

10-1

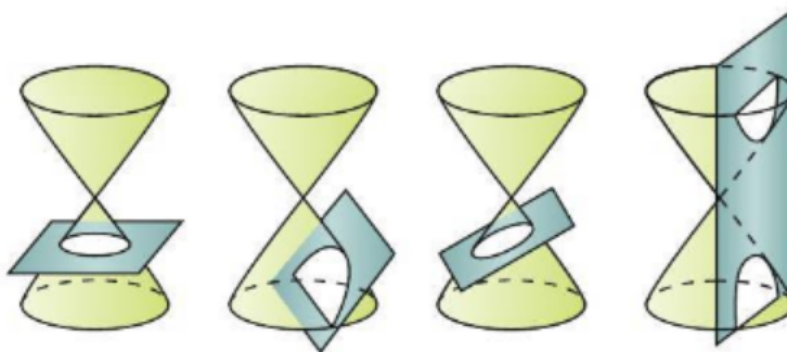
Exploring Conic Sections

Objective To graph and identify conic sections

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.



10-2 Parabolas

Objective To write the equation of a parabola and to graph parabolas

take note

Key Concept Parabola

Definition

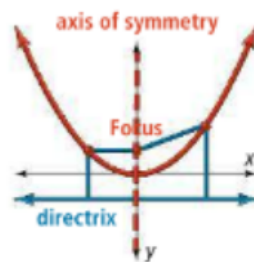
A parabola is the set of all points in a plane that are the same distance from a fixed line and a fixed point not on the line.

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

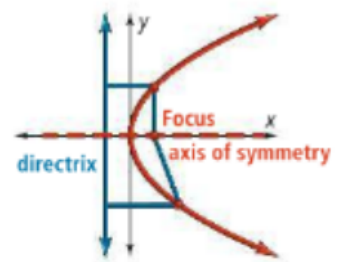
The fixed line is called the **directrix**.

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

Graph



Vertical Parabola



Horizontal Parabola



Key Concept Transformations of a Parabola

Vertical Parabola

Equation

Focus

Directrix

Vertex (0, 0)

$$y = \frac{1}{4c}x^2$$

$$(0, c)$$

$$y = -c$$

Vertex (h, k)

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

$$(h, k + c)$$

$$y = k - c$$

Horizontal Parabola

Equation

Focus

Directrix

Vertex (0, 0)

$$x = \frac{1}{4c}y^2$$

$$(c, 0)$$

$$x = -c$$

Vertex (h, k)

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

$$(h + c, k)$$

$$x = h - c$$

Problem 4 Analyzing a Parabola

What are the vertex, focus, and directrix of the parabola with equation $y = x^2 - 4x + 8$?

Know

The equation of the parabola

Need

- vertex
- focus
- directrix

Plan

- Find c , h , and k
- Use these values to find the vertex, focus, and directrix.

First, complete the square to get the equation in vertex form.

$$y = x^2 - 4x + 8$$

Standard form $y = ax^2 + bx + c$

$$y = (x^2 - 4x + 4) + 8 - 4 \quad \text{Add } \left(\frac{1}{2} \cdot -4\right)^2 \text{ inside parentheses; subtract it outside.}$$

$$y = (x - 2)^2 + 4$$

Vertex form $y = \frac{1}{4c}(x - h)^2 + k$

Note that, in this case, $\frac{1}{4c} = 1$, so $c = 0.25$.

The vertex (h, k) is $(2, 4)$.

The focus $(h, k + c)$ is $(2, 4.25)$.

The directrix $y = k - c$ is $y = 3.75$.



Got It? 4. What are the vertex, focus, and directrix of the parabola with equation $y = x^2 + 8x + 18$?

$$y = x^2 + 8x + 16 + 18 - 16$$

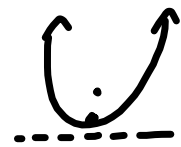
$$y = (x+4)^2 + 2$$

Vertex: $(-4, 2)$

Focus: $(-4, \frac{9}{4})$

Directrix: $y = 2 - \frac{1}{4}$

$$y = \frac{7}{4}$$



$$P = \frac{1}{4a} = \frac{1}{4(1)} = \frac{1}{4}$$