10.2 Graph $y = ax^2 + bx + c$

TEKS A.4.A, A.9.D; 2A.6.B, 2A.7.A

Before You graphed simple quadratic functions.

Now You will graph general quadratic functions.

Why? So you can investigate a cable's height, as in Example 4.

Key Vocabulary
- **minimum value**
- **maximum value**

You can use the properties below to graph any quadratic function. You will justify the formula for the axis of symmetry in Exercise 38 on page 639.

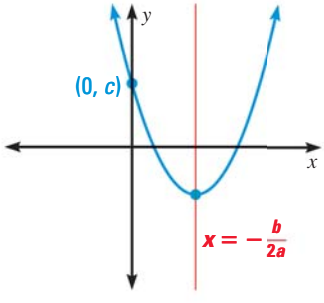
KEY CONCEPT *For Your Notebook*

Properties of the Graph of a Quadratic Function

The graph of $y = ax^2 + bx + c$ is a parabola that:

- opens up if $a > 0$ and opens down if $a < 0$.
- is narrower than the graph of $y = x^2$ if $|a| > 1$ and wider if $|a| < 1$.
- has an axis of symmetry of $x = -\frac{b}{2a}$.
- has a vertex with an x-coordinate of $-\frac{b}{2a}$.
- has a y-intercept of c. So, the point $(0, c)$ is on the parabola.

$y = ax^2 + bx + c, a > 0$



EXAMPLE 1 Find the axis of symmetry and the vertex

Consider the function $y = -2x^2 + 12x - 7$.

a. Find the axis of symmetry of the graph of the function.

b. Find the vertex of the graph of the function.

Solution

a. For the function $y = -2x^2 + 12x - 7$, $a = -2$ and $b = 12$.

$$x = -\frac{b}{2a} = -\frac{12}{2(-2)} = 3$$ Substitute −2 for *a* and 12 for *b*. Then simplify.

IDENTIFY THE VERTEX
Because the vertex lies on the axis of symmetry, $x = 3$, the x-coordinate of the vertex is 3.

b. The x-coordinate of the vertex is $-\frac{b}{2a}$, or 3.

To find the y-coordinate, substitute 3 for x in the function and find y.

$$y = -2(3)^2 + 12(3) - 7 = 11$$ Substitute 3 for *x*. Then simplify.

▶ The vertex is (3, 11).