. $x - y = 3$

$-y = x + 3$

$y = x - 3$

The equation does not represent direct variation.

23. $x + 2y = 0$

$2y = -x$

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

Yes, the equation represents direct variation. The constant of variation is $-\frac{1}{2}$.

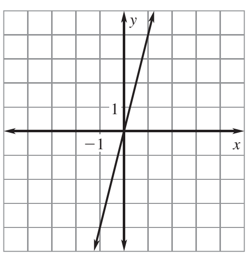
24. $8x - 2y = 0$

$-2y = -8x$

$y = 4x$

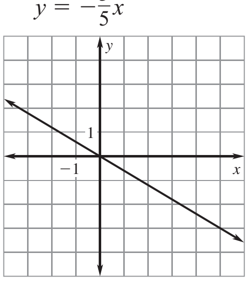
Yes, the equation represents direct variation. The constant of variation is 4.

25.



26. $-5y = 3x$

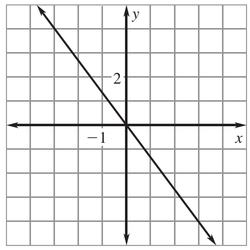
$y = -\frac{3}{5}x$



27. $4x + 3y = 0$

$3y = -4x$

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



28. $s = ad$

$5 = a(2)$

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

$s = \frac{5}{2}d$

$s = \frac{5}{2}(6) = 15$

15 inches of snow fell in 6 hours.

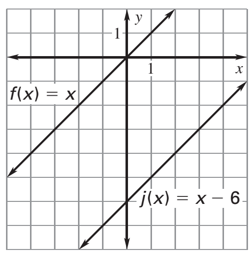
29. $g(x) = 2x - 3$

$g(7) = 2(7) - 3 = 11$

30. $h(x) = -\frac{1}{2}x - 7$

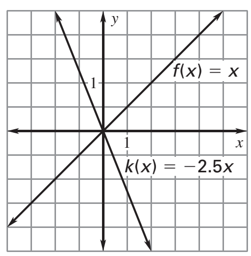
$h(-6) = -\frac{1}{2}(-6) - 7 = 3 - 7 = -4$

31. $j(x) = x - 6$



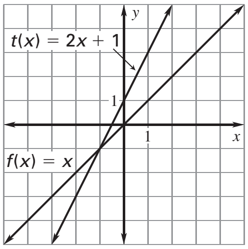
Both graphs have the same slope, so they are parallel. The *y*-intercept of *j* is 6 units lower than that of *f*.

32. $k(x) = -2.5x$



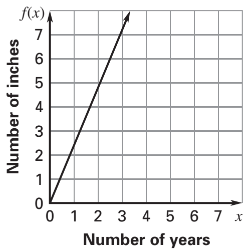
The graph of *k* has a negative slope, so it rises from right to left. Both graphs pass through the origin.

33. $t(x) = 2x + 1$



The graph of t has a greater slope than the graph of f, so it rises faster from left to right. The y-intercept of t is one unit higher than that of f.

34. $f(x) = 2.4x$



domain: $x \geq 0$

range: $f(x) \geq 0$

$f(x) = 250$

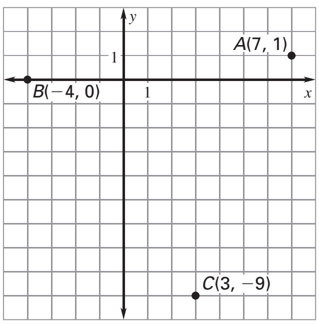
$250 = 2.4x$

$104.17 \approx x$

This means that Mount Everest rises 250 inches in 104 years.

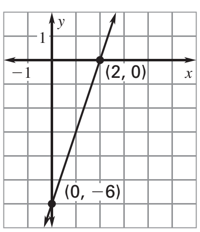
Chapter Test for the chapter "Graphing Linear Equations and Functions"

1–3.

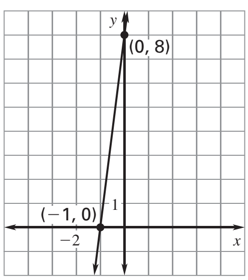


1. The point $A(7, 1)$ is 7 units to the right of the origin and 1 unit up. Point A is in Quadrant I.
2. The point $B(-4, 0)$ is 4 units to the left of the origin on the x-axis.
3. The point $C(3, -9)$ is 3 units to the right of the origin and 9 units down. Point C is in Quadrant IV.

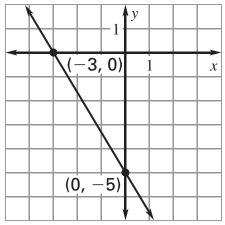
4.



5.



6.



7. $m = \dfrac{y_2 - y_1}{x_2 - x_1}$

$m = \dfrac{4 - 1}{8 - 2} = \dfrac{3}{6} = \dfrac{1}{2}$

8. $m = \dfrac{y_2 - y_1}{x_2 - x_1}$

$m = \dfrac{-1 - 7}{0 - (-2)} = \dfrac{-8}{2} = -4$

9. $m = \dfrac{y_2 - y_1}{x_2 - x_1}$

$m = \dfrac{14 - 5}{3 - 3} = \dfrac{9}{0}$

Slope is undefined.

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

$m = -\frac{3}{2}, b = -10$

11. $7x + 2y = -28$

$2y = -7x - 28$

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

$m = -\frac{7}{2}, b = -14$

12. $3x - 8y = 48$

$-8y = -3x + 48$

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

$m = \frac{3}{8}, b = -6$

13. $x + 4y = 4$

$4y = -x + 4$

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

Not direct variation

14. $-\frac{1}{3}x - y = 0$

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

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

The equation does represent direct variation. The constant of variation is $-\frac{1}{3}$.

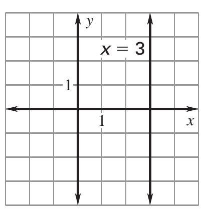
15. $3x - 3y = 0$

$-3y = -3x$

$y = x$

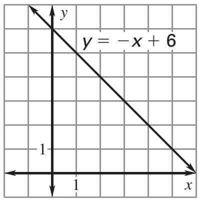
The equation does represent direct variation. The constant of variation is 1.

16.



17. $y + x = 6$

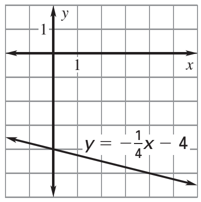
$y = -x + 6$



18. $2x + 8y = -32$

$8y = -2x - 32$

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



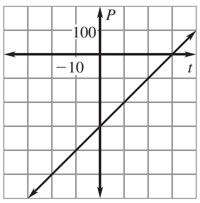
19. $f(x) = -4x$

$f(2.5) = -4(2.5) = -10$

20. $g(x) = \frac{5}{2}x - 6$

$g(-2) = \frac{5}{2}(-2) - 6 = -5 - 6 = -11$

21. $P = 10t - 300$



You must work 30 hours to break even.

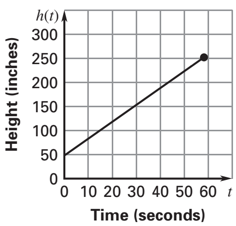
22. a. $d = \frac{150}{30}m$

$d = 5m$

b. $d = 5(50) = 250$

The dose of medicine for a patient whose mass is 50 kilograms is 250 milligrams.

23. $h(t) = 3.5t + 48$

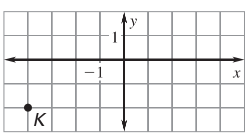


Domain: $0 \le t \le 58.3$

Range: $48 \le h \le 252$

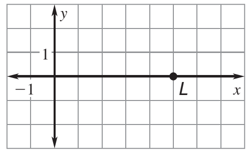
Extra Practice for the chapter "Graphing Linear Equations and Functions"

1.



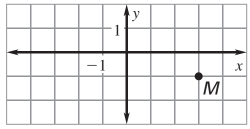
Point K is in Quadrant III.

2.



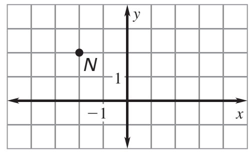
Point L is on the x-axis.

3.



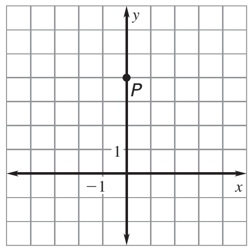
Point M is in Quadrant IV.

4.



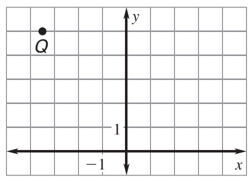
Point N is in Quadrant II.

5.



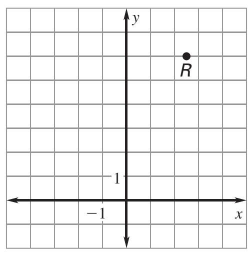
Point P is on the y-axis

6.



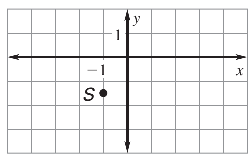
Point Q is in Quadrant II.

7.



Point R is in Quadrant I.

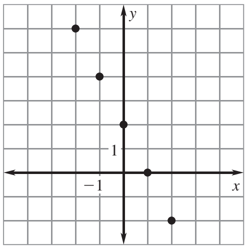
8.



Point S is in Quadrant III.

9.

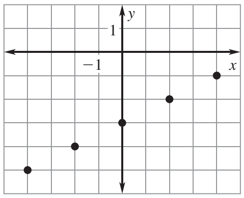
x	$y = -2x + 2$
-2	$y = -2(-2) + 2 = 6$
-1	$y = -2(-1) + 2 = 4$
0	$y = -2(0) + 2 = 2$
1	$y = -2(1) + 2 = 0$
2	$y = -2(2) + 2 = -2$



The range consists of the y-values from the table: -2, 0, 2, 4, and 6.

10.

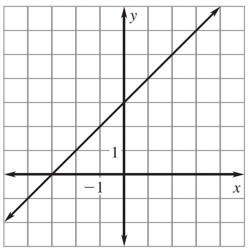
x	$y = \frac{1}{2}x - 3$
-4	$y = \frac{1}{2}(-4) - 3 = -5$
-2	$y = \frac{1}{2}(-2) - 3 = -4$
0	$y = \frac{1}{2}(0) - 3 = -3$
2	$y = \frac{1}{2}(2) - 3 = -2$
4	$y = \frac{1}{2}(4) - 3 = -1$



The range consists of the y-values from the table: -5, -4, -3, -2, and -1.

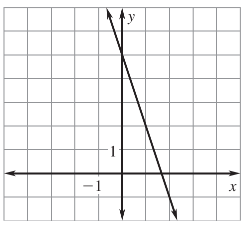
11. $y - x = 3 \rightarrow y = x + 3$

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



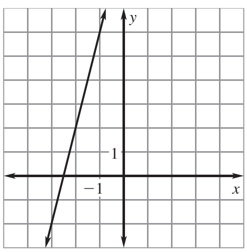
12. $y + 3x = 5 \rightarrow y = -3x + 5$

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



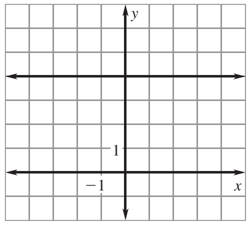
13. $y - 4x = 10 \rightarrow y = 4x + 1$

x	-4	-3	-2	-1	0
y	-6	-2	2	6	10



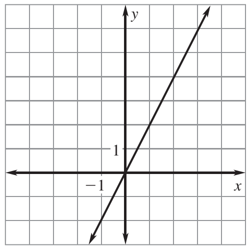
14. $y = 4$

For ever value of x, the value of y is 4.



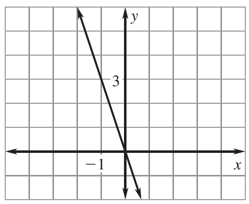
15. $2x - y = 0 \rightarrow y = 2x$

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



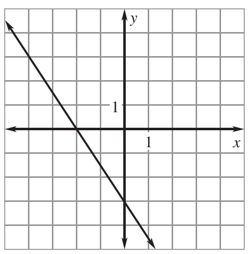
16. $3x + y = 0 \rightarrow y = -3x$

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



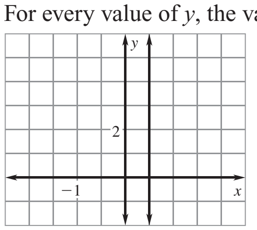
17. $3x + 2y = -6 \rightarrow y = -\frac{3}{2}x - 3$

x	-4	-3	-2	-1	0
y	3	1.5	0	-1.5	-3



18. $x = 0.5$

For every value of y, the value of x is 0.5.



19. $2x - y = 12$

x-intercept: $2x - (0) = 12$

$2x = 12$

$x = 6$

y-intercept: $2(0) - y = 12$

$y = 12$

$y = -12$

The x-intercept is 6. The y-intercept is -12.

20. $-5x - 2y = 20$

x-intercept: $-5x - 2(0) = 20$

$-5x = 20$

$x = -4$

y-intercept: $-5(0) - 2y = 20$

$-2y = 20$

$y = -10$

The x-intercept is -4. The y-intercept is -10.

21. $-4x + 1.5y = 4$

x-intercept: $-4x + 1.5(0) = 4$

$-4x = 4$

$x = -1$

y-intercepts: $-4(0) + 1.5y = 4$

$1.5y = 4$

$y \approx 2.67$

The x-intercept is -1. The y-intercept is about 2.67.

22. $y = \frac{3}{4}x - 15$

x-intercept: $0 = \frac{3}{4}x - 15$

$15 = \frac{3}{4}x$

$20 = x$

y-intercept: $y = \frac{3}{4}(0) - 15$

$y = -15$

The x-intercept is 20. The y-intercept is -15.

23. $y = 3x - 6$

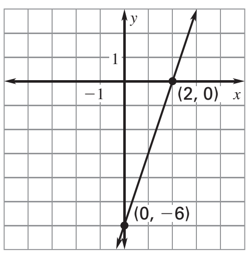
x-intercept: $0 = 3x - 6$

$6 = 3x$

$2 = x$

y-intercept: $y = 3(0) - 6$

$y = -6$



24. $4x + 5y = -20$

x-intercept: $4x + 5(0) = -20$

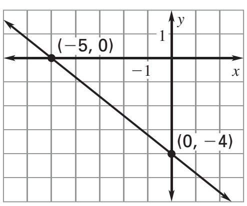
$4x = -20$

$x = -5$

y-intercept: $4(0) + 5y = -20$

$5y = -20$

$y = -4$



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

x-intercept: $\frac{2}{3}x + \frac{1}{2}(0) = 10$

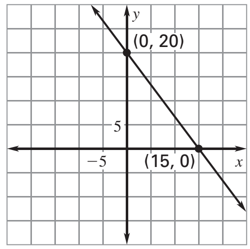
$\frac{2}{3}x = 10$

$x = 15$

y-intercept: $\frac{2}{3}(0) + \frac{1}{2}y = 10$

$\frac{1}{2}y = 10$

$y = 20$



26. $0.3x - y = 6$

x-intercept: $0.3x - 0 = 6$

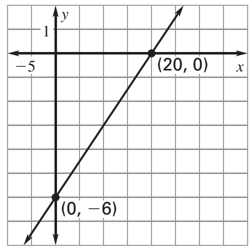
$0.3x = 6$

$x = 20$

y-intercept: $0.3(0) - y = 6$

$-y = 6$

$y = -6$



27. Let $(x_1, y_1) = (4, 2)$ and $(x_2, y_2) = (6, 8)$.

$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{8 - 2}{6 - 4} = \frac{6}{2} = 3$

The slope of the line is 3.

28. Let $(x_1, y_2) = (-3, 0)$ and $(x_2, y_2) = (2, -5)$.

$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-5 - 0}{2 - (-3)} = \frac{-5}{5} = -1$

The slope of the line is -1.

29. Let $(x_1, y_1) = (-5, 3)$ and $(x_2, y_2) = (-8, 10)$.

$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{10 - 3}{-8 - (-5)} = \frac{7}{-8 + 5} = -\frac{7}{3}$

The slope of the line is $-\frac{7}{3}$.

30. Let $(x_1, y_1) = (9, 4)$ and $(x_2, y_2) = (0,1)$.

$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{1 - 4}{0 - 9} = \frac{-3}{-9} = \frac{1}{3}$

The slope of the line is $\frac{1}{3}$.

31. Let $(x_1, y_1) = (-2, 5)$ and $(x_2, y_2) = (-2, 10)$.

$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{10 - 5}{-2 - (-2)} = \frac{-5}{0}$

Division by zero is undefined, so there is no slope.

32. Let $(x_1, y_1) = (6, -4)$ and $(x_2, y_2) = (4, -4)$.

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

33. $y = 7x + 8$

The slope of the line is 7, and the y-intercept is 8.

34. $y = 10x - 6$

The slope of the line is 10, and the y-intercept is -6.

35. $y = 3 - 4x$

The slope of the line is -4 and the y-intercept is 3.

36. $y = x$

The slope of the line is 1, and the y-intercept is 0.

37. $2x + y = 8 \rightarrow y = -2x + 8$

The slope of the line is -2 and the y-intercept is 8.

38. $10x - y = 20 \rightarrow y = 10x - 20$

The slope of the line is 10 and the y-intercept is -20.

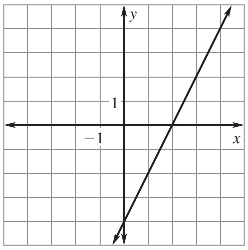
39. $5x + 2y = 10 \rightarrow y = -\frac{5}{2}x + 5$

The slope of the line is $-\frac{5}{2}$ and the y-intercept is 5.

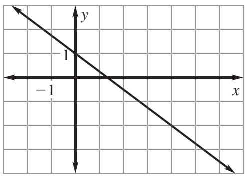
40. $-2x - y = 3 \rightarrow y = -2x - 3$

The slope of the line is -2 and the y-intercept is -3.

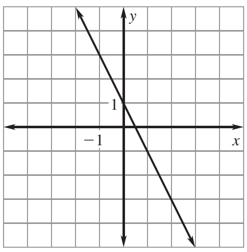
41. $y = 2x - 4$



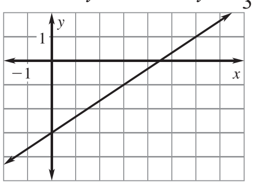
42. $y = -\frac{3}{4}x + 1$



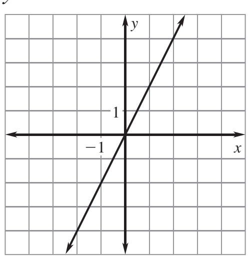
43. $2x + y = 1 \rightarrow y = -2x + 1$



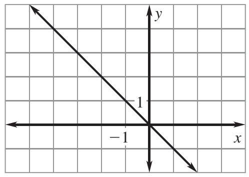
44. $-2x + 3y = -9 \rightarrow y = \frac{2}{3}x - 3$



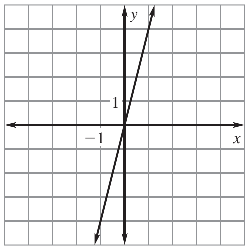
45. $y = 2x$



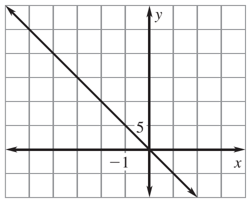
46. $y = -x$



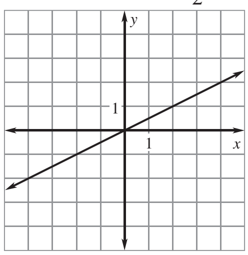
47. $y = 4x$



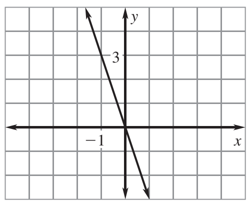
48. $5x + y = 0 \rightarrow y = -5x$



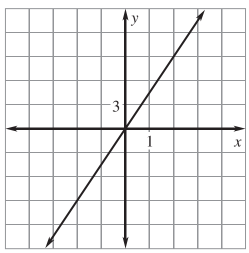
49. $x - 2y = 0 \rightarrow y = \frac{1}{2}x$



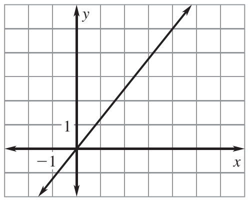
50. $3x + y = 0 \rightarrow y = -3x$



51. $2y = 9x \rightarrow y = \frac{9}{2}x$



52. $y - \frac{5}{4}x = 0 \rightarrow y = \frac{5}{4}x$



53. $f(x) = -7x - 3$

When $f(x) = -17$:

$-17 = -7x - 3$

$-14 = -7x$

$2 = x$

When $x = 2$, $f(x) = -17$.

54. $g(x) = 5x - 4$

When $g(x) = 12$:

$12 = 5x - 4$

$16 = 5x$

$\frac{16}{5} = x$

When $x = \frac{16}{5}$, $g(x) = 12$.

55. $t(x) = 3x + 1$

When $t(x) = -11$:

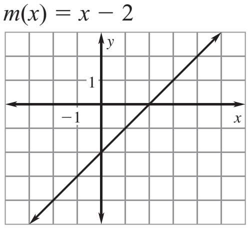
$-11 = 3x + 1$

$-12 = 3x$

$-4 = x$

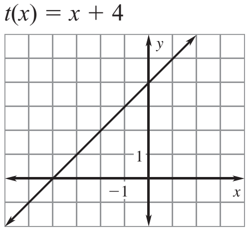
When $x = -4$, $t(x) = -11$.

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



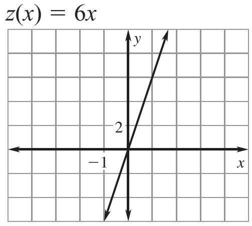
Because the graphs of m and f have the same slope, $m = 1$, the lines are parallel. The y-intercept of m is 2 less than the y-intercept of f.

57. $t(x) = x + 4$



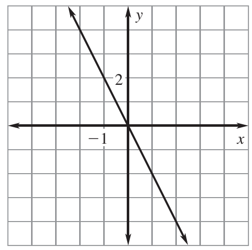
The graph is a vertical translation 2 units down of $f(x) = x$.

58. $z(x) = 6x$



The graph is a vertical translation 4 units up of $f(x) = x$.

59. $h(x) = -2x$



The graph is a vertical stretch by a factor of 6 of $f(x) = x$.