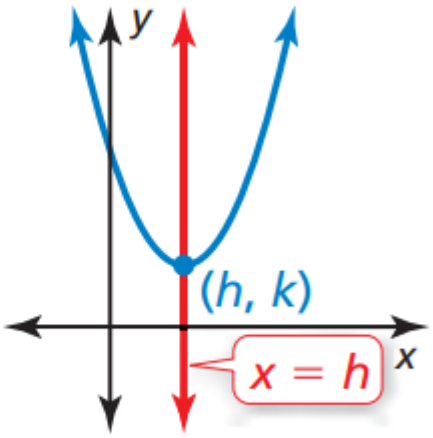
Exploring Properties of Parabolas

An **axis of symmetry** is a line that divides a parabola into mirror images and passes through the vertex. Because the vertex of $f(x) = a(x - h)^2 + k$ is (h, k), the axis of symmetry is the vertical line $x = h$.



Previously, you used transformations to graph quadratic functions in vertex form. You can also use the axis of symmetry and the vertex to graph quadratic functions written in vertex form.

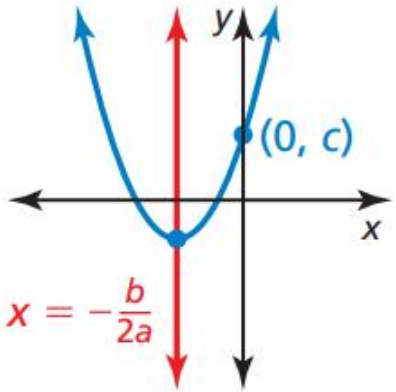
Graph $f(x) = -2(x + 3)^2 + 4$. Label the vertex and axis of symmetry.

Graph $f(x) = 0.5(x + 4)^2 - 2$. Label the vertex and axis of symmetry.

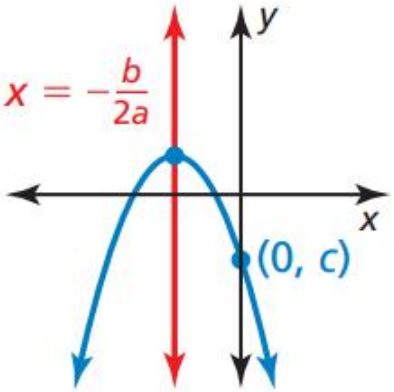
KEY IDEA

Properties of the Graph of $f(x) = ax^2 + bx + c$

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



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



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

Graph $f(x) = 3x^2 - 6x + 1$. Label the vertex and axis of symmetry.

Graph $f(x) = x^2 + 2x - 1$. Label the vertex and axis of symmetry.

A parabola passes through the points (−1, 4) and (4, 4). Find the axis of symmetry.