

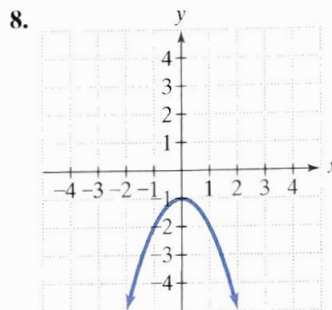
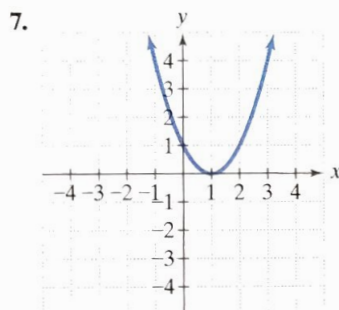
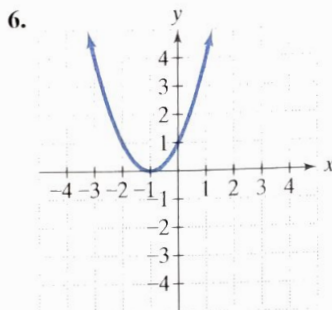
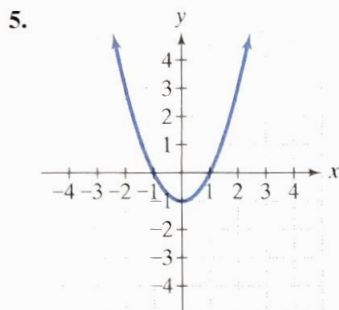
In Exercises 5–8, the graph of a quadratic function is given. Write the function's equation, selecting from the following options.

$$f(x) = x^2 + 2x + 1$$

$$h(x) = x^2 - 1$$

$$g(x) = x^2 - 2x + 1$$

$$j(x) = -x^2 - 1$$



39.  $f(x) = 3x^2 - 12x - 1$  \*    40.  $f(x) = 2x^2 - 8x - 3$  \*  
 41.  $f(x) = -4x^2 + 8x - 3$  \*    42.  $f(x) = -2x^2 - 12x + 3$  \*  
 43.  $f(x) = 5x^2 - 5x$  \*    44.  $f(x) = 6x^2 - 6x$  \*

**Practice Plus**

In Exercises 45–48, give the domain and the range of each quadratic function whose graph is described.

45. The vertex is  $(-1, -2)$  and the parabola opens up.  
 46. The vertex is  $(-3, -4)$  and the parabola opens down.  
 47. Maximum =  $-6$  at  $x = 10$     domain:  $(-\infty, \infty)$ ; range:  $(-\infty, -6]$   
 48. Minimum =  $18$  at  $x = -6$     domain:  $(-\infty, \infty)$ ; range:  $[18, \infty)$

In Exercises 49–52, write an equation in standard form of the parabola that has the same shape as the graph of  $f(x) = 2x^2$ , but with the given point as the vertex.

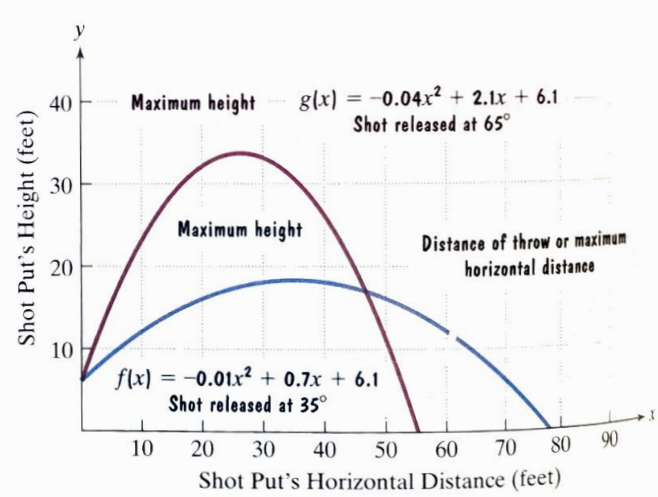
49.  $(5, 3)$      $f(x) = 2(x - 5)^2 + 3$     50.  $(7, 4)$      $f(x) = 2(x - 7)^2 + 4$   
 51.  $(-10, -5)$  \*    52.  $(-8, -6)$      $f(x) = 2(x + 8)^2 - 6$

In Exercises 53–56, write an equation in standard form of the parabola that has the same shape as the graph of  $f(x) = 3x^2$  or  $g(x) = -3x^2$ , but with the given maximum or minimum.

53. Maximum =  $4$  at  $x = -2$  \*    54. Maximum =  $-7$  at  $x = 5$  \*  
 55. Minimum =  $0$  at  $x = 11$  \*    56. Minimum =  $0$  at  $x = 9$  \*

**Application Exercises**

An athlete whose event is the shot put releases the shot with the same initial velocity but at different angles. The figure shows the parabolic paths for shots released at angles of  $35^\circ$  and  $65^\circ$ . Exercises 57–58 are based on the functions that model the parabolic paths.



57. When the shot whose path is shown by the blue graph is released at an angle of  $35^\circ$ , its height,  $f(x)$ , in feet, can be modeled by

$$f(x) = -0.01x^2 + 0.7x + 6.1,$$

where  $x$  is the shot's horizontal distance, in feet, from its point of release. Use this model to solve parts (a) through (c) and verify your answers using the blue graph.

- a. What is the maximum height of the shot and how far from its point of release does this occur?    18.35 ft; 35 ft  
 b. What is the shot's maximum horizontal distance, to the nearest tenth of a foot, or the distance of the throw?    77.8 ft  
 c. From what height was the shot released?    6.1 ft

In Exercises 9–16, find the coordinates of the vertex for the parabola defined by the given quadratic function.

9.  $f(x) = 2(x - 3)^2 + 1$  (\*\*\*)    10.  $f(x) = -3(x - 2)^2 + 12$  \*  
 11.  $f(x) = -2(x + 1)^2 + 5$  \*\*    12.  $f(x) = -2(x + 4)^2 - 8$  \*  
 13.  $f(x) = 2x^2 - 8x + 3$  (\*\*\*)    14.  $f(x) = 3x^2 - 12x + 1$  \*  
 15.  $f(x) = -x^2 - 2x + 8$  (\*\*\*)    16.  $f(x) = -2x^2 + 8x - 1$  \*

In Exercises 17–38, use the vertex and intercepts to sketch the graph of each quadratic function. Give the equation of the parabola's axis of symmetry. Use the graph to determine the function's domain and range.

17.  $f(x) = (x - 4)^2 - 1$  \*    18.  $f(x) = (x - 1)^2 - 2$  \*  
 19.  $f(x) = (x - 1)^2 + 2$  \*    20.  $f(x) = (x - 3)^2 + 2$  \*  
 21.  $y - 1 = (x - 3)^2$  \*    22.  $y - 3 = (x - 1)^2$  \*  
 23.  $f(x) = 2(x + 2)^2 - 1$  \*    24.  $f(x) = \frac{5}{4} - (x - \frac{1}{2})^2$  \*  
 25.  $f(x) = 4 - (x - 1)^2$  \*    26.  $f(x) = 1 - (x - 3)^2$  \*  
 27.  $f(x) = x^2 - 2x - 3$  \*    28.  $f(x) = x^2 - 2x - 15$  \*  
 29.  $f(x) = x^2 + 3x - 10$  \*    30.  $f(x) = 2x^2 - 7x - 4$  \*  
 31.  $f(x) = 2x - x^2 + 3$  \*    32.  $f(x) = 5 - 4x - x^2$  \*  
 33.  $f(x) = x^2 + 6x + 3$  \*    34.  $f(x) = x^2 + 4x - 1$  \*  
 35.  $f(x) = 2x^2 + 4x - 3$  \*    36.  $f(x) = 3x^2 - 2x - 4$  \*  
 37.  $f(x) = 2x - x^2 - 2$  \*    38.  $f(x) = 6 - 4x + x^2$  \*

In Exercises 39–44, an equation of a quadratic function is given.

- a. Determine, without graphing, whether the function has a minimum value or a maximum value.  
 b. Find the minimum or maximum value and determine where it occurs.  
 c. Identify the function's domain and its range.

\*See Answers to Selected Exercises.