



## 3.2 Intro to Quadratic Functions

### Objectives:

- Define, identify, and graph quadratic functions
- Multiply linear binomials to produce a quadratic expression



# Investigating Quadratic Functions



Graph the following functions using your graphing calculator.

$$f(x)$$

$$g(x)$$

$$f(x) \cdot g(x)$$

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

$$g(x) = 2x + 11$$

$$h(x) = 4x^2 + 22x - 2$$

In what ways do the graphs of  $f$  and  $g$  differ from the graph of  $f \cdot g$ ?

How are the  $x$ -intercepts of the graphs of  $f$  and  $g$  related to the  $x$ -intercepts of the graph of  $f \cdot g$ ?



# Quadratic Function

A quadratic function is any function that can be written in the form  $f(x) = ax^2 + bx + c$ , where  $a \neq 0$ .

The graph of a quadratic function is called a parabola.



# Example 1

Let  $g(x) = (4x + 3)(x - 6)$ . Show that  $g$  represents a quadratic function. Identify  $a$ ,  $b$ , and  $c$ .

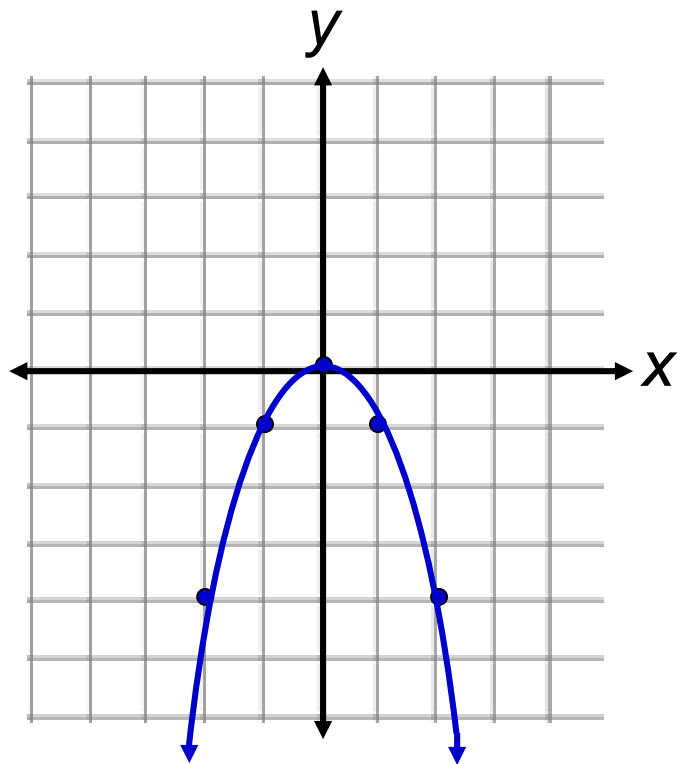
$$g(x) = 4x^2 - 21x - 18$$

$$a = 4, b = -21, c = -18$$



# Example 2

Graph the quadratic function  $f(x) = -x^2$ .



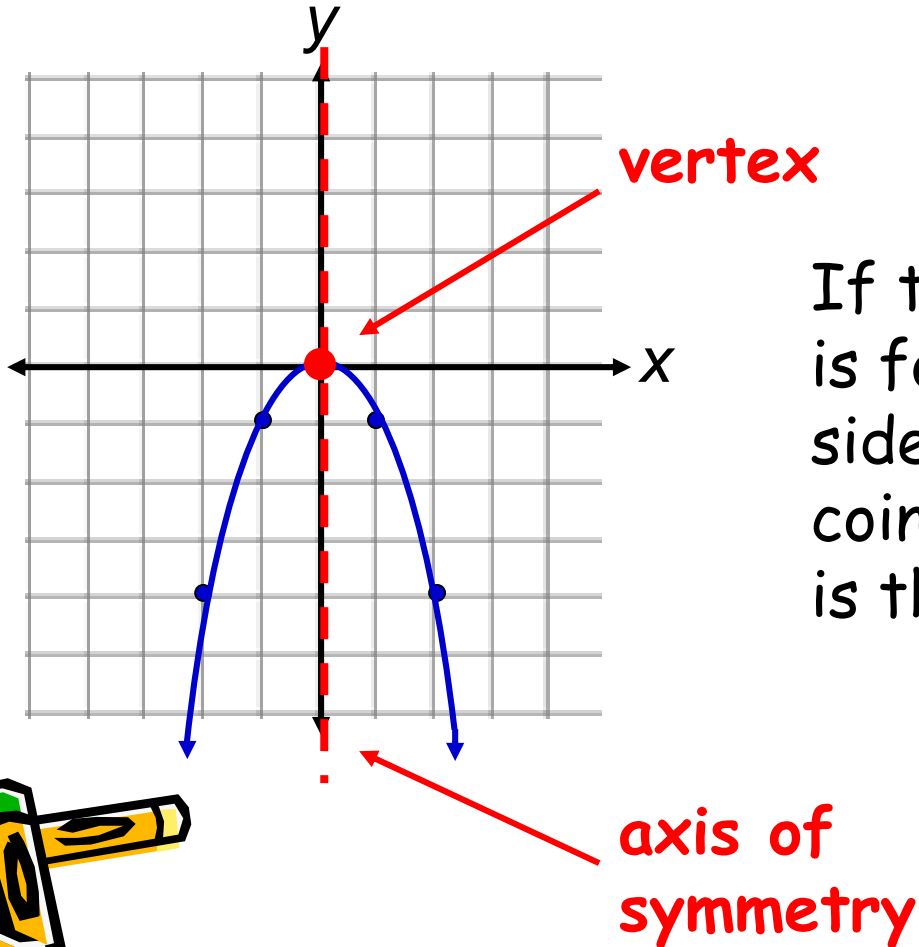
$$f(x) = -x^2$$

x	f(x)
-2	-4
-1	-1
0	0
1	-1
2	-4



## Example 2

Graph the quadratic function  $f(x) = -x^2$ .



The **vertex** is the maximum or minimum point of a parabola. If the graph of a parabola is folded so that the two sides of the parabola coincide, then the fold line is the **axis of symmetry**.

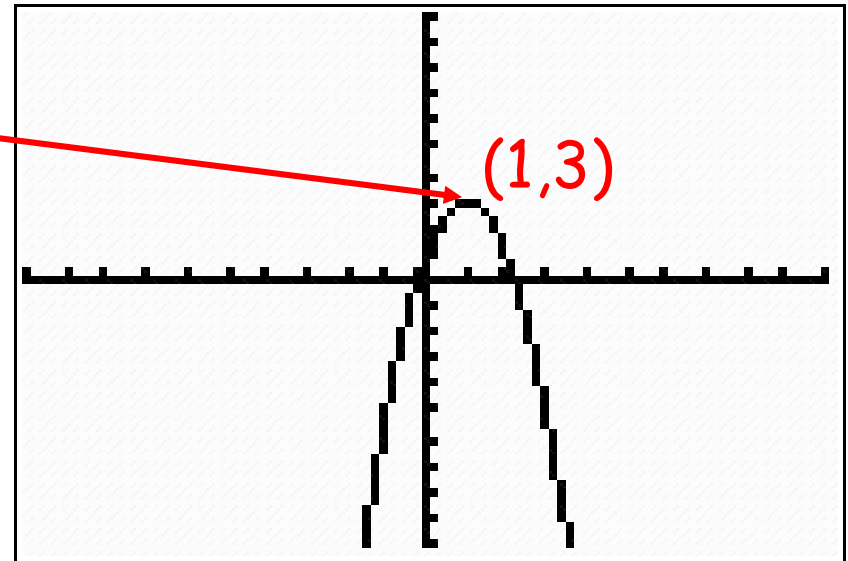
# Example 3

Identify whether  $g(x) = -2x^2 + 4x + 1$  has a maximum value or a minimum value at the vertex. Then give the approximate coordinates of the vertex.



vertex

since the parabola opens down, it has a maximum value at the vertex

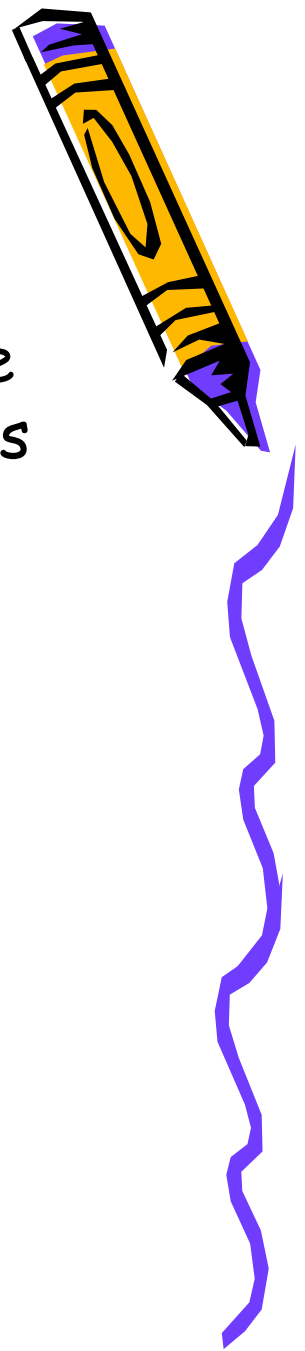
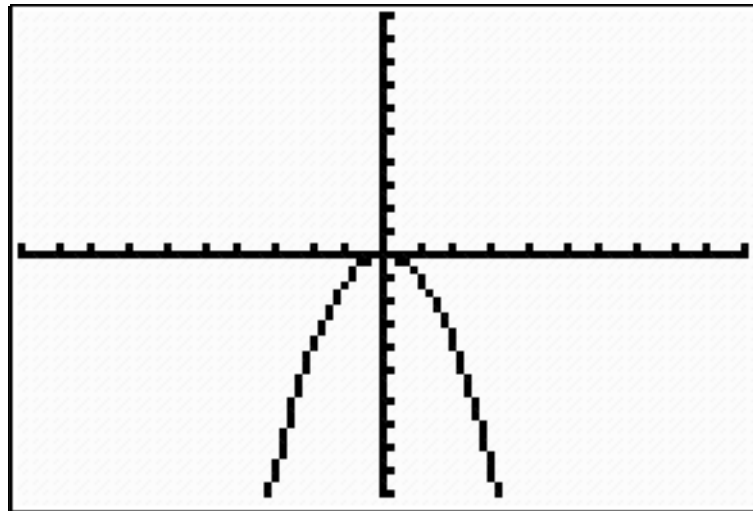


# Minimum and Maximum Values

Let  $f(x) = ax^2 + bx + c$ , where  $a \neq 0$ .

If  $a < 0$ , the parabola opens downward and the vertex is the highest point. The  $y$ -coordinate of the vertex is the maximum value of  $f$ .

$$a < 0$$





## Example 4

State whether the parabola opens up or down and whether it has a maximum or minimum at the vertex.

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

the parabola opens up, it has a minimum value at the vertex

b)  $g(x) = 7 - 6x - 2x^2$

the parabola opens down, it has a maximum value at the vertex

