**Section 3.1—Quadratic Functions**

**Quadratic Function**—any function in the form

**Parabola**—the graph of any quadratic function

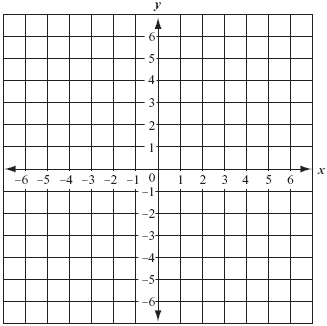
**Vertex of a Parabola**—turning point; lowest point when it opens upward and highest point when it opens downward

**Axis of Symmetry**—the line about which a parabola is symmetric

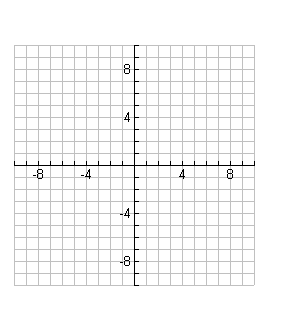
**Standard Form of a Quadratic Equation**

* The vertex is the point .
* The parabola is symmetric about the line .
* If , the parabola opens upward; if the parabola opens downward.

**Graphing Quadratic Equations in Standard Form**

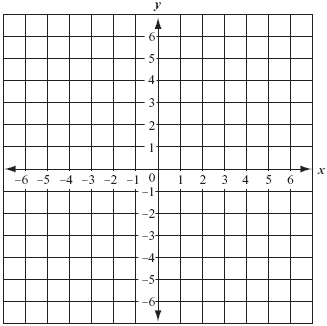
* 1. Determine whether the parabola opens upward or downward.
  2. Determine the vertex of the parabola.
  3. Find any x-intercepts by solving
  4. Find the y-intercept by computing
  5. Plot the intercepts, the vertex, and any additional points as needed. Connect the points with a smooth curve.

**Example**—Graph the quadratic function .

**Example**—Graph the quadratic function

**Vertex of a Parabola with Equation**

We can still use the same 5 steps to graph a parabola in this form. The only difference is how we find the vertex.

**Example**—Graph the quadratic function . Use the graph to determine the domain and range.

**Minimum and Maximum: Quadratic Functions**

Consider the quadratic function

1. If , then f has a minimum that occurs at . This minimum value is at .
2. If , then f has a maximum that occurs at . This minimum value is at .

In each case, the value of x gives the location of the minimum or maximum value.

**Example**—Using , complete the following.

1. Determine, without graphing, whether the function has a minimum value or maximum value.
2. Find the maximum or minimum value and determine where it occurs.
3. Identify the domain and range.

**Example**—The function models the number of accidents, , per 50 million miles driven, for drivers x years old, where . What is the age of a driver having the least number of car accidents? What is the minimum number of car accidents per 50 million miles driven?