# PRACTICE & PROBLEM SOLVING

UNDERSTAND

11. Use Structure The graph of the function $f(x) = x^2$ will be translated 3 units up and 1 unit left. What is the resulting function $g(x)$?

12. Error Analysis A classmate said that the vertex of $g(x) = -5(x + 2)^2 - 4$ is (2, 4). Is your classmate correct? If not, what is the correct vertex?

13. Higher Order Thinking The graph below is a translated reflection of the graph of the parent function. Write the quadratic function to model the graph.
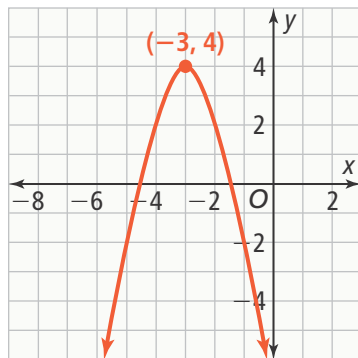
14. Construct Arguments Explain why the graph of the equation $g(x) = -(x + 1)^2 - 3$ would be a parabola opening downward.

15. Use Structure Amaya is standing 30 ft from a volleyball net. The net is 8 ft high. Amaya serves the ball. The path of the ball is modeled by the equation $y = -0.02(x - 18)^2 + 12$, where x is the ball's horizontal distance in feet from Amaya's position and y is the distance in feet from the ground to the ball.

   a. How far away is the ball from Amaya when it is at its maximum height? Explain.

   b. Describe how you would find the ball's height when it crosses the net at $x = 30$.

PRACTICE

Describe the transformation of the parent function $f(x) = x^2$. Then graph the transformed function.
SEE EXAMPLE 1

16. $f(x) = (x - 1)^2 + 3$ **17.** $y = (x + 1)^2 - 3$

18. $g(x) = 2x^2$ **19.** $f(x) = -(x - 1)^2 + 7$

20. $y = -2(x + 1)^2 + 1$ **21.** $f(x) = \frac{1}{2}(x - 2)^2 + 3$

**Identify the vertex, axis of symmetry, maximum or minimum, domain, and range of each function.**
SEE EXAMPLE 2

22. $y = 2(x - 2)^2 + 5$ **23.** $f(x) = -(x - 1)^2 + 2$

24. $g(x) = -(x + 4)^2$ **25.** $y = \frac{1}{3}(x + 2)^2 - 1$

Write the equation of each parabola in vertex form. SEE EXAMPLE 3

26. Vertex: (1, 2); Point: (2, −5)

27. Vertex: (3, 6); y-intercept: 2

28. Vertex: (0, 5); Point: (1, −2)

Write the equation of the function represented by the parabola in vertex form and in the form $y = ax^2 + bx + c$. SEE EXAMPLE 4

29.
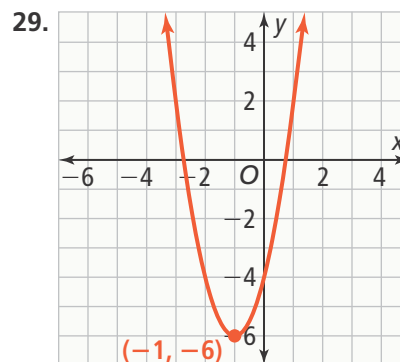
Write the equation $g(x)$ in vertex form of a quadratic function for the transformations given the function $f(x) = x^2$. SEE EXAMPLE 5

30. Let $g(x)$ be the function whose graph is a translation 4 units left and 1 unit up of the graph of $f(x)$.

31. Let $g(x)$ be the function whose graph is a reflection in the x-axis and translated 3 units right of the graph of $f(x)$.

APPLY

32. Look for Relationships The height, in inches, that a person can jump while wearing a pair of jumping shoes is based on the time, x, in seconds, from the start of the jump. Beth is testing out Max Jumps and Jumpsters to determine which shoes she likes better. Compare the maximum heights on the two sets of shoes.
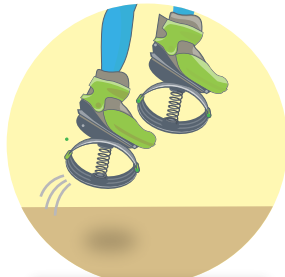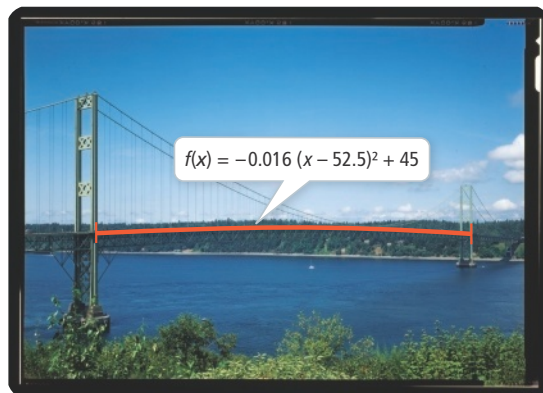
$f(x) = -0.7(x-8)^2 + 16$ $g(x) = -1.23(x-8)^2 + 38$

33. Make Sense and Persevere Find three additional points on the parabola that has vertex (1, –2) and passes through (0, –5).

34. Make Sense and Persevere The curvature of the Tacoma Narrows Bridge in Washington is in the shape of a parabola.

$f(x) = -0.016\,(x - 52.5)^2 + 45$

In the given function, x represents the horizontal distance (in meters) from the arch's left end and y represents the distance (in meters) from the base of the arch. What is the width of the arch?

35. Model With Mathematics An object is thrown from a height of 5 in. After 2 s, the object reaches a maximum height of 9 in., and then it lands back on the ground 5 s after it was thrown. Write the vertex form of the quadratic equation that models the object's path, and draw the graph.

ASSESSMENT PRACTICE

36. The graph of $g(x) = 3(x - 2)^2$ is a transformation of the graph of $f(x) = x^2$. Are the following transformations of f that map to g? Select *yes* or *no*.

	Yes	No
Translation left		
Translation right		
Translation up		
Translation down		
Reflection over x-axis		
Vertical Compression		
Vertical Stretch		

37. SAT/ACT Which of the following functions represents a parabola that has a vertex located at (−3, 4) and that passes through the point (−1, −4)?

Ⓐ $f(x) = x^2 - 5$

Ⓑ $f(x) = -2(x + 3)^2 + 4$

Ⓒ $f(x) = (x + 3)^2 + 4$

Ⓓ $f(x) = 2(x + 1)^2 - 4$

Ⓔ $f(x) = 2(x - 3)^2 - 32$

38. Performance Task The Bluebird Bakery sells more cookies when it lowers its prices, but this also changes profits.

$0.75 each
40¢ ea.

The profit function for the cookies is $f(x) = -500(x - 0.45)^2 + 400$. The function, $f(x) = -500(x - 45)^2 + 400$ represents the profit earned when the price of a cookie is x dollars. The bakery wants to maximize their profits.

Part A What is the domain of the function? Explain.

Part B Find the daily profits for selling cookies for $0.40 each and for $0.75 each.

Part C What price should the bakery charge to maximize their profits from selling cookies?

Part D What is the maximum profit?