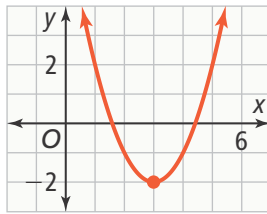




UNDERSTAND

10. Make Sense and Persevere

How you can determine the values of h and k from the graph shown? Write the function for the parabola.

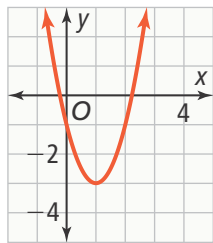


11. Reason To graph the function $f(x) = (x - 5)^2 - 8$, a student translates the graph of the quadratic parent function 5 units right and 8 units down. Can a student produce the graph of $f(x) = 2(x + 3)^2 - 5$ by simply translating the quadratic parent function? Explain.

12. Error Analysis A student used the steps shown to graph $f(x) = (x - 1)^2 + 6$. Describe and correct the student's error.

1. Plot the vertex at $(-1, 6)$.
2. Graph points at $(-2, 15)$ and $(-3, 22)$.
3. Reflect the points across the axis of symmetry $x = -1$.
4. Connect the points with a parabola. X

13. Mathematical Connections The graph shown is a translation of the graph of $f(x) = 2x^2$. Write the function for the graph in vertex form.



14. Higher Order Thinking The graph of h is the graph of $g(x) = (x - 2)^2 + 6$ translated 5 units left and 3 units down.

- a. Describe the graph of h as a translation of the graph of $f(x) = x^2$.
- b. Write the function h in vertex form.

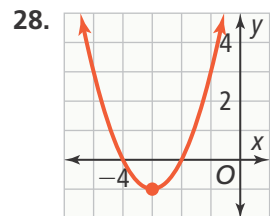
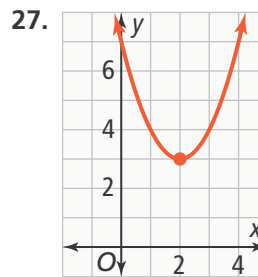
PRACTICE

Identify the vertex and the axis of symmetry for each function. SEE EXAMPLES 1 AND 2

- | | |
|--------------------------|------------------------|
| 15. $f(x) = x^2 + 2$ | 16. $f(x) = x^2 - 5$ |
| 17. $g(x) = x^2 - 1$ | 18. $h(x) = x^2 + 0.5$ |
| 19. $f(x) = x^2 - 2.25$ | 20. $f(x) = x^2 + 50$ |
| 21. $h(x) = x^2 + 7$ | 22. $g(x) = (x - 1)^2$ |
| 23. $g(x) = (x + 2)^2$ | 24. $f(x) = (x - 6)^2$ |
| 25. $f(x) = (x - 0.5)^2$ | 26. $g(x) = (x - 4)^2$ |

Each graph shown is a translation of the graph of $f(x) = x^2$. Write each function in vertex form.

SEE EXAMPLE 3



Identify the vertex, axis of symmetry, and direction of the graph of each function. Compare the width of the graph to the width of the graph of $f(x) = x^2$.

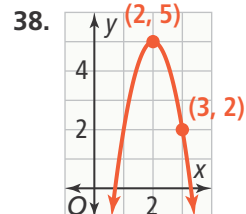
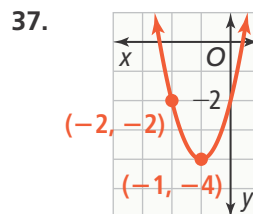
SEE EXAMPLE 3

29. $f(x) = 2(x + 1)^2 + 4$
30. $g(x) = (x - 3)^2 - 3$
31. $g(x) = -0.75(x - 5)^2 + 6$
32. $h(x) = -3(x + 2)^2 - 5$

Sketch the graph of each function. SEE EXAMPLE 4

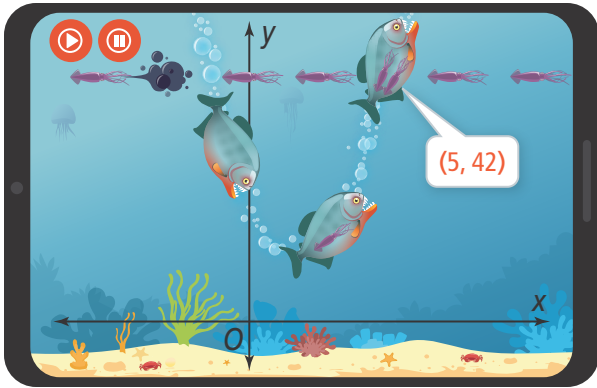
- | | |
|-------------------------------|--------------------------------|
| 33. $f(x) = 2(x - 1)^2 + 4$ | 34. $g(x) = -2(x - 0.5)^2 + 1$ |
| 35. $f(x) = 0.5(x + 2)^2 + 2$ | 36. $h(x) = -2(x - 2)^2 - 2$ |

Each graph represents a quadratic function. Write each function in vertex form. SEE EXAMPLE 5

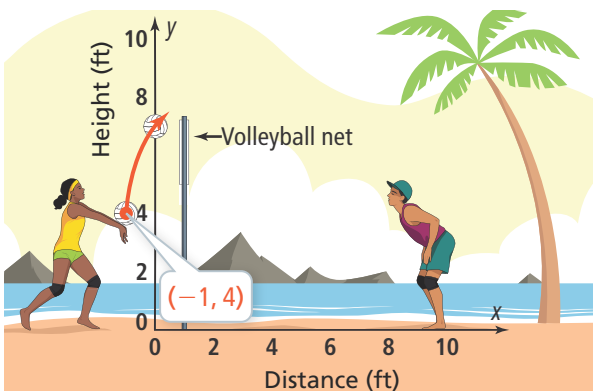


APPLY

39. **Make Sense and Persevere** A computer game designer uses the function $f(x) = 4(x - 2)^2 + 6$ to model the path of the fish. The horizontal path of the squid intersects the path of the fish. At what other point does the squid's path intersect the path of the fish?



40. **Model With Mathematics** Suppose a goalie kicks a soccer ball. The ball travels in a parabolic path from point $(0, 0)$ to $(57, 0)$.
- Consider a quadratic function in vertex form for the path of the ball. Which values can you determine? What values are you unable to determine? Explain.
 - Technology** Use a graphing calculator to explore the undetermined values. Find a set of values that generates a realistic graph. Explain how the key features of the graph correspond to the situation.
41. **Construct Arguments** The function $f(x) = -(x - 1)^2 + 8$ models the path of a volleyball. The height of the net is 7 ft 4 in.



Will the ball go over if the player is 2 ft from the net? 4 ft, from the net? Explain.

ASSESSMENT PRACTICE

42. The function $f(x) = 2(x - 3)^2 + 9$ is graphed in the coordinate plane. Which of the following are true? Select all that apply.
- The graph is a parabola that opens downward.
 - The vertex of the graph is $(-3, 9)$.
 - The axis of symmetry of the graph is $x = 3$.
 - The y -intercept of the graph is 9.
 - The minimum of the function is 9.
43. **SAT/ACT** The graph of $g(x) = x^2$ is translated right 2 units and down 10 units. Which of the following is the function of the new graph?
- $f(x) = (x + 2)^2 - 10$
 - $f(x) = (x - 2)^2 - 10$
 - $f(x) = 2x^2 - 10$
 - $f(x) = -2x^2 - 10$
 - $f(x) = -2(x - 10)^2$
44. **Performance Task** An engineer is designing a suspension bridge with a center cable. The cable is shaped like a parabola and is attached to stability towers on both ends at the same height. For simplicity she assumes a quadratic function, and uses $f(x) = 0.0006(x - 300)^2 + 6$ to model the cable between the towers.



- Part A** How high above the road surface is the lowest point of the cable?
- Part B** How far apart are the two towers? Explain.