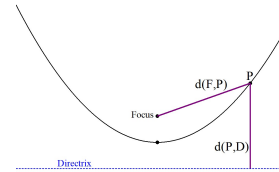


# 7.2 The Parabola

## ▼ Geometric Definition of a Parabola

A **parabola** is the collection of all points  $P$  in the plane that are the same distance  $d$  from a fixed point  $F$  as they are from a fixed line  $D$ . The point  $F$  is the **focus** and the line  $D$  is the **directrix**.



## ▼ Parabola with vertex at the origin $(0, 0)$

Up:  $x^2 = 4ay$

Down:  $x^2 = -4ay$

Right:  $y^2 = 4ax$

Left:  $y^2 = -4ax$

## ▼ Parabola with vertex at $(h, k)$

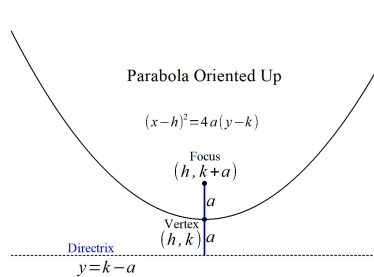
Up:  $(x - h)^2 = 4a(y - k)$

Down:  $(x - h)^2 = -4a(y - k)$

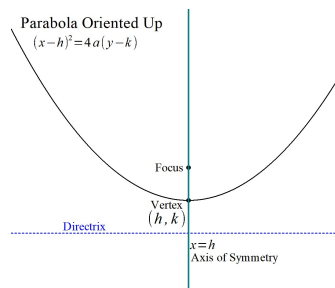
Right:  $(y - k)^2 = 4a(x - h)$

Left:  $(y - k)^2 = -4a(x - h)$

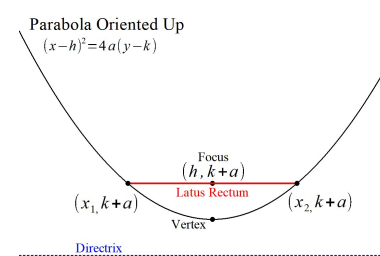
## ▼ Features of an Parabola Oriented Up



$a$  is the distance between the focus and the vertex and  $a$  is the distance between the vertex and the directrix



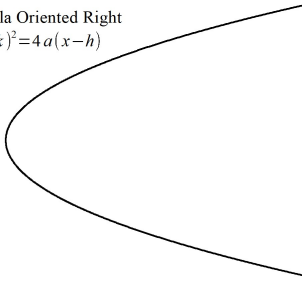
The **axis of symmetry** is the line that passes through the vertex and focus.



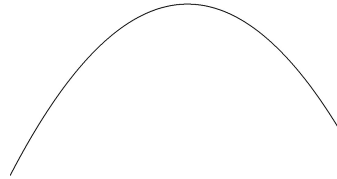
The **latus rectum** is parallel to the directrix and passes through the focus.

▼ Label the Features of the other Parabolas

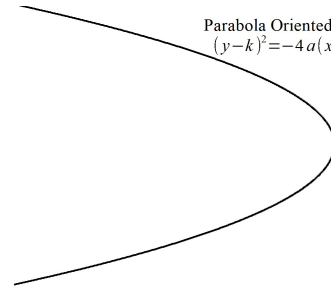
Parabola Oriented Right  
 $(y-k)^2 = 4a(x-h)$



Parabola Oriented Down  
 $(x-h)^2 = -4a(y-k)$



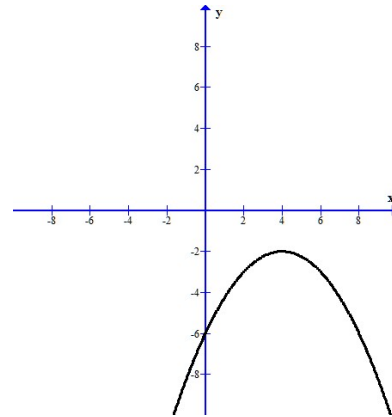
Parabola Oriented Left  
 $(y-k)^2 = -4a(x-h)$



▼ Examples: Given the graph find the features and equation

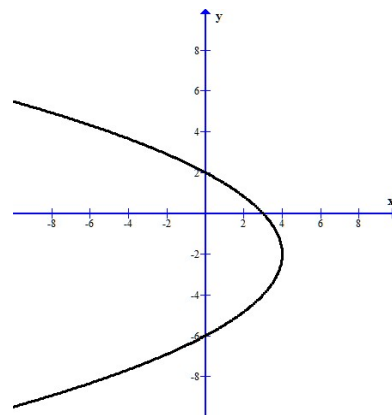
▼ Example 1

Find the equation of the parabola, the vertex, focus, directrix, latus rectum points



▼ Example 2

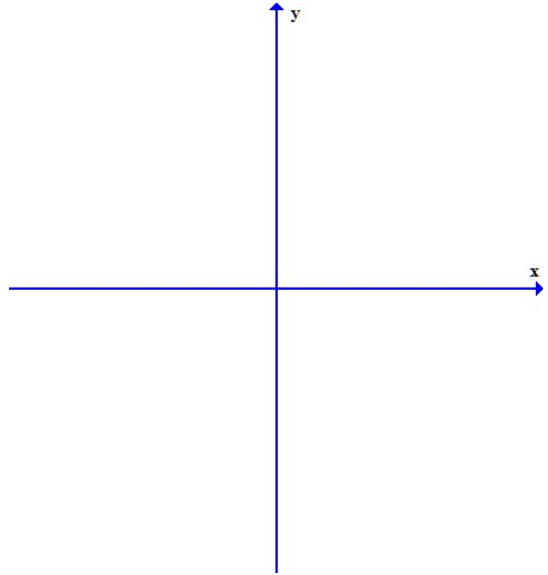
Find the equation of the parabola, the vertex, focus, directrix, latus rectum points



▼ Examples: Given the features find the equation and the graph

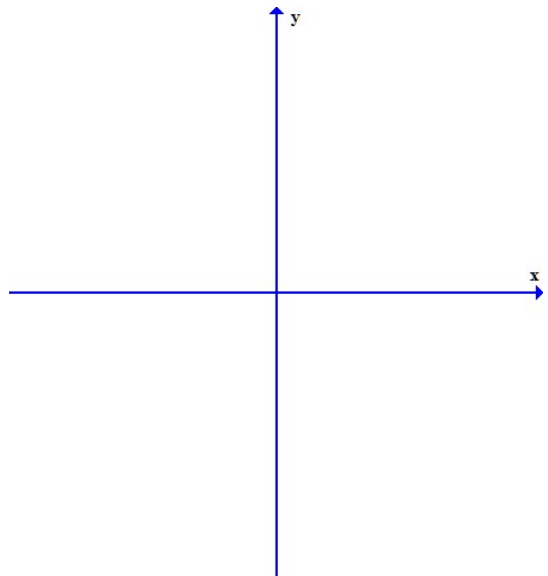
▼ Example 1: Find the orientation, vertex, and write the equation of the parabola and graph it.

The focus is  $(2, 0)$  and the directrix is  $x = -2$



▼ Example 2: Find the orientation, vertex, and write the equation of the parabola and graph it.

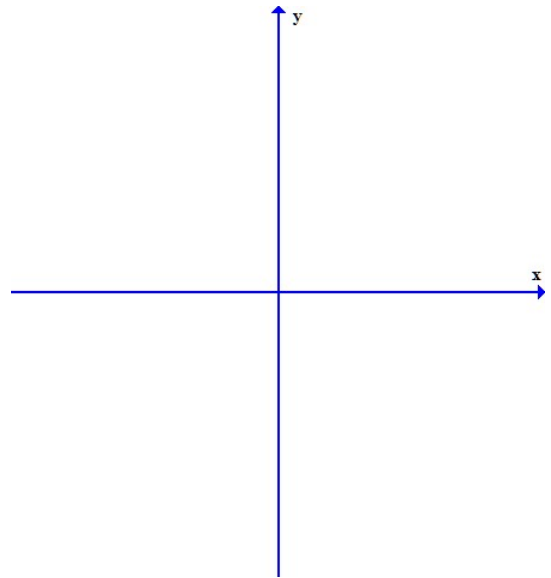
The vertex is at  $(2, 1)$  the axis of symmetry is the line  $y = 1$  and  $(-6, 3)$  is on the graph.



▼ Examples: Given the equations find the features and graph

▼ Example 1: Find the orientation, vertex, focus, directrix, latus rectum points and graph the parabola.

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



▼ Example 2: Rewrite using completing the square. Find the orientation, vertex, focus, directrix, latus rectum points and graph the parabola.

$$x^2 + 6x - 8y + 1 = 0$$

