

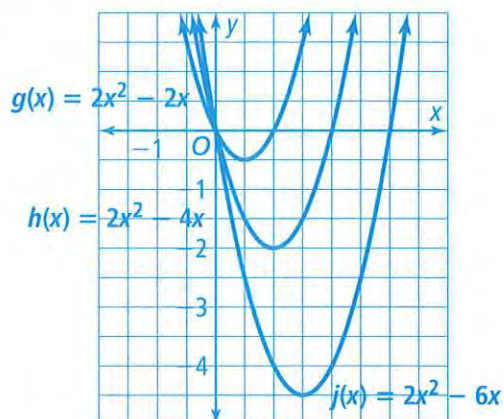
## 8-3

## Quadratic Functions in Standard Form

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## EXPLORE &amp; REASON

Three functions of the form  $f(x) = ax^2 + bx$  are graphed for  $a = 2$  and different values of  $b$ .



- A. What do the graphs have in common? In what ways do they differ?
- B. What do you notice about the  $x$ -intercepts of each graph? What do you notice about the  $y$ -intercepts of each graph?
- C. **Look for Relationships** Look at the ratio  $\frac{b}{a}$  for each function and compare it to its graph. What do you notice? © MP.7

## HABITS OF MIND

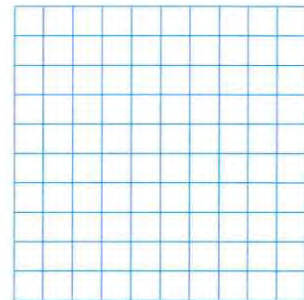
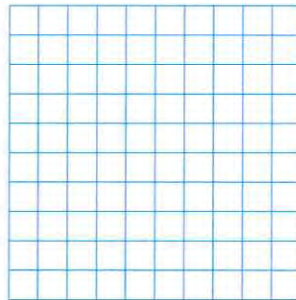
**Construct Arguments** Can more than one parabola have the same description? Explain. © MP.3

**EXAMPLE 1**  **Try It!** Analyze the Axis of Symmetry for  $f(x) = ax^2 + bx + c$ 

1. Evaluate  $f(x) = ax^2 + bx + c$  for  $x = 0$ . How does  $f(0)$  relate to result in Example 1?

**EXAMPLE 2**  **Try It!** Graph a Quadratic Function in Standard Form

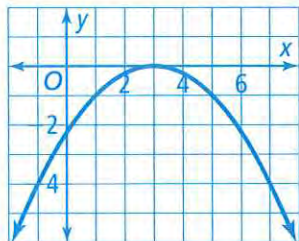
2. Graph each function. What are the  $y$ -intercept, the axis of symmetry, and the vertex of each function?
  - a.  $f(x) = x^2 + 2x + 4$
  - b.  $g(x) = -0.75x^2 + 3x - 4$

**HABITS OF MIND**

**Use Appropriate Tools** Suppose you want to graph a quadratic function in standard form on a graphing calculator. How could finding the vertex, axis of symmetry, and  $y$ -intercept of the function help you choose a viewing window for the graph? © MP.5

**EXAMPLE 3**  **Try It! Compare Properties of Quadratic Functions**

3. Compare  $f(x) = -0.3x^2 - 0.6x - 0.2$  to function  $g$ , shown in the graph. What are the maximum values? Which function has the greater maximum value?

**HABITS OF MIND**

**Reason** In Example 3, how can you tell from the equation of function  $f$  that the function has a maximum? How can you tell from the table that the function representing Fountain B has a maximum? © MP.2

**EXAMPLE 4**  **Try It! Analyze the Structure of Different Forms**

4. Suppose the path of the ball in Example 4 is  $f(x) = -0.25(x - 1)^2 + 6.25$ . Find the ball's initial and maximum heights.

**HABITS OF MIND**

**Use Structure** Consider the different forms of the quadratic function. Which form would you use to find the  $y$ -intercept of its graph? Which form would you use to find the maximum or minimum of the function? Explain. © MP.7

## Do You UNDERSTAND?

1. **ESSENTIAL QUESTION** How is the standard form of a quadratic function different from the vertex form?

2. **Communicate Precisely** How are the form and graph of  $f(x) = ax^2 + bx + c$  similar to the form and graph of  $g(x) = a(x - h)^2 + k$ ? How are they different? © MP.6

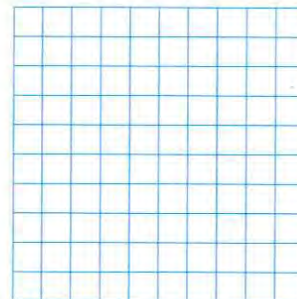
3. **Vocabulary** How can you write a function in standard form, given its vertex form?

4. **Error Analysis** Sage began graphing  $f(x) = -2x^2 + 4x + 9$  by finding the axis of symmetry  $x = -1$ . Explain the error Sage made. © MP.3

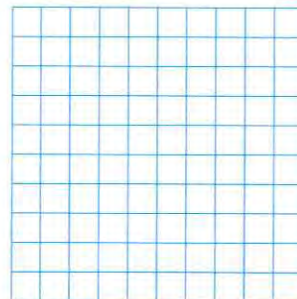
## Do You KNOW HOW?

Graph each function. For each, identify the axis of symmetry, the  $y$ -intercept, and the coordinates of the vertex.

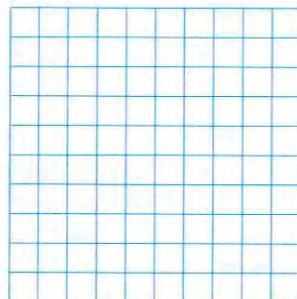
5.  $f(x) = 2x^2 + 8x - 1$



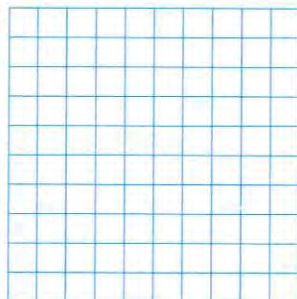
6.  $f(x) = -0.5x^2 + 2x + 3$



7.  $f(x) = -3x^2 - 6x - 5$



8.  $f(x) = 0.25x^2 - 0.5x - 6$



9. A water balloon is tossed into the air. The function  $h(x) = -0.5(x - 4)^2 + 9$  gives the height, in feet, of the balloon from the surface of a pool as a function of the balloon's horizontal distance from where it was first tossed. Will the balloon hit the ceiling 12 ft above the pool? Explain.