9.5 Graph and Write Equations of Hyperbolas

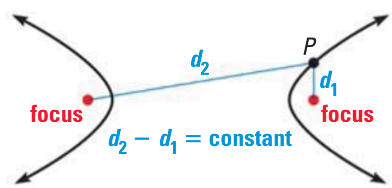
TEKS *a.5, 2A.5.B, 2A.5.C*

Before	You graphed and wrote equations of parabolas, circles, and ellipses.
Now	You will graph and write equations of hyperbolas.
Why?	So you can model curved mirrors, as in Example 3.

Key Vocabulary
- **hyperbola**
- **foci**
- **vertices**
- **transverse axis**
- **center**

Recall that 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 (the foci) is a constant.

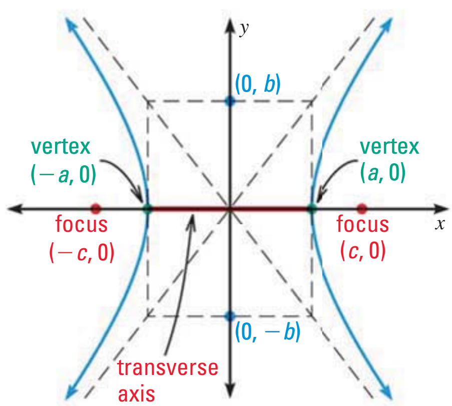
A **hyperbola** is the set of all points P such that the *difference* of the distances between P and two fixed points, again called the **foci**, is a constant.



The line through the foci intersects the hyperbola at the two **vertices**. The **transverse axis** joins the vertices. Its midpoint is the hyperbola's **center**. A hyperbola has two *branches*, and has two asymptotes that contain the diagonals of a rectangle centered at the hyperbola's center, as shown.

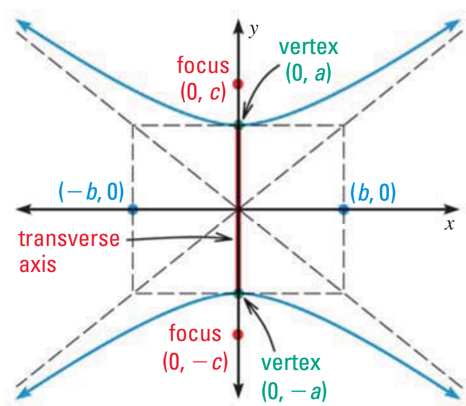
IDENTIFY AXES

If the x^2-term in the equation of a hyperbola is positive, the transverse axis lies on the x-axis. If the y^2-term is positive, the transverse axis lies on the y-axis.



Hyperbola with horizontal transverse axis

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



Hyperbola with vertical transverse axis

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

KEY CONCEPT *For Your Notebook*

Standard Equation of a Hyperbola with Center at the Origin

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

The foci lie on the transverse axis, c units from the center, where $c^2 = a^2 + b^2$.