

4.3 Quadratic Functions

▼ Definition of a Quadratic Function

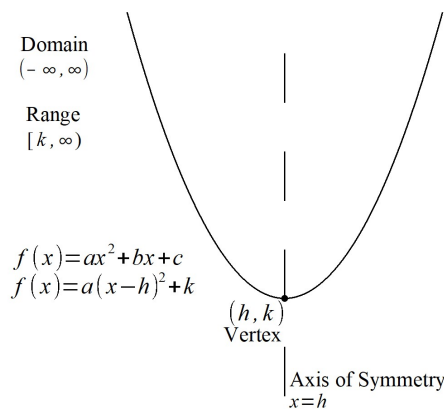
A quadratic function is of the form $f(x) = ax^2 + bx + c$, where a , b , and c are real numbers and $a \neq 0$. This form is called **general form** of a quadratic function.

▼ Standard Form of a Quadratic Function (Vertex Form)

The **standard form** of a quadratic function is

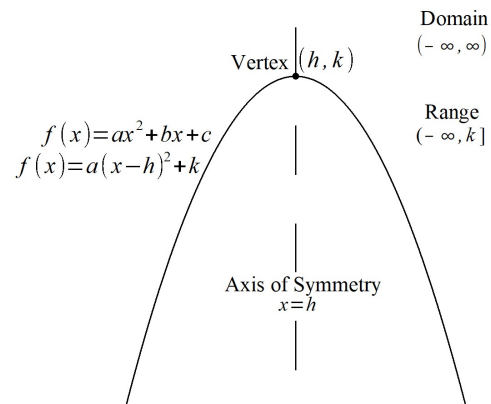
$f(x) = a(x - h)^2 + k$, where the ordered pair (h, k) is the vertex of the parabola.

▼ Features of the Graph of a Quadratic Function (Parabola)



$$a > 0$$

Orientation: "Up"



$$a < 0$$

Orientation: "Down"

▼ Vertex Formula

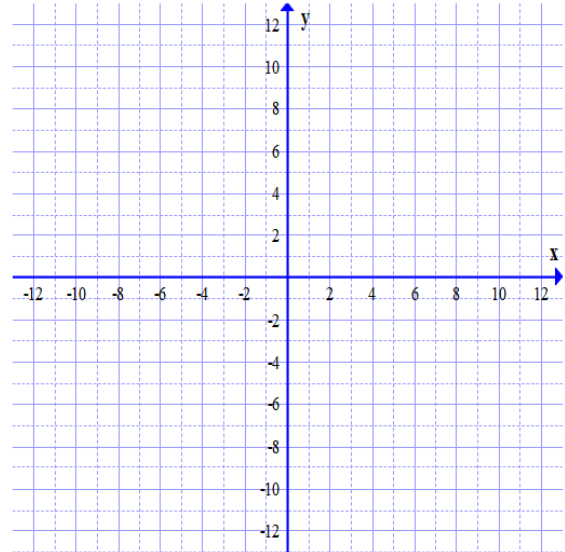
When the quadratic function is in general form $[f(x) = ax^2 + bx + c]$, the vertex can be found using the vertex formula.

Vertex:

$$\left(-\frac{b}{2a}, f\left(-\frac{b}{2a}\right) \right)$$

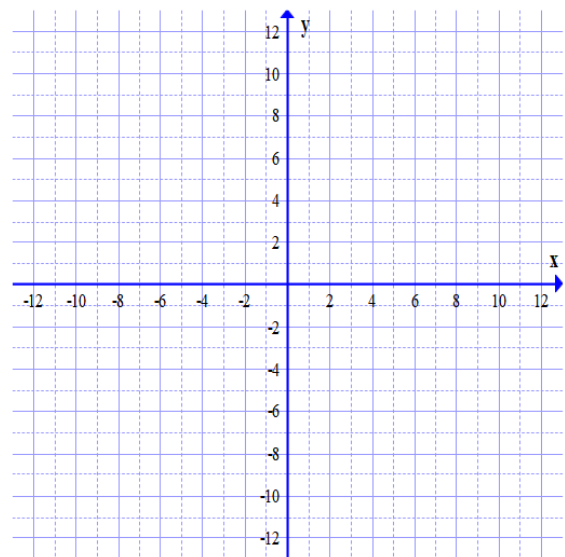
▼ Example 1: Given the equation of a quadratic function in standard form, find the orientation, vertex, axis of symmetry, intercepts, domain, range of the parabola and graph the parabola.

$$f(x) = -3(x - 1)^2 + 12$$



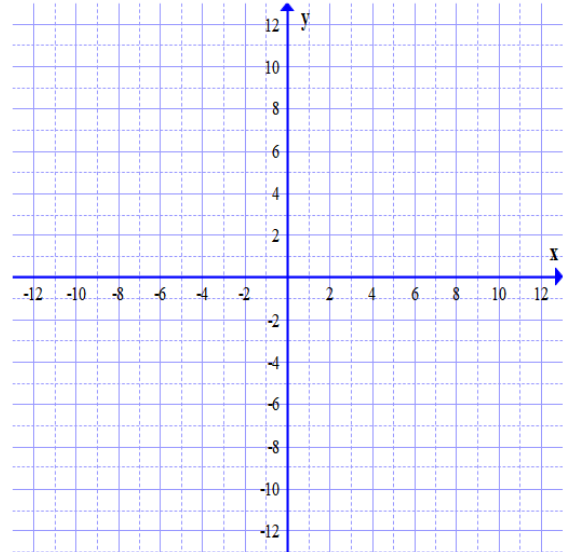
▼ Example 2: Given the equation of a quadratic function in standard form, find the orientation, vertex, axis of symmetry, intercepts, domain, and range of the parabola and graph the parabola.

$$f(x) = (x - 5)^2 - 9$$



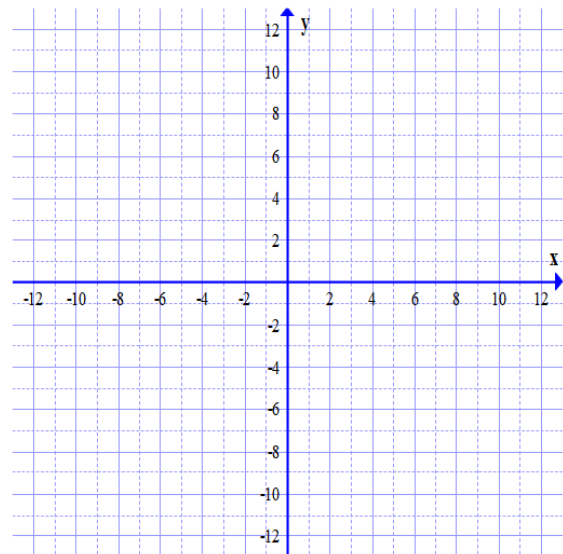
▼ Example 3: Given the equation of a quadratic function in general form, find the orientation, vertex, axis of symmetry, intercepts, domain, and range of the parabola and graph the parabola. (Use completing the square to find the vertex)

$$f(x) = -x^2 - 2x + 8$$



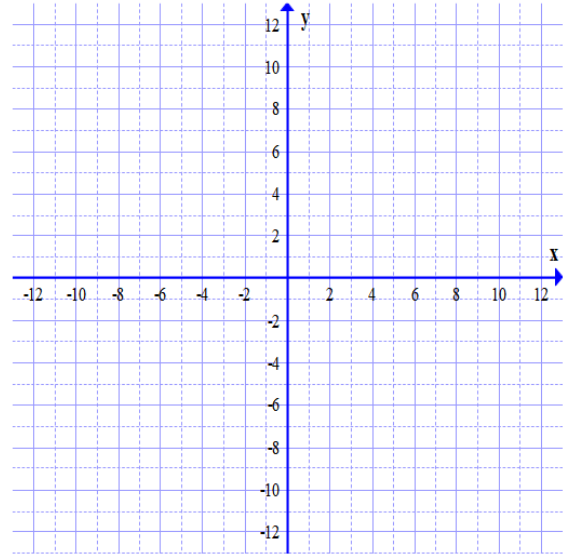
▼ Example 4: Given the equation of a quadratic function in general form, find the orientation, vertex, axis of symmetry, intercepts, domain, and range of the parabola and graph the parabola. (Use completing the square to find the vertex)

$$f(x) = x^2 - 6x + 5$$



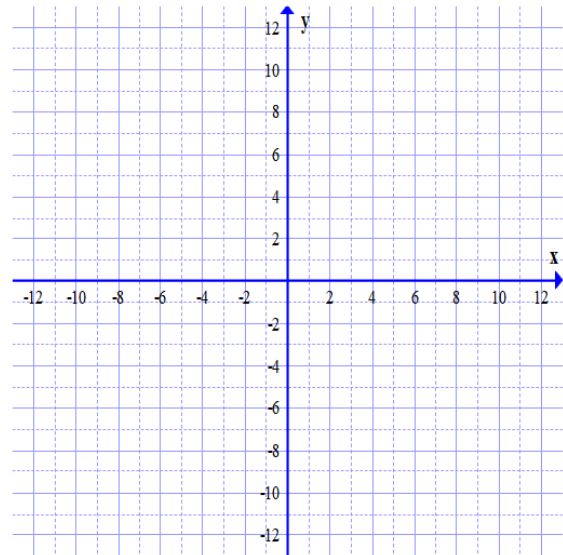
▼ Example 5: Given the equation of a quadratic function in general form, find the orientation, vertex, axis of symmetry, intercepts, domain, and range of the parabola and graph the parabola. (Use the vertex formula to find the vertex)

$$f(x) = 2x^2 - 8x + 3$$



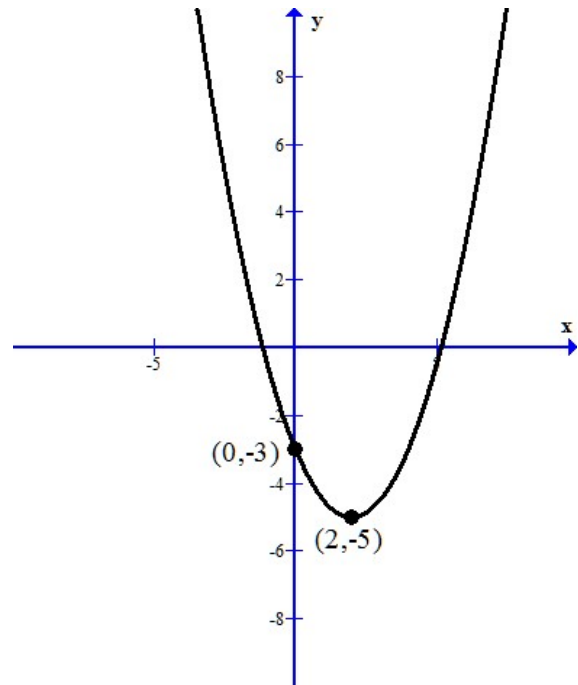
▼ Example 6: Given the equation of a quadratic function in general form, find the orientation, vertex, axis of symmetry, intercepts, domain, and range of the parabola and graph the parabola. (Use the vertex formula to find the vertex)

$$f(x) = 2x^2 - 4x - 3$$



▼ Example 7: Determine the equation of a Quadratic Function Given its Graph

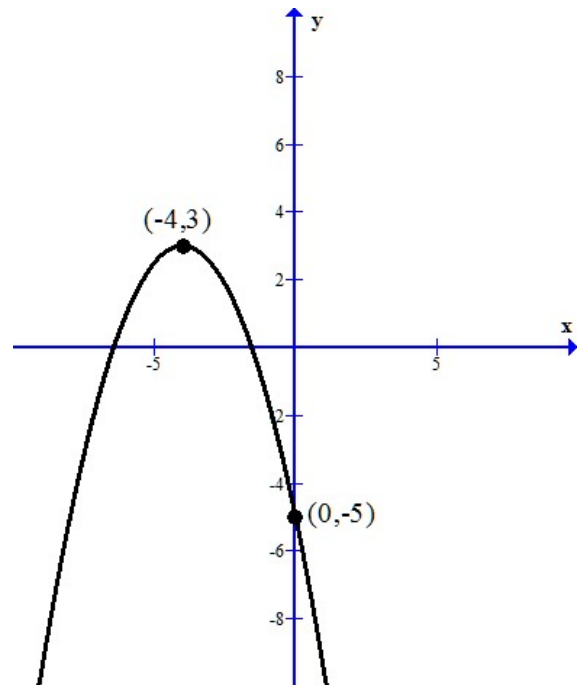
- a. Is the leading coefficient positive or negative?
- b. What is the vertex?
- c. What is the value of the leading coefficient?



- d. Write the function in standard form.
- e. Write the function in general form.

▼ Example 8: Determine the equation of a Quadratic Function Given its Graph

- a. Is the leading coefficient positive or negative?
- b. What is the vertex?
- c. What is the value of the leading coefficient?



- d. Write the function in standard form.
- e. Write the function in general form.

▼ Example 9: Does the function have a maximum or minimum value? What is the maximum or minimum value?

$$f(x) = -x^2 - 8x + 4$$

▼ Example 10: Does the function have a maximum or minimum value? What is the maximum or minimum value?

$$f(x) = x^2 - 12x$$