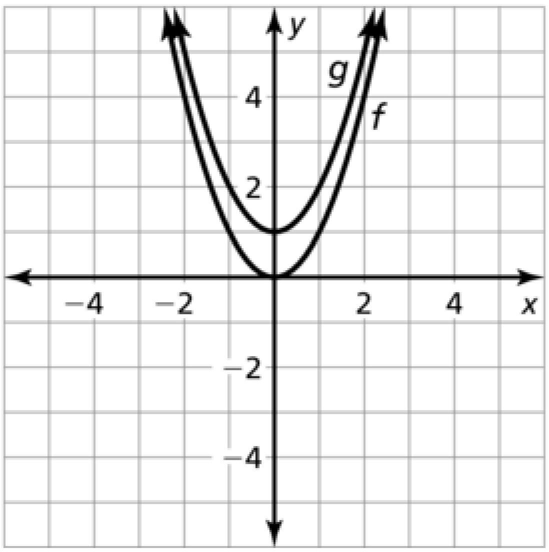
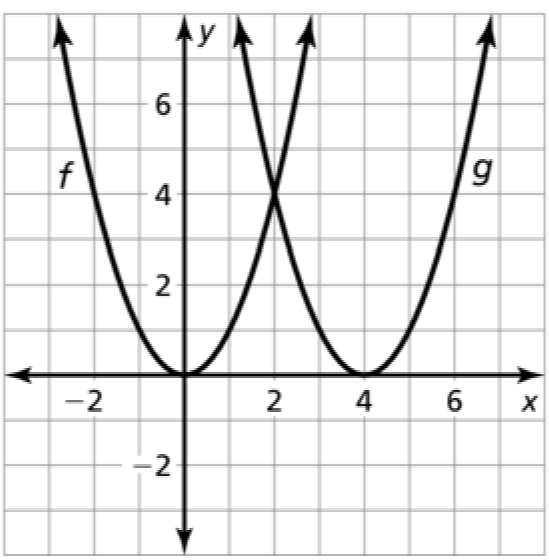
pp. 52-53 (#4-32 evens)

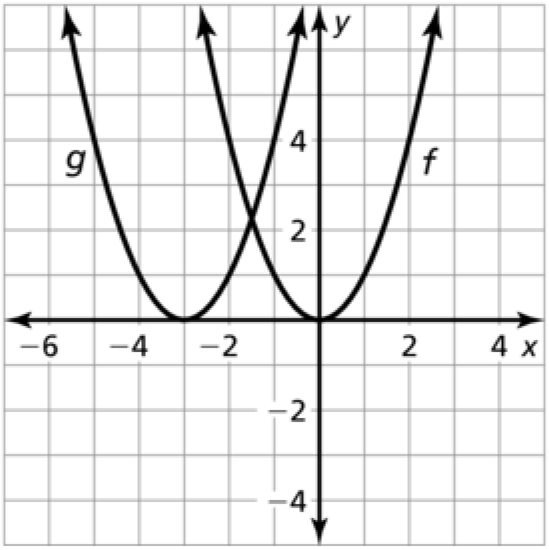
4. The graph of g is a translation 1 unit up of the graph of f.



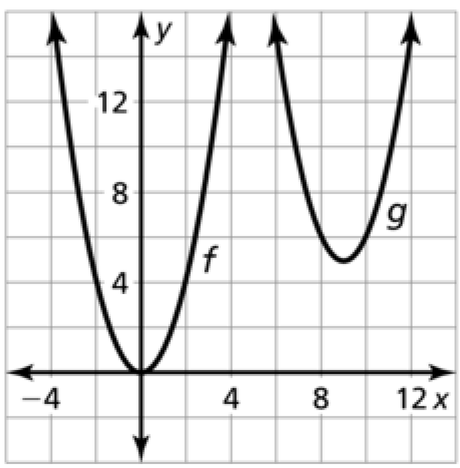
6. The graph of g is a translation 4 units right of the graph of f.



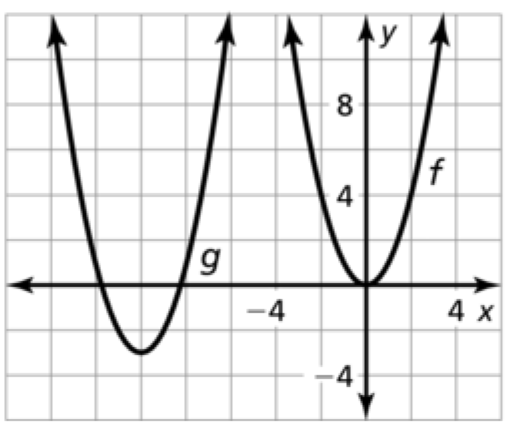
8. The graph of g is a translation 3 units left of the graph of f.



10. The graph of g is a translation 9 units right and 5 units up of the graph of f.



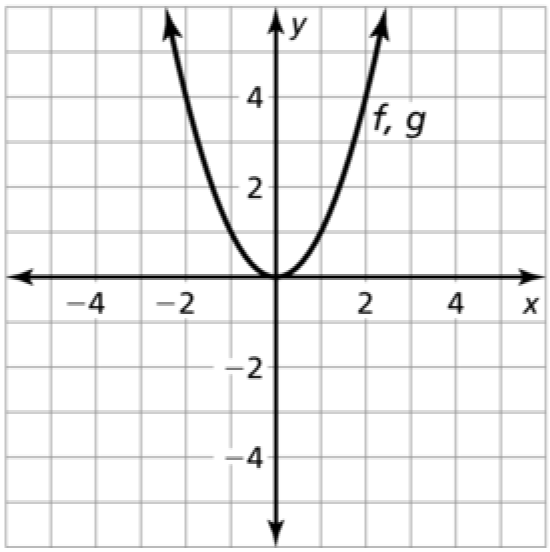
12. The graph of g is a translation 10 units left and 3 units down of the graph of f.



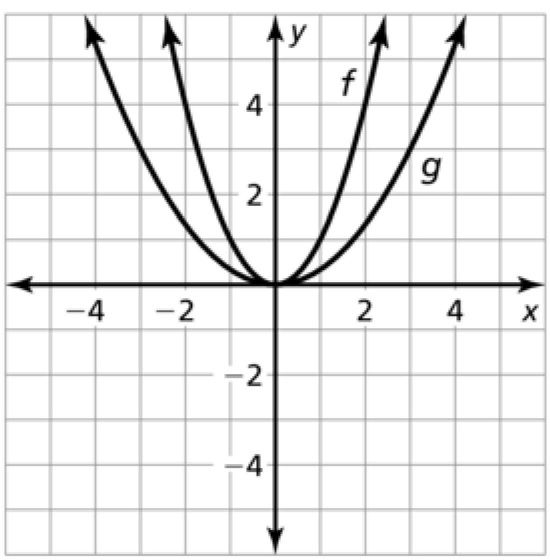
14. D; The graph has been translated 1 unit up.

16. B; The graph has been translated 1 unit left and 1 unit down.

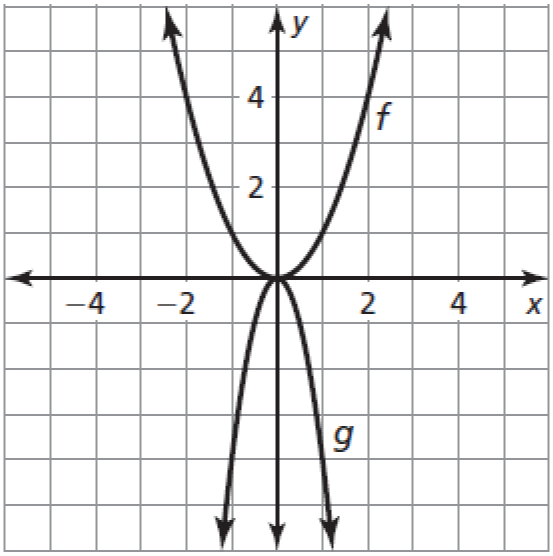
18. The graph of g is a reflection in the y-axis of the graph of f.



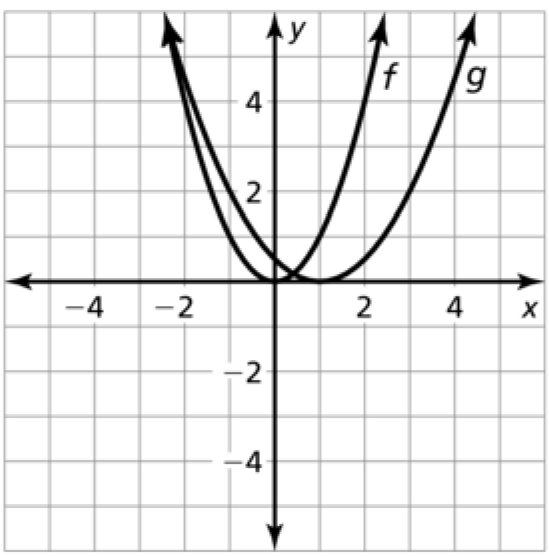
20. The graph of g is a vertical shrink by a factor of $\frac{1}{3}$ of the graph of f.



22. The graph of g is a horizontal shrink by a factor of $\frac{1}{2}$ followed by a reflection in the x-axis of the graph of f.



24. The graph of g is a vertical shrink by a factor of $\frac{1}{2}$ followed by a translation 1 unit right.



26. The order of the transformations is not correct and the graph is a translation 4 units up, not down; The graph is a vertical stretch by a factor of 6 and a reflection in the x-axis, followed by a translation 4 units up of the graph of the parent quadratic function.

28. The graph of f is a vertical stretch by a factor of 4 followed by a reflection in the x-axis and a translation 1 unit left and 5 units down of the graph of the parent quadratic function; $(-1, -5)$

30. The graph of f is a vertical shrink by a factor of $\frac{1}{2}$ followed by a translation 1 unit right of the graph of the parent quadratic function; (1, 0)

32. $g(x) = \frac{1}{3}(x - 3)^2$; (3, 0)

pp. 53-54 (#33-52)

33. $g(x) = 8\left(\frac{1}{2}x\right)^2 - 4$; $(0, -4)$

34. $g(x) = -(2x + 6)^2 - 2$; $(-3, -2)$

35. C; The graph is a vertical stretch by a factor of 2 followed by a translation 1 unit right and 2 units down of the parent quadratic function.

36. B; The graph is a vertical shrink by a factor of $\frac{1}{2}$ followed by a translation 1 unit left and 2 units down of the parent quadratic function.

37. D; The graph is a vertical stretch by a factor of 2 and a reflection in the x-axis, followed by a translation 1 unit right and 2 units up of the parent quadratic function.

38. E; The graph is vertical stretch by a factor of 2 followed by a translation 1 unit left and 2 units up of the parent quadratic function.

39. F; The graph is a vertical stretch by a factor of 2 and a reflection in the x-axis followed by a translation 1 unit left and 2 units down of the parent quadratic function.

40. A; The graph is a vertical stretch by a factor of 2 followed by a translation 1 unit right and 2 units up of the parent quadratic function.

41. Subtract 6 from the output; Substitute $2x^2 + 6x$ for $f(x)$; Multiply the output by -1; Substitute $2x^2 + 6x - 6$ for $h(x)$; Simplify.

42. Multiply the input by -1; Replace x with $-x$ in $f(x)$; Simplify; Subtract 4 from the input; Replace x with $x - 4$ in $f(x)$; Simplify.

43. $h(x) = -0.03(x - 14)^2 + 10.99$

44. The graph of g is a horizontal stretch by a factor of $\sqrt{6}$ of the graph of f; about 1.67 ft

45. **a.** $y = \frac{-5}{1089}(x - 33)^2 + 5$

b. The domain is $0 \le x \le 66$ and the range is $0 \le y \le 5$; The domain represents the horizontal distance and the range represents the height of the fish.

c. yes; The value changes to $-\frac{1}{225}$; The vertex has changed but it still goes through the point (0, 0), so there has been a horizontal stretch or shrink which changes the value of *a*.

46. The graph of *g* is a translation 4 units left and 2 units down of the graph of *f*.

47. **a.** $a = 2$, $h = 1$, $k = 6$; $g(x) = 2(x - 1)^2 + 6$

b. $g(x) = 2f(x - 1) + 6$; For each function, *a*, *h*, and *k* are the same but the second function does not indicate the type of function that is being translated.

c. $a = 2$, $h = 1$, $k = 3$; $g(x) = 2(x - 1)^2 + 3$; $g(x) = 2f(x - 1) + 3$; For each function, *a*, *h*, and *k* are the same, but the answer in part (b) does not indicate the type of function that is being translated.

d. *Sample answer:* vertex form; Writing a transformed function using function notation requires an extra step of substituting $f(x)$ into the newly transformed function.

48. *Sample answer:* $g(x) = f(2x) + 6 = -0.5(2x - 6)^2 + 24$; *You jump higher but not as far.*

49. a vertical shrink by a factor of $\frac{7}{16}$

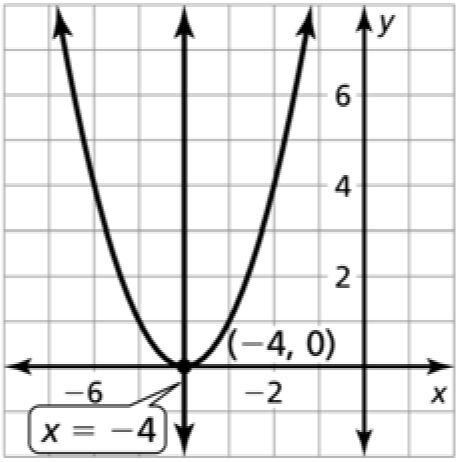
50. $(-4, -1)$

51. (4, 4)

52. $(-2, 2)$

pp. 61-62 (#4, 8, 12, 16, #18-36 evens, #37-38, #40-48 evens, #49-52)

4.



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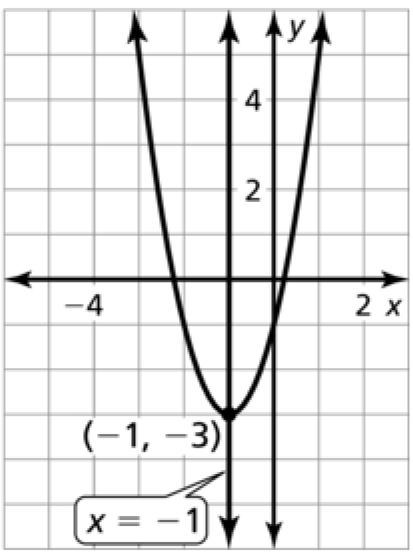

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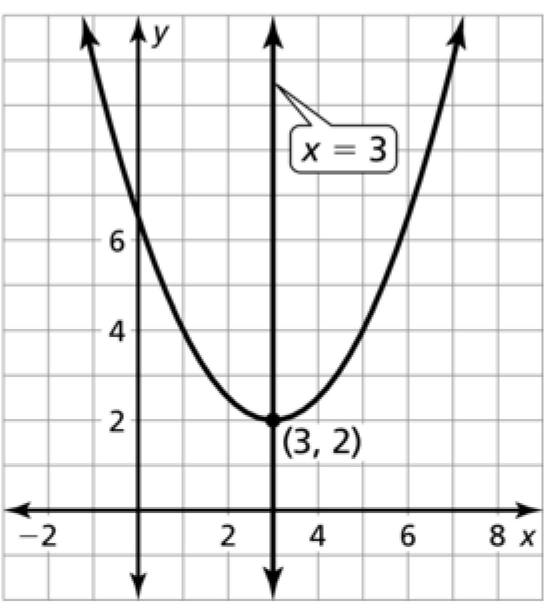
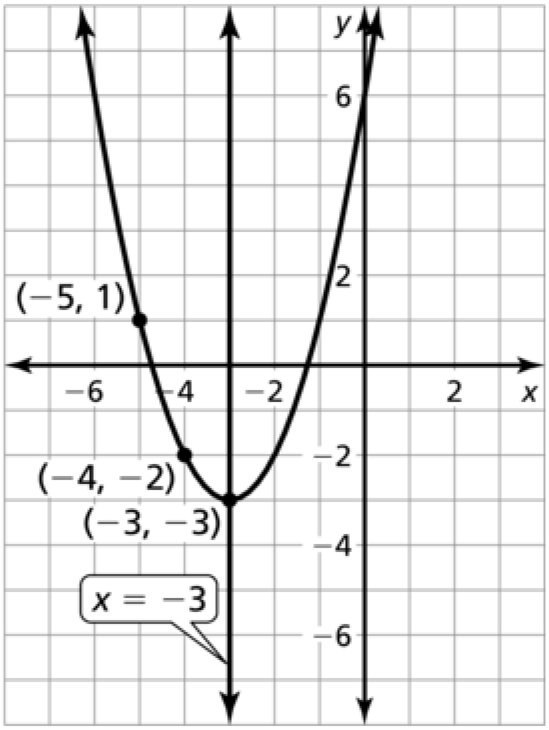


16. D

18. A

20.



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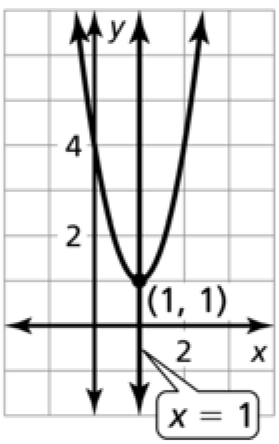

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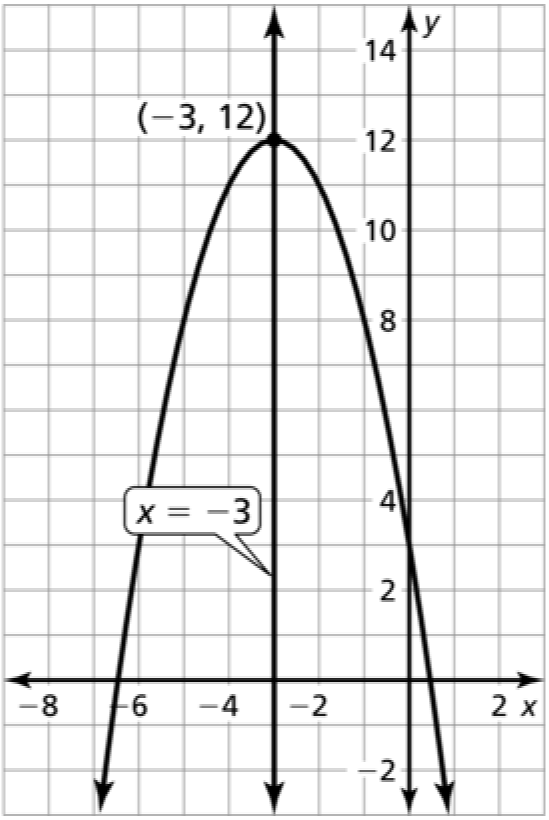

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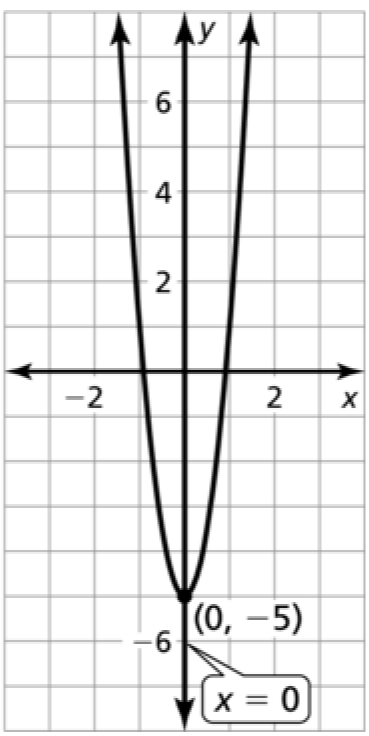

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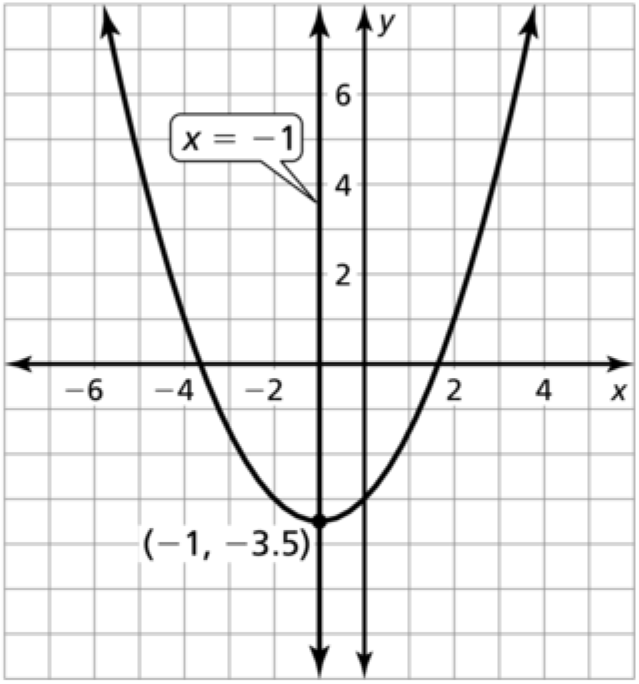

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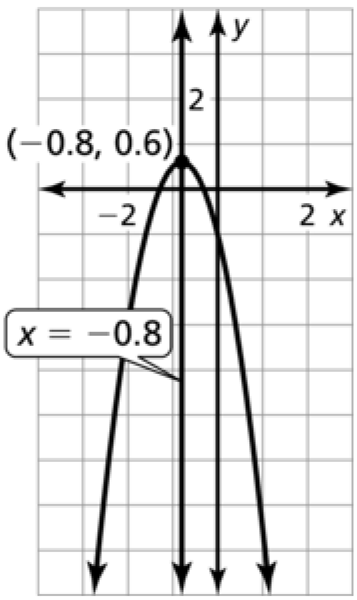


32. highest; If the graph is increasing until it reaches $x = 2$ and then decreasing after, then the vertex must be the highest point.

34. c is -7, not 7; The y-intercept of the graph is the value of c, which is -7.

36. (35, 18.25); When the shot put is at its highest point, it is 35 feet from its starting point and 18.25 feet off the ground.

37. B

38. C; In $y = a(x - h)^2 + k$, a represents a vertical stretch or shrink. When $0 < a < 1$, the graph will shrink creating a wider graph. Equation C is the only a such that $0 < a < 1$.

40. The minimum value is 7. The domain is all real numbers and the range is $y \geq 7$. The function is decreasing to the left of $x = 0$ and increasing to the right of $x = 0$.

42. The maximum value is 8. The domain is all real numbers and the range is $y \leq 8$. The function is increasing to the left of $x = -1$ and decreasing to the right of $x = -1$.

44. The minimum value is -32. The domain is all real numbers and the range is $y \geq -32$. The function is decreasing to the left of $x = -3$ and increasing to the right of $x = -3$.

46. The minimum value is -4. The domain is all real numbers and the range is $y \geq -4$. The function is decreasing to the left of $x = 2$ and increasing to the right of $x = 2$.

48. The minimum value is -2. The domain is all real numbers and the range is $y \geq -2$. The function is decreasing to the left of $x = -2$ and increasing to the right of $x = -2$.

49. **a.** 1 m

b. 3.25 m

c. The diver is ascending from 0 meters to 0.5 meter and descending from 0.5 meter until hitting the water after approximately 1.1 meters.

50. **a.** 3090 rev/min; 74.68 ft-lbs

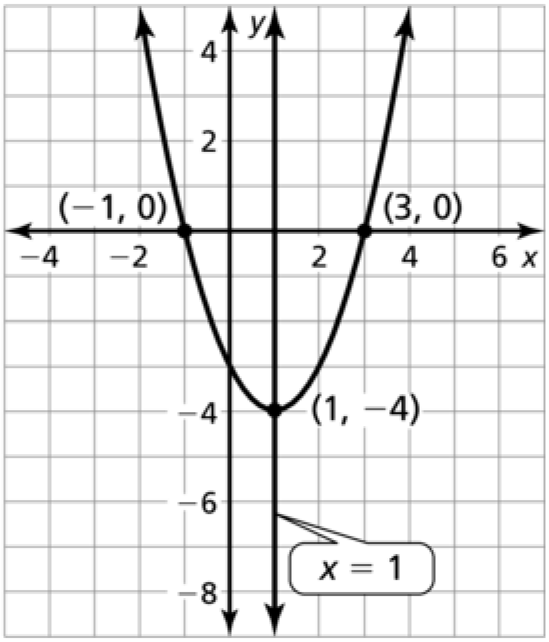
b. The engine torque increases as the speed increases until the engine speed reaches 3.09 thousands of revolutions per minutes then the torque begins to decrease.

51. $A = w(20 - w) = -w^2 + 20w$; The maximum area is 100 square units.

52. $A = \frac{1}{2}b(6 - b) = -\frac{1}{2}b^2 + 3b$; The maximum area is 4.5 square units.

pp. 63-64 (#54-64 evens, #65-82, skip #68)

54.



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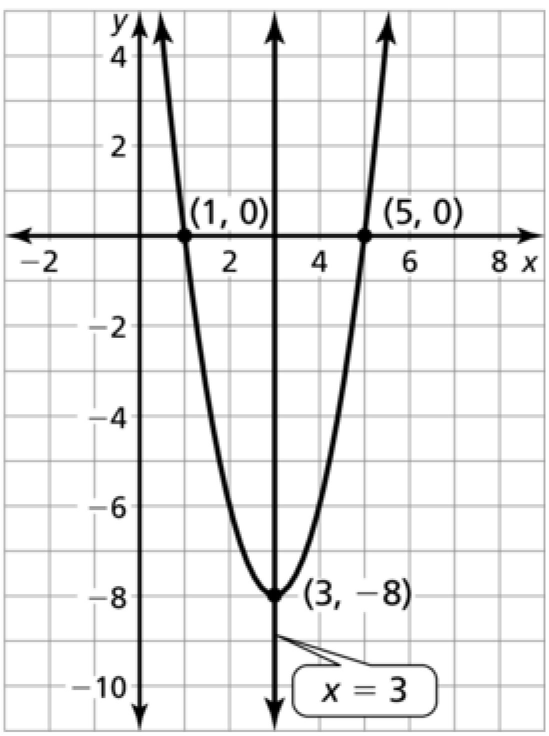

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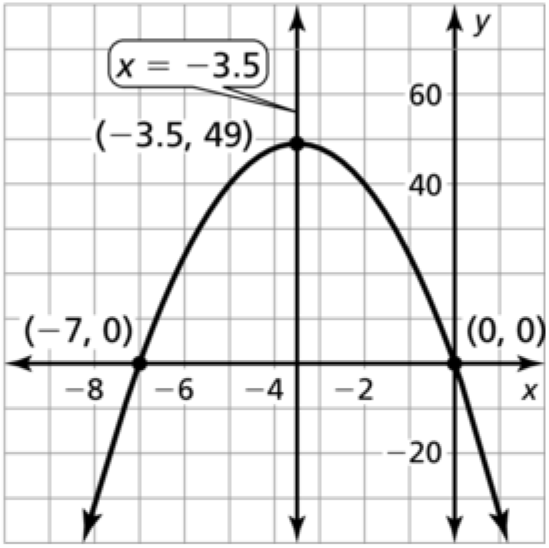
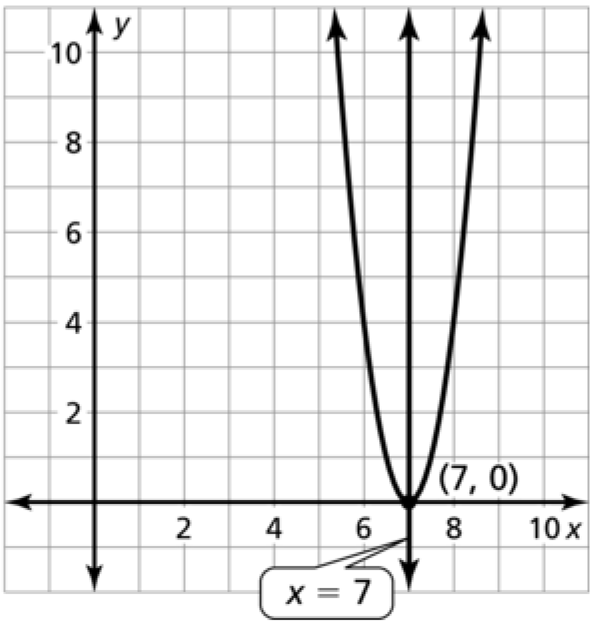


60.



62. $p = -1$, $q = 3$; The graph is decreasing to the left of $x = 1$ and increasing to the right of $x = 1$.

64. $p = -5$, $q = -1$; The graph is increasing to the left of $x = -3$ and decreasing to the right of $x = -3$.

65. the second kick; the first kick

66. 160 ft; about 1.5 ft

67. no; Either of the points could be the axis of symmetry, or neither of the points could be the axis of symmetry. You can only determine the axis of symmetry if the y-coordinates of the two points are the same, because the axis of symmetry would lie halfway between the two points.

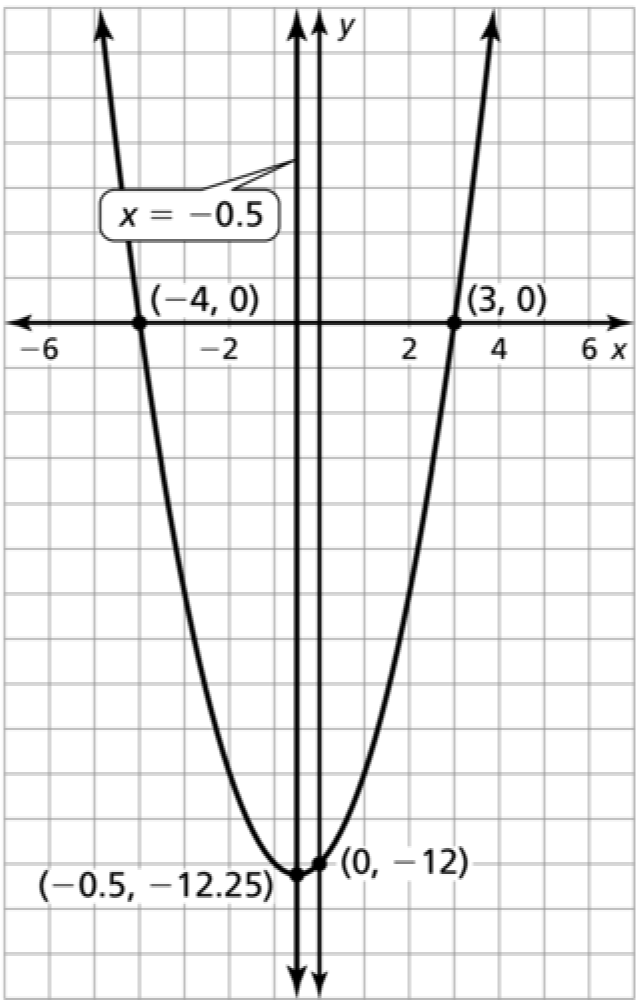
68. *Sample answer:* $y = 2(x - 2)(x - 4)$ and $y = 2(x + 1)(x - 7)$

69. \$1.75

70. \$300

71. All three graphs are the same; $f(x) = x^2 + 4x + 3$, $g(x) = x^2 + 4x + 3$

72. $f(x) = (x + 4)(x - 3)$

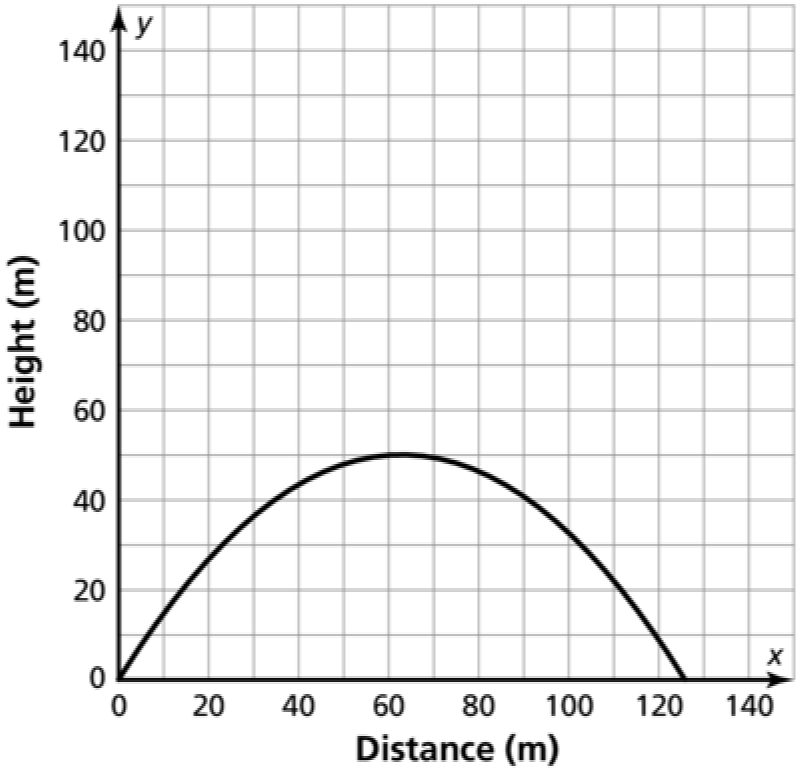


73. no; The vertex of the graph is (3.25, 2.1125), which means the mouse cannot jump over a fence that is higher than 2.1125 feet.

74. **a.** the minimum

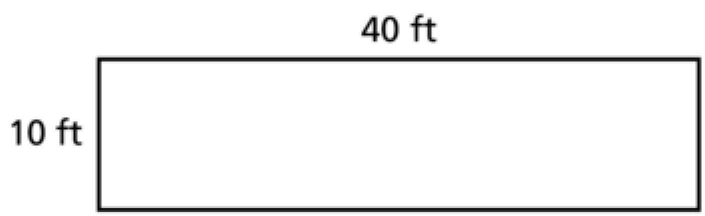
b. Instead of representing the minimum, $f\left(\frac{p + q}{2}\right)$ would represent the maximum.

75.



The domain is $0 \leq x \leq 126$ and the range is $0 \leq y \leq 50$; The domain represents the distance from the start of the bridge on one side of the river, and the range represents the height of the bridge.

76. *Sample answer:*



Of all possible designs, a square garden with sides of 25 feet will have the greatest area; A square has the largest area of all rectangles with the same perimeter.

77. no; The vertex must lie on the axis of symmetry, and (0, 5) does not lie on $x = -1$.

78. The y-intercept is apq.

79. **a.** about 14.1%; about 55.5 cm^3/g

b. about 13.6%; about 44.1 cm^3/g

c. The domain for hot-air popping is $5.52 \leq x \leq 22.6$, and the range is $0 \leq y \leq 55.5$. The domain for hot-oil popping is $5.35 \leq x \leq 21.8$, and the range is $0 \leq y \leq 44.1$. This means that the moisture content for the kernels can range from 5.52% to 22.6% and 5.35% to 21.8%, while the popping volume can range from 0 to 55.5 cubic centimeters per gram and 0 to 44.11 cubic centimeters per gram.

80. The x-coordinate of the vertex does not change, and the y-coordinate moves further from the x-axis; The x-coordinate of the vertex does not change, and the y-coordinate moves closer to the x-axis.

81. 4

82. 8

pp. 72-73 (#2-10 evens, #11-12, #14-36 evens)

2. Using the equation for directrix $y = -p$, the result is $p = -5$. Since the focus is $(0, p)$, the focus must be $(0, -5)$.

4. $y = -\frac{1}{16}x^2$

6. $y = -\frac{1}{28}x^2$

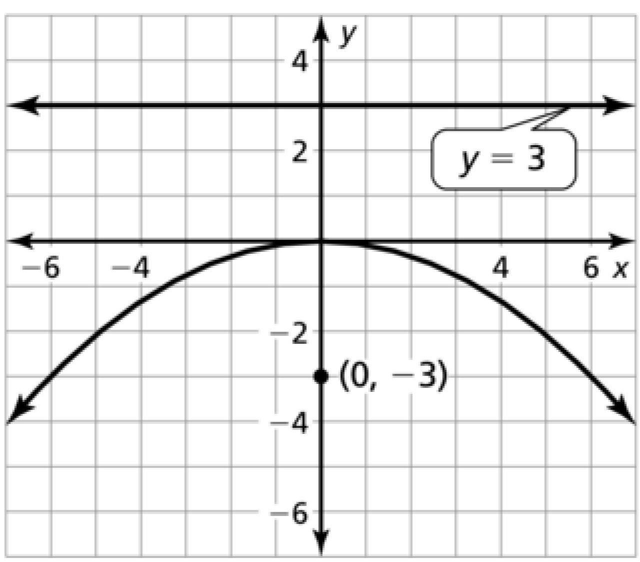
8. $y = \frac{1}{20}x^2$

10. $y = \frac{1}{36}x^2$

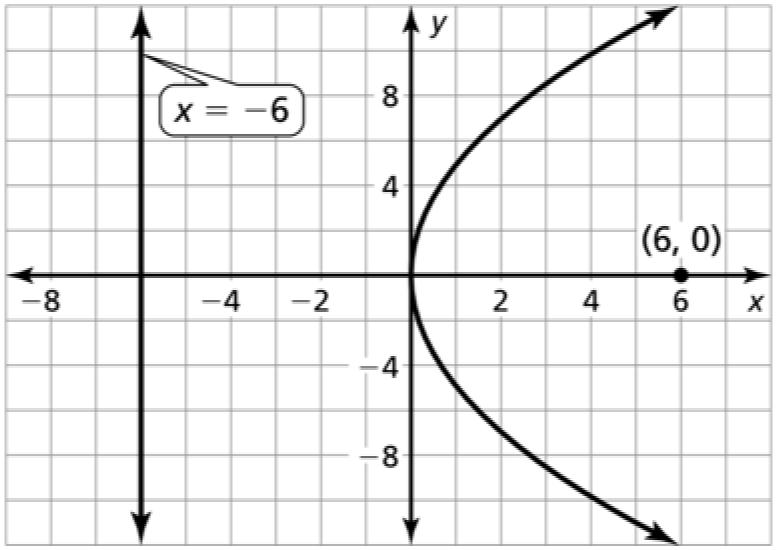
11. A, B and D; Each has a value for p that is negative. Substituting in a negative value for p in $y = \dfrac{1}{4p}x^2$ results in a parabola that has been reflected across the x-axis.

12. B, C and E; Use the focus to create the equation $y = -\frac{1}{36}x^2$. Points B, C and E are the fourth quadrant points that satisfy the equation.

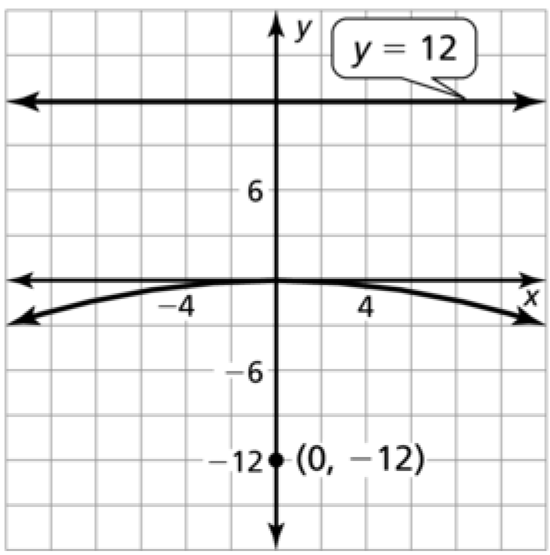
14. The focus is $(0, -3)$. The directrix is $y = 3$. The axis of symmetry is the y-axis.



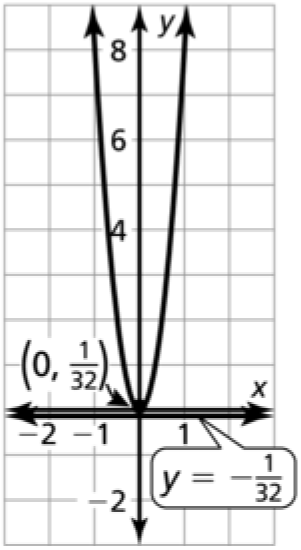
16. The focus is (6, 0). The directrix is $x = -6$. The axis of symmetry is the x-axis.



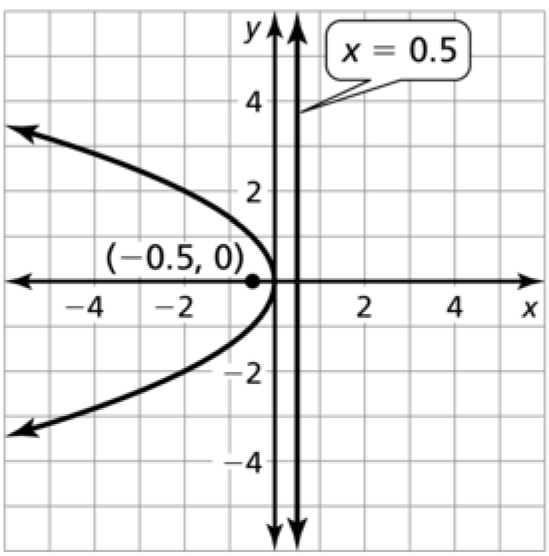
18. The focus is (0, −12). The directrix is $y = 12$. The axis of symmetry is the y-axis.



20. The focus is $\left(0, \frac{1}{32}\right)$. The directrix is $y = -\frac{1}{32}$. The axis of symmetry is the y-axis.



22. Because $p = -0.5$, the focus is $(-0.5, 0)$, and the directrix is $x = 0.5$.



24. 5 in.; The bulb should be placed at the focus. The distance from the vertex to the focus is $p = \frac{20}{4} = 5$ in.

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

28. $x = \frac{1}{8}y^2$

30. $x = \frac{3}{8}y^2$

32. $y = -\frac{3}{32}x^2$

34. $y = \frac{1}{5}x^2$

36. $x = -\frac{5}{16}y^2$

pp. 73-74 (#37-54)

37. $x = -\frac{1}{16}y^2 - 4$

38. $x = \frac{1}{8}(y - 1)^2 + 4$

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

40. $y = -\frac{1}{24}(x + 6)^2 - 4$

41. The vertex is $(3, 2)$. The focus is $(3, 4)$. The directrix is $y = 0$. The axis of symmetry is $x = 3$. The graph is a vertical shrink by a factor of $\frac{1}{2}$ followed by a translation 3 units right and 2 units up.

42. The vertex is $(-2, 1)$. The focus is $(-2, 0)$. The directrix is $y = 2$. The axis of symmetry is $x = -2$. The graph is a reflection in the x-axis and a translation 2 units left and 1 unit up.

43. The vertex is $(1, 3)$. The focus is $(5, 3)$. The directrix is $x = -3$. The axis of symmetry is $y = 3$. The graph is a horizontal shrink by a factor of $\frac{1}{4}$ followed by a translation 1 unit right and 3 units up.

44. The vertex is $(-3, -5)$. The focus is $(-3, -4.75)$. The directrix is $y = -5.25$. The axis of symmetry is $x = -3$. The graph is a vertical stretch by a factor of 4 followed by a translation 3 units left and 5 units down.

45. The vertex is $(2, -4)$. The focus is $\left(\frac{23}{12}, -4\right)$. The directrix is $x = \frac{25}{12}$. The axis of symmetry is $y = -4$. The graph is a horizontal stretch by a factor of 12 followed by a reflection in the y-axis and a translation 2 units right and 4 units down.

46. The vertex is $(-1, -5)$. The focus is $\left(-\frac{15}{16}, -5\right)$. The directrix is $x = -\frac{17}{16}$. The axis of symmetry is $y = -5$. The graph is a horizontal stretch by a factor of 16 followed by a translation 1 unit left and 5 units down.

47. $x = \frac{1}{5.2}y^2$; about 3.08 in.

48. $y = \frac{1}{6.8}x^2$; The domain is $-2.9 \leq x \leq 2.9$ and the range is $0 \leq y \leq 1.7$; The domain represents the width of the trough, and the range represents the height of the trough.

49. As $|p|$ increases, the graph gets wider; As $|p|$ increases, the constant in the function gets smaller which results in a vertical shrink, making the graph wider.

50. **a.** B is the vertex, C is the focus, and A is a point on the directrix.

b. The focus and directrix will both be shifted down 3 units.

51. $y = \frac{1}{4}x^2$

52. *Sample answer:* One equation is $y = \frac{1}{8}(x - a)^2 + (b - 2)$ with a directrix of $y = b - 4$. Another equation is $y = -\frac{1}{8}(x - a)^2 + (b + 2)$ with a directrix of $y = b + 4$.

53. $x = \frac{1}{4p}y^2$

54. 8

pp. 80-81 (#1-22)

1. A quadratic model is appropriate when the second differences are constant.
2. What is the distance from $f(0)$ to $f(2)$? $\sqrt{8}$ units, or about 2.8 units; -1
3. $y = -3(x + 2)^2 + 6$
4. $y = 0.25(x - 4)^2 - 1$
5. $y = 0.06(x - 3)^2 + 2$
6. $y = -6(x + 5)^2 + 9$
7. $y = -\frac{1}{3}(x + 6)^2 - 12$
8. $y = \frac{3}{7}(x + 1)^2 + 14$
9. $y = -4(x - 2)(x - 4)$
10. $y = (x + 1)(x - 2)$
11. $y = \frac{1}{10}(x - 12)(x + 6)$
12. $y = -2(x - 9)(x - 1)$
13. $y = 2.25(x + 16)(x + 2)$
14. $y = 0.01(x + 7)(x + 3)$
15. If given the x-intercepts, it is easier to write the equation in intercept form. If given the vertex, it is easier to write the equation in vertex form.
16. A and C
17. $y = -16(x - 3)^2 + 150$
18. $y = -16x^2 + 180$
19. $y = -0.75x(x - 4)$
20. $y = -\frac{1}{9}(x - 3)^2 + 1$

21. The x-intercepts were substituted incorrectly.

$y = a(x - p)(x - q)$

$4 = a(3 + 1)(3 - 2)$

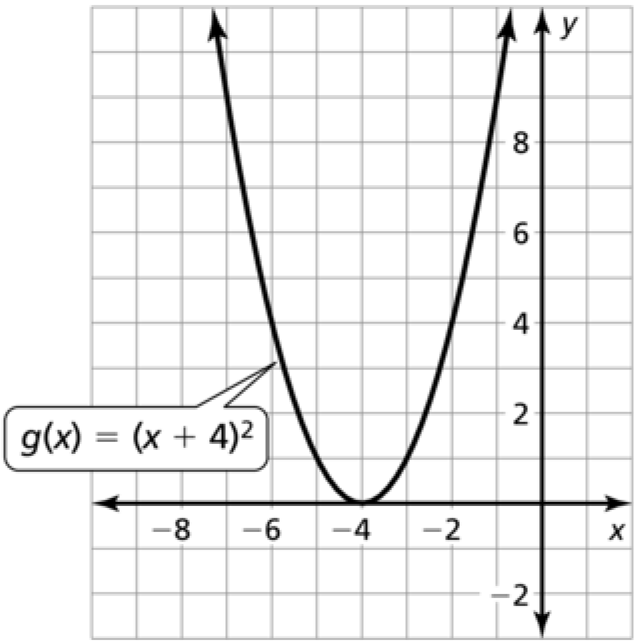
$a = 1$

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

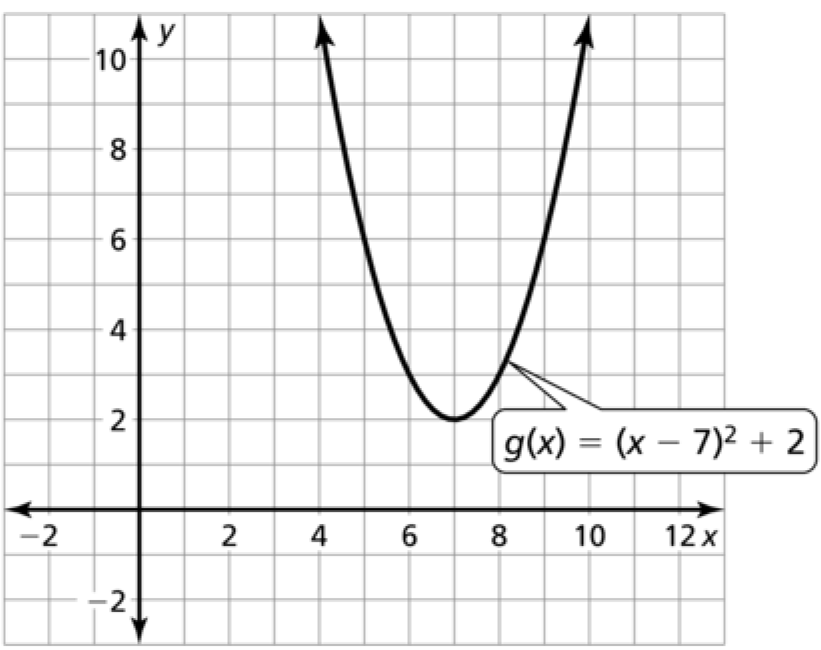
22. $y = -x^2 + 7x$; *Sample answer:* A rectangle 1 meter by 6 meters would result in an area of 6 square meters; A rectangle 3.5 meters by 3.5 meters would result in a maximum area of 12.25 square meters.

pp. 84-86 (#1-16)

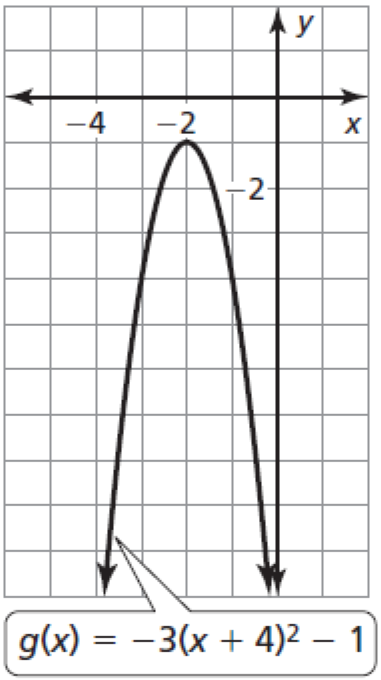
1. The graph is a translation 4 units left of the parent quadratic function.



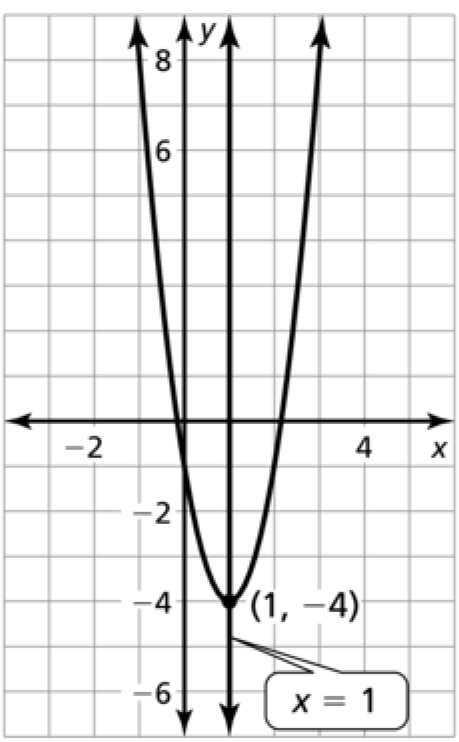
2. The graph is a translation 7 units right and 2 units up of the parent quadratic function.



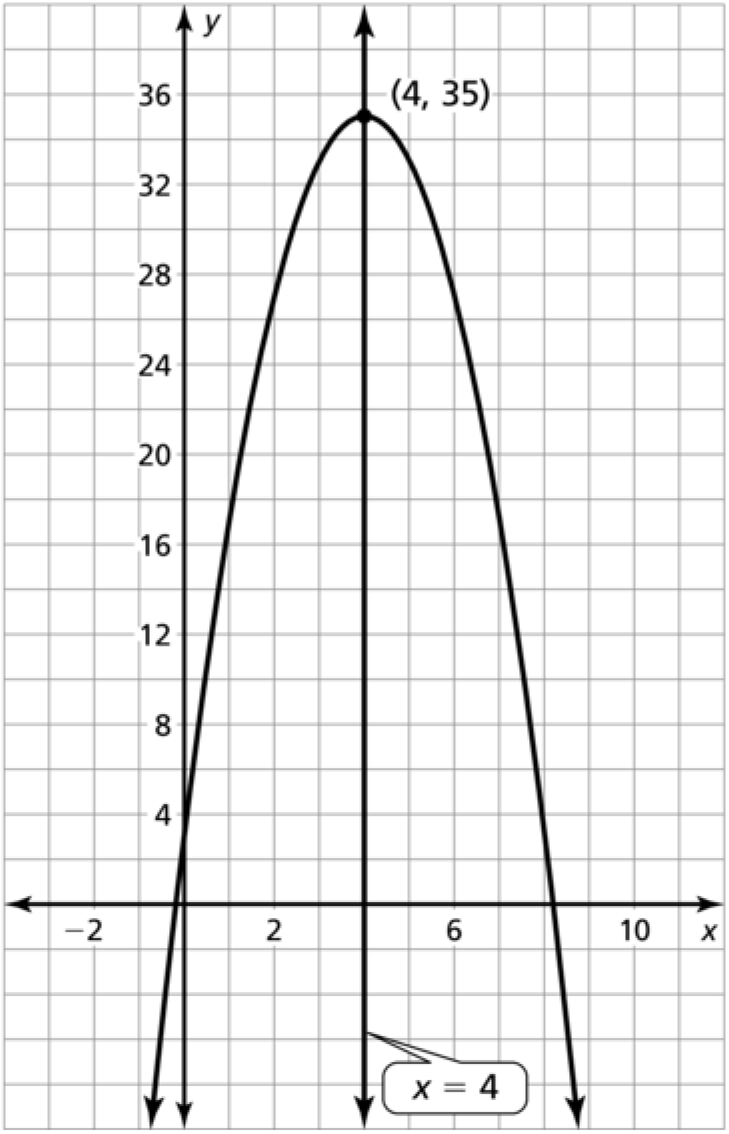
3. The graph is a vertical stretch by a factor of 3 followed by a reflection in the x-axis and a translation 2 units left and 1 unit down of the parent quadratic function.



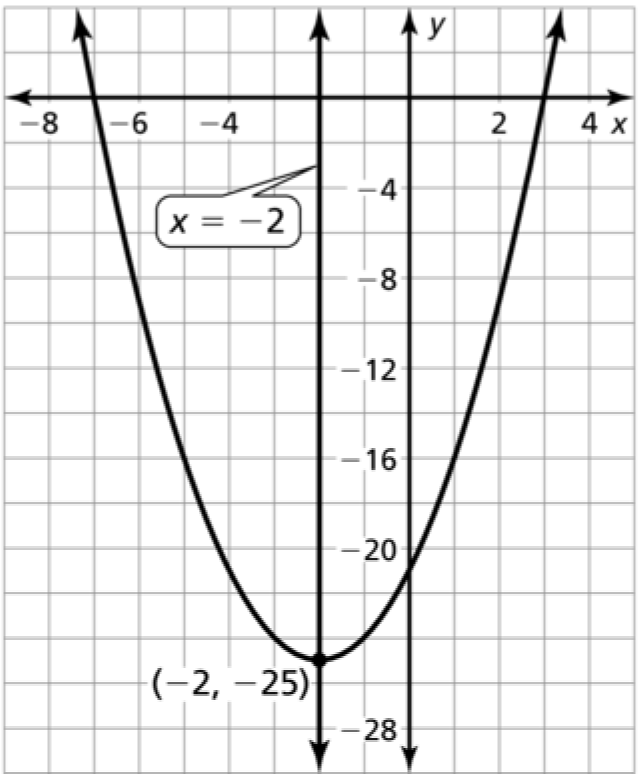
4. $g(x) = \frac{9}{4}(x + 5)^2 - 2$
5. $g(x) = (-x + 2)^2 - 2(-x + 2) + 3 = x^2 - 2x + 3$
6. The minimum value is -4; The function is decreasing to the left of $x = 1$ and increasing to the right of $x = 1$.



7. The maximum value is 35; The function is increasing to the left of $x = 4$ and decreasing to the right of $x = 4$.

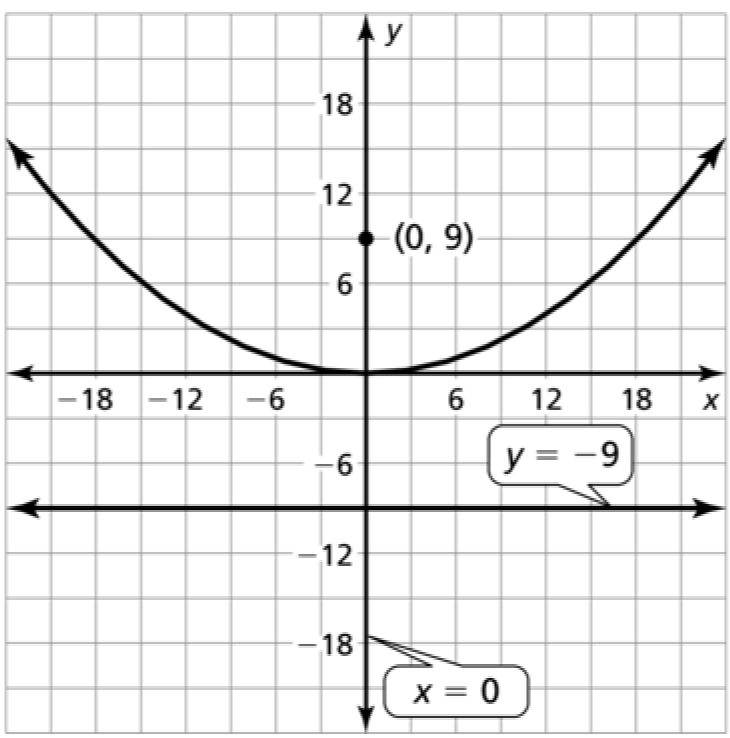


8. The minimum value is -25; The function is decreasing to the left of $x = -2$ and increasing to the right of $x = -2$.



9. 2.25 in.

10. The focus is (0, 9), the directrix is $y = -9$, and the axis of symmetry is $x = 0$.



11. $x = -\frac{1}{8}y^2$

12. $y = -\frac{1}{16}(x - 2)^2 + 6$

13. $y = \frac{16}{81}(x - 10)^2 - 4$

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

15. $y = 4x^2 + 5x + 1$

16. The average rate of change from $(-4, 16)$ to the vertex is -6 and the average rate of change from the vertex to $(-1, 7)$ is 3.