9.4 Graph and Write Equations of Ellipses

TEKS a.5, 2A.5.B, 2A.5.C

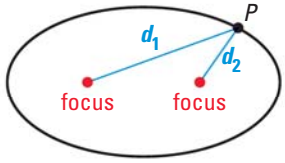
Before You graphed and wrote equations of parabolas and circles.

Now You will graph and write equations of ellipses.

Why? So you can model an elliptical region, as in Example 3.

Key Vocabulary
- **ellipse**
- **foci**
- **vertices**
- **major axis**
- **center**
- **co-vertices**
- **minor axis**

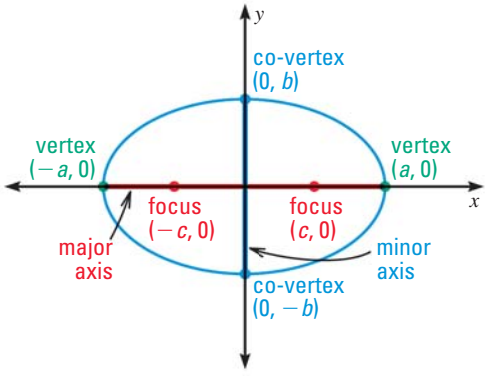
An **ellipse** is the set of all points P in a plane such that the sum of the distances between P and two fixed points, called the **foci**, is a constant.



$d_1 + d_2 =$ constant

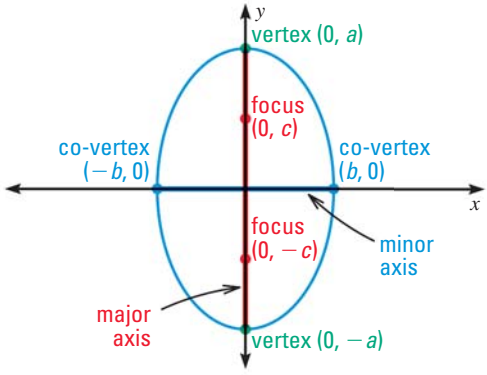
The line through the foci intersects the ellipse at the two **vertices**. The **major axis** joins the vertices. Its midpoint is the ellipse's **center**. The line perpendicular to the major axis at the center intersects the ellipse at the two **co-vertices**, which are joined by the **minor axis**. In this chapter, ellipses have a horizontal or a vertical major axis.

IDENTIFY AXES
Observe that the major axis of an ellipse contains the foci and is always longer than the minor axis.



Ellipse with horizontal major axis

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$



Ellipse with vertical major axis

$$\frac{x^2}{b^2} + \frac{y^2}{a^2} = 1$$

KEY CONCEPT *For Your Notebook*

Standard Equation of an Ellipse with Center at the Origin

Equation	Major Axis	Vertices	Co-Vertices
$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$	Horizontal	$(\pm a, 0)$	$(0, \pm b)$
$\frac{x^2}{b^2} + \frac{y^2}{a^2} = 1$	Vertical	$(0, \pm a)$	$(\pm b, 0)$

The major and minor axes are of lengths $2a$ and $2b$, respectively, where $a > b > 0$. The foci of the ellipse lie on the major axis at a distance of c units from the center, where $c^2 = a^2 - b^2$.