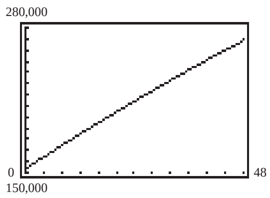
79. (a) *Keystrokes:*

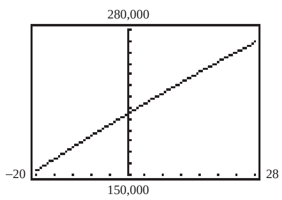
[Y=] [(−)] 5.46 [X,T,θ] [x^2] [+] 2665.56 [X,T,θ] [+] 153,363 [GRAPH]



(b) $t = 0$ corresponds to the year 1970 (20 years later).

(c) *Keystrokes:*

[Y=] [(−)] 5.46 [(] [X,T,θ] [+] 20 [)] [x^2] [+] 2665.56 [(] [X,T,θ] [+] 20 [)] [+] 153,363 [GRAPH]



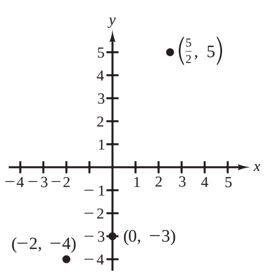
81. If the domain of the function $f(x) = 2x$ changes from $[0, 2]$ to $[0, 4]$, then the range changed from $[0, 4]$ to $[0, 8]$.

83. The four types of shifts of the graph of a function are vertical shift upward, vertical shift downward, horizontal shift to the left, horizontal shift to the right.

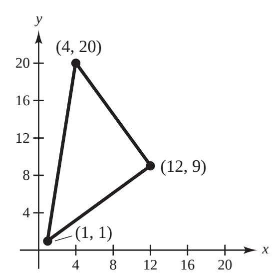
85. $g(x) = f(-x)$ is a reflection in the y-axis of the graph of $f(x)$.

Review Exercises for Chapter 2

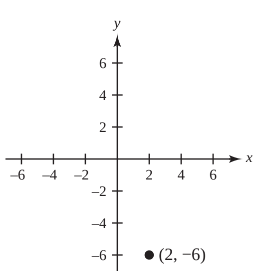
1.



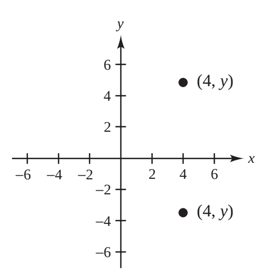
3.



5. Quadrant IV



7. Quadrant I, IV



9. (a) $(4, 2)$ $2 \stackrel{?}{=} 4 - \frac{1}{2}(4)$

$2 \stackrel{?}{=} 4 - 2$

$2 = 2$ yes

(b) $(-1, 5)$ $5 \stackrel{?}{=} 4 - \frac{1}{2}(-1)$

$5 \stackrel{?}{=} 4 + \frac{1}{2}$

$5 \neq 4\frac{1}{2}$ no

(c) $(-4, 0)$ $0 \stackrel{?}{=} 4 - \frac{1}{2}(-4)$

$0 \stackrel{?}{=} 4 + 2$

$0 \neq 6$ no

(d) $(8, 0)$ $0 \stackrel{?}{=} 4 - \frac{1}{2}(8)$

$0 \stackrel{?}{=} 4 - 4$

$0 = 0$ yes

11. $d = \sqrt{(4-4)^2 + (3-8)^2}$

$= \sqrt{0 + 25}$

$= \sqrt{25}$

$= 5$

13. $d = \sqrt{(-5-1)^2 + (-1-2)^2}$

$= \sqrt{36 + 9}$

$= \sqrt{45}$

$= 3\sqrt{5}$

15. $y = 5 - \frac{3}{2}x$ matches graph (c).

17. $y = |x| + 4$ matched graph (a).

19. $y = 6 - \frac{1}{3}x$

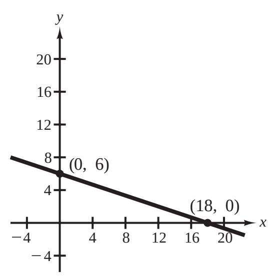
$y = 6 - \frac{1}{3}(0)$

$y = 6$ $(0, 6)$

$0 = 6 - \frac{1}{3}x$

$\frac{1}{3}x = 6$

$x = 18$ $(18, 0)$



21. $3y - 2x - 3 = 0$

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

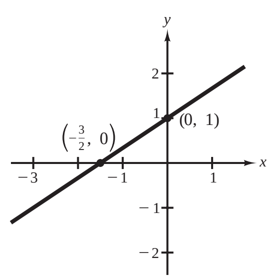
$3y = 3$

$y = 1$ $(0, 1)$

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

$-2x = 3$

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



23. $y = x^2 - 1$

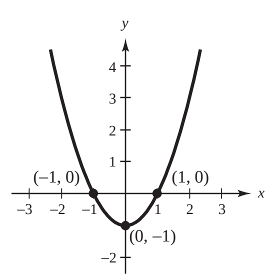
$y = 0^2 - 1$

$= -1$ $(0, -1)$

$0 = x^2 - 1$

$0 = (x-1)(x+1)$

$x = 1$ $x = -1$ $(1, 0), (-1, 0)$



25. $y = |x| - 2$

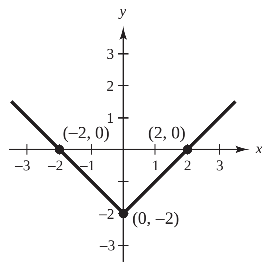
$y = |0| - 2$

$= -2$

$0 = |x| - 2$

$2 = |x|$

$\pm 2 = x \qquad (2, 0), (-2, 0)$



27. $y = 4x - 6$

y-intercept

$y = 4(0) - 6$

$= -6 \qquad (0, -6)$

x-intercept

$0 = 4x - 6$

$6 = 4x$

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

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

29. $7x - 2y = -14$

y-intercept

$7(0) - 2y = -14$

$-2y = -14$

$y = 7 \qquad (0, 7)$

x-intercept

$7x - 2(0) = -14$

$7x = -14$

$x = -2 \qquad (-2, 0)$

31. $y = |x - 5|$

y-intercept

$y = |0 - 5|$

$= 5 \qquad (0, 5)$

x-intercept

$0 = |x - 5|$

$0 = x - 5$

$5 = x \qquad (5, 0)$

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

y-intercept

$y = |2(0) + 1| - 5$

$= -5$

$= -4 \qquad (0, -4)$

x-intercepts

$0 = |2x + 1| - 5$

$5 = |2x + 1|$

$5 = 2x + 1 \qquad \text{or} \qquad -5 = 2x + 1$

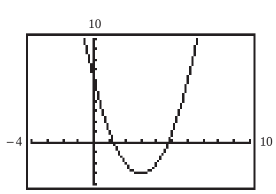
$4 = 2x \qquad\qquad -6 = 2x$

$2 = x \qquad\qquad -3 = x$

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

35. *Keystrokes:*

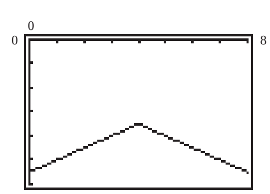
[Y=] [(] [X,T,θ] [−] 3 [)] [x^2] [−] 3 [GRAPH]



(1.27, 0), (4.73, 0), (0, 6)

37. *Keystrokes:*

[Y=] [(−)] [ABS] [(] [X,T,θ] [−] 4 [)] [−] 7 [GRAPH]

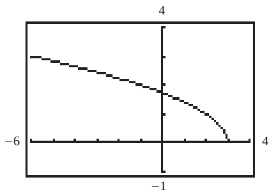


(0, −11)

no *x*-intercepts

39. *Keystrokes:*

Y= √ (3 − X,T,θ) GRAPH



(3, 0), (0, 1.73)

41. $m = \dfrac{3 - 1}{6 - (-1)} = \dfrac{2}{7}$

43. $m = \dfrac{3 - 3}{4 - (-1)} = \dfrac{0}{5} = 0$

45. $m = \dfrac{0 - 6}{8 - 0} = \dfrac{-6}{8} = \dfrac{-3}{4} = -\dfrac{3}{4}$

47. $m = \dfrac{3 - (-3)}{1 - (-3)} = \dfrac{6}{4} = \dfrac{3}{2}$

$$\frac{3}{2} = \frac{3 - t}{1 - 0}$$

$$3 = 6 - 2t$$

$$-3 = -2t$$

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

49. $-3 = \dfrac{y + 4}{x - 2}$

(0, 2), (1, −1)

51. $\dfrac{5}{4} = \dfrac{y - 1}{x - 3}$

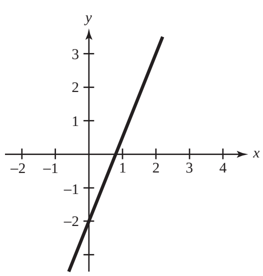
(7, 6), (11, 11)

53. Since m is undefined the line is a vertical line so points such as (3, 0), (3, 1), and (3, −2) are on this line.

55. $5x - 2y - 4 = 0$

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

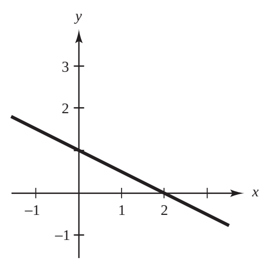
$$y = \tfrac{5}{2}x - 2$$



57. $x + 2y - 2 = 0$

$$2y = -x + 2$$

$$y = -\tfrac{1}{2}x + 1$$



59. $L_1: y = \frac{3}{2}x + 1$

$L_2: y = \frac{2}{3}x - 1$

$m_1 = \frac{3}{2}, m_2 = \frac{2}{3}$

$m_1 \neq m_2, m_1 \cdot m_2 \neq -1$

So lines are neither

61. $L_1: y = \frac{3}{2}x - 2$

$L_2: y = -\frac{2}{3}x + 1$

$m_1 = \frac{3}{2}, m_2 = -\frac{2}{3}$

$m_1 \cdot m_2 = -1$

So lines are perpendicular

63. $L_1: 2x - 3y - 5 = 0$

$L_2: x + 2y - 6 = 0$

$L_1: -3y = -2x + 5$

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

$m_1 = \frac{2}{3}$

$L_2: 2y = -x + 6$

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

$m_2 = -\frac{1}{2}$

$m_1 \neq m_2, m_1 \cdot m_2 \neq -1$

So lines are neither

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

$y + 4 = 2x - 2$

$2x - y - 6 = 0$

67. $y - 4 = -4(x + 1)$

$y - 4 = -4x - 4$

$4x + y = 0$

69. $y - 4 = -\frac{2}{3}\left(x - \frac{5}{2}\right)$

$y - 4 = -\frac{2}{3}x + \frac{5}{3}$

$3y - 12 = -2x + 5$

$2x + 3y - 17 = 0$

71. $y - 5 = 0[x - (-6)]$

$y - 5 = 0$

73. $m = \dfrac{0 + 3}{-6 - 0} = \dfrac{3}{-6} = -\dfrac{1}{2}$

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

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

$2y = -x - 6$

$x + 2y + 6 = 0$

75. $m = \dfrac{6 - (-3)}{4 - (-2)} = \dfrac{6 + 3}{4 + 2} = \dfrac{9}{6} = \dfrac{3}{2}$

$y - 6 = \dfrac{3}{2}(x - 4)$

$y - 6 = \dfrac{3}{2}x - 6$

$2(y - 6) = 2\left(\dfrac{3}{2}x - 6\right)$

$2y - 12 = 3x - 12$

$3x - 2y = 0$

77. $m = \dfrac{\dfrac{7}{6} - \dfrac{1}{6}}{4 - \dfrac{4}{3}} \cdot \dfrac{6}{6} = \dfrac{7 - 1}{24 - 8} = \dfrac{6}{16} = \dfrac{3}{8}$

$y - \dfrac{7}{6} = \dfrac{3}{8}(x - 4)$

$y - \dfrac{7}{6} = \dfrac{3}{8}x - \dfrac{12}{8}$

$48y - 56 = 18x - 72$

$18x - 48y - 16 = 0$

$9x - 24y - 8 = 0$

79. $3x + y = 2$

$y = -3x + 2$

(a) $y + \dfrac{4}{5} = -3\left(x - \dfrac{3}{5}\right)$ or $3x + y - 1 = 0$

(b) $y + \dfrac{4}{5} = \dfrac{1}{3}\left(x - \dfrac{3}{5}\right)$ or $x - 3y - 3 = 0$

81. $5x = 3$

$x = \frac{3}{5}$ $m =$ undefined

(a) $x = 12$ or $x - 12 = 0$

(b) $y = 1$ or $y - 1 = 0$

83. No, this relation is not a function because the 8 in the domain is paired to two numbers (1 and 2) in the range.

85. Yes, this relation is a function because each number in the domain is paired to only one number in the range.

87. $f(x) = 4 - \frac{5}{2}x$

(a) $f(-10) = 4 - \frac{5}{2}(-10) = 4 + 25 = 29$

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

(c) $f(t) + f(-4) = \left(4 - \frac{5}{2}t\right) + \left[4 - \frac{5}{2}(-4)\right] = 4 - \frac{5}{2}t + 4 + 10 = 18 - \frac{5}{2}t$

(d) $f(x + h) = 4 - \frac{5}{2}(x + h) = 4 - \frac{5}{2}x - \frac{5}{2}h$

89. $f(t) = \sqrt{5 - t}$

(a) $f(-4) = \sqrt{5 - (-4)} = \sqrt{9} = 3$

(b) $f(5) = \sqrt{5 - 5} = 0$

(c) $f(3) = \sqrt{5 - 3} = \sqrt{2}$

(d) $f(5z) = \sqrt{5 - 5z}$

91. $\begin{Bmatrix} -3x, & \text{if} & x \le 0 \\ 1 - x^2, & \text{if} & x > 0 \end{Bmatrix}$

(a) $f(2) = 1 - 2^2 = -3$

(b) $f\left(-\frac{2}{3}\right) = -3\left(-\frac{2}{3}\right) = 2$

(c) $f(1) = 1 - 1^2 = 0$

(d) $f(4) - f(3) = (1 - 4^2) - (1 - 3^2) = 1 - 16 - 1 + 9 = -7$

93. (a) $\dfrac{f(x + 2) - f(2)}{x} = \dfrac{[3 - 2(x + 2)] - [3 - 2(2)]}{x} = \dfrac{3 - 2x - 4 - 3 + 4}{x} = \dfrac{-2x}{x} = -2$

(b) $\dfrac{f(x - 3) - f(3)}{x} = \dfrac{[3 - 2(x - 3)] - [3 - 2(3)]}{x} = \dfrac{3 - 2x + 6 - 3 + 6}{x} = \dfrac{-2x + 12}{x}$

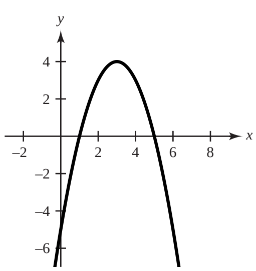
95. Find the domain of $h(x) = 4x^2 - 7$.

Domain: $-\infty < x < \infty$ or $(-\infty, \infty)$

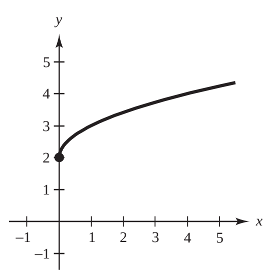
97. Find the domain of $f(x) = \sqrt{5 - 2x}$.

Domain: $\left(-\infty. \frac{5}{2}\right]$ or $-\infty < x \le \frac{5}{2}$

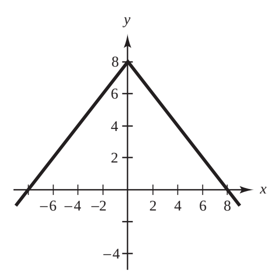
99.



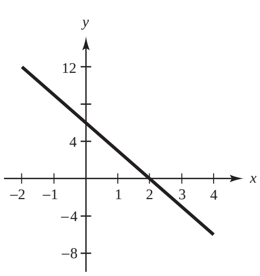
101.



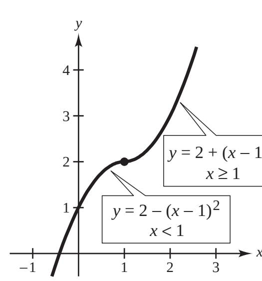
103.



105.



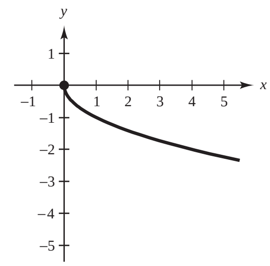
107.



109. No, y is not a function of x.

111. Yes, y is a function of x.

113. $h(x) = -\sqrt{x}$ is a reflection in the x-axis of $f(x) = \sqrt{x}$



115. $h(x) = \sqrt{x - 1}$ is a horizontal shift 1 unit to the right of $f(x) = \sqrt{x}$

117. $y = x^2 - 2$

Vertical shift 2 units downward

119. $y = -(x + 3)^2$

Reflection in the x-axis and a horizontal shift 3 units to the left

121. *Verbal model:* $\boxed{\dfrac{\text{Rise}}{\text{Run}}} = \boxed{\dfrac{\text{Rise}}{\text{Run}}}$

Proportion: $\dfrac{1}{12} = \dfrac{3}{x}$

$x = 36$

Verbal model: $\boxed{\begin{matrix}\text{Leg}\\1\end{matrix}}^2 + \boxed{\begin{matrix}\text{Leg}\\2\end{matrix}}^2 = \boxed{\text{Hypotenuse}}^2$

Labels: Leg 1 $= 3$

Leg 2 $= 36$

Hypotenuse $= x$

Equation: $3^2 + 36^2 = x^2$

$9 + 1296 = x^2$

$\sqrt{1305} = x$

$3\sqrt{145} = x \approx 36.12$ feet

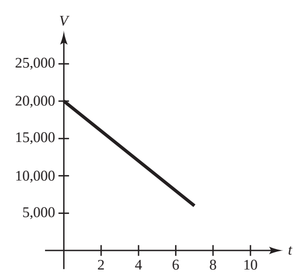
123. (0, \$20,000), (7, \$6000)

$$m = \frac{6,000 - 20,000}{7 - 0} = \frac{-14,000}{7} = -2,000$$

$$V - 20,000 = -2,000(t - 0)$$

$$V - 20,000 = -2,000t$$

$$V = -2,000t + 20,000,\ 0 \le t \le 7$$



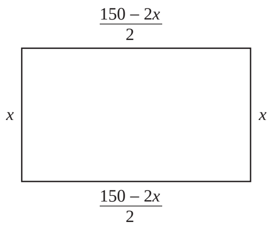
125. $m = \dfrac{-0.88 - 4.75}{4.75 - (-0.88)} = \dfrac{-5.63}{5.63} = -1$

$$y + 0.88 = -1(x - 4.75)$$

$$y = -x + 4.75 - 0.88$$

$$y = -x + 3.87$$

127.



Verbal model: [Perimeter] = 2[Length] + 2[Width]

$$150 = 2\text{Length} + 2x$$

$$\frac{150-2x}{2} = \text{Length}$$

$$75 - x = \text{Length}$$

Verbal model: [Area] = [Length] · [Width]

Labels: Area $= A(x)$

Length $= 75 - x$

Width $= x$

Function: $A(x) = (75 - x)x$

Domain: $0 < x < \frac{75}{2}$

129. (a) $v = -32(2) + 80$

$v = -64 + 80$

$v = 16$ feet per second

(b) $0 = -32t + 80$

$32t = 80$

$t = \frac{80}{32}$

$t = \frac{5}{2}$ seconds

(c) $v = -32(3) + 80$

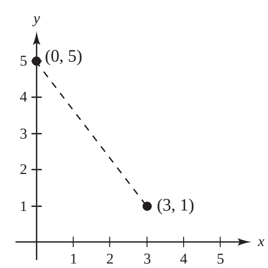
$v = -96 + 80$

$v = -16$ feet per second

Chapter Test for Chapter 2

1. (x, y) lies in Quadrant IV if $x > 0$ and $y < 0$.

2. $d = \sqrt{(0-3)^2 + (5-1)^2} = \sqrt{9+16} = \sqrt{25} = 5$



3. (a) $y = -3(0 + 1) = -3$ $(0, -3)$; y-intercept

(b) $0 = -3(x + 1)$

$x = -1,$ $(-1, 0)$; x-intercept

4.