

**Objectives:**

- To write the equation of a parabola and to graph parabolas.

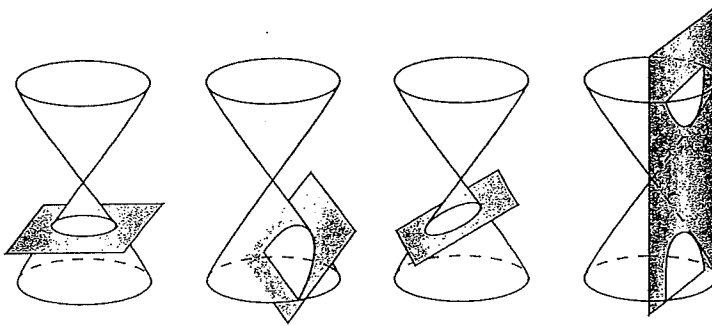
**Common Core Standard**

**3.GPE.2** Derive the equation of a parabola given a focus and directrix.

*Take note*

**Key Concept Conic Sections**

A conic section is a curve you get by intersecting a plane and a double cone. By changing the inclination of the plane, you can get a circle, a parabola, an ellipse, or a hyperbola.



*Take note*

**Key Concept Parabola**

**Definition**

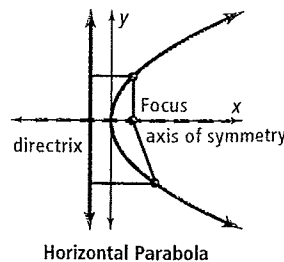
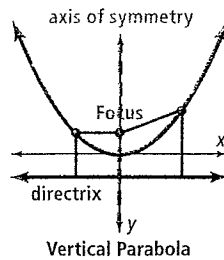
A parabola is the set of all points in a plane that are the same distance from a fixed line and a fixed point not on the line.

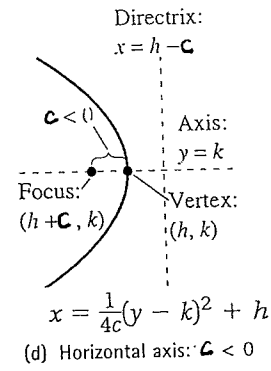
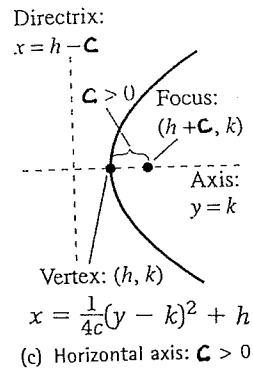
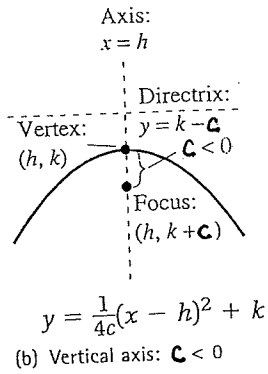
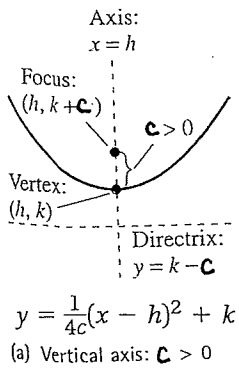
The fixed point is called the **focus of a parabola**.

The fixed line is called the **directrix**.

The distance between the vertex and the focus is the **focal length** of the parabola.

**Graph**





### Example 1: Parabolas with Equation $y = ax^2$

a.) What is an equation of the parabola with vertex at the origin and focus  $(0, \frac{1}{2})$ ?

b.) What are the focus and directrix of the parabola with equation  $y = 6x^2$ ?

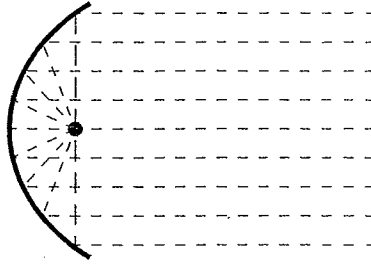
### Example 2: Parabolas with Equation $x = ay^2$

a.) What is an equation of a parabola with vertex at the origin and directrix  $x = -1/8$ ?

b.) What are the vertex, focus, and directrix of the parabola with equation  $x = \frac{3}{5}y^2$ ?

The geometry of a parabola implies a very important reflective property that gives real-world meaning to the word "focus."

As the diagram of the *parabolic reflector* shows, lines from the focus reflect off the parabola along lines parallel to the axis of symmetry. This is how a flashlight works. Conversely, lines parallel to the axis of symmetry reflect off the parabola directly into the focus. This is how a satellite dish works.



### **Example 3: Using Parabolas to Solve Problems**

The mirrored reflector of a flashlight is 16cm across and 10 cm deep. How far from the vertex should the light bulb be positioned?

### **Example 4: Analyzing a Parabola**

What are the vertex, focus, and directrix of the parabola with equation  $y = x^2 - 6x + 15$ ?

**Example 5: Writing an Equation of a Parabola**

Which is an equation of the parabola with vertex (10, 2) and focus (10, 1)?

a.)  $y = -\frac{1}{4}(x + 10)^2 - 2$

b.)  $y = -\frac{1}{4}(x - 10)^2 + 2$

c.)  $y = -\frac{1}{4}(x + 10)^2 + 2$

d.)  $y = -\frac{1}{4}(x - 10)^2 - 2$