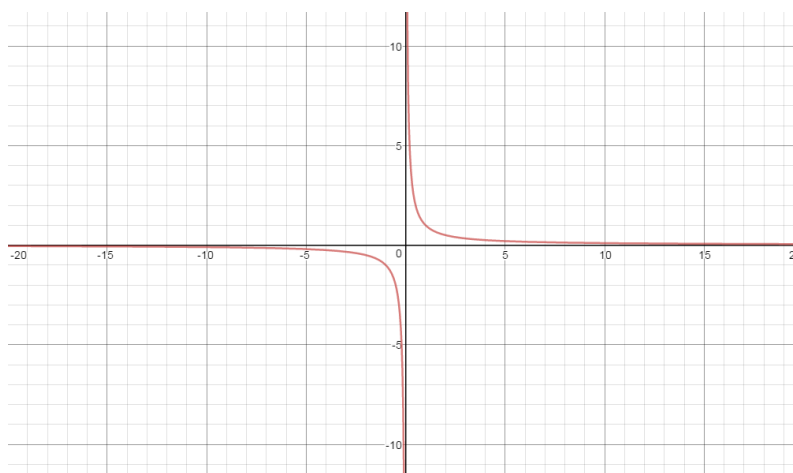


## Conics (continued) Hyperbola

Goal:

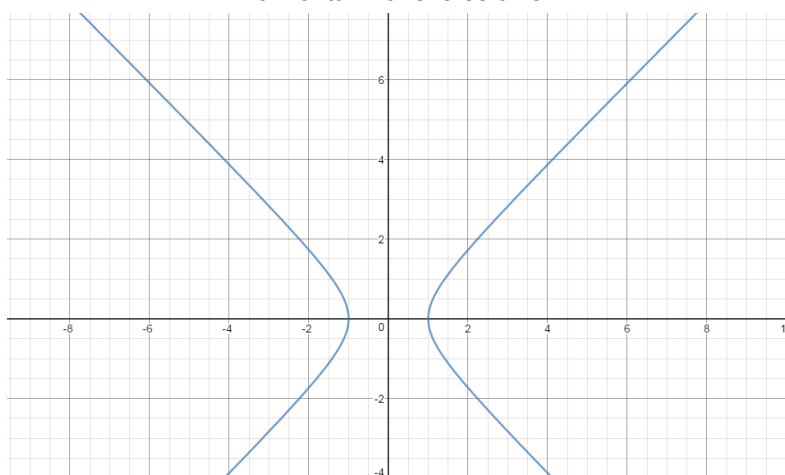
- to understand the characteristics of a hyperbola
- to determine the equation of a hyperbola centered at the origin

We have previously seen hyperbolas when studying rational functions. In that case, the asymptotes were horizontal and vertical.

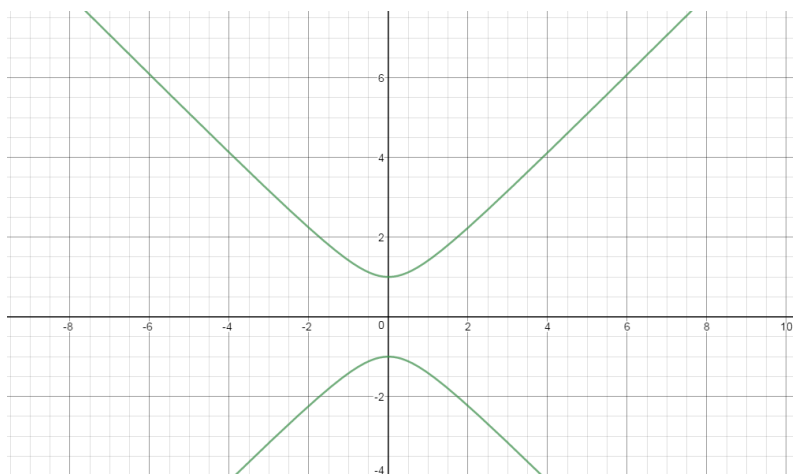


For the initial study of conics, we look at hyperbolas where the asymptotes are diagonals. This means that the branches of the hyperbola will have horizontal or vertical transverse axes.

Horizontal Transverse axis



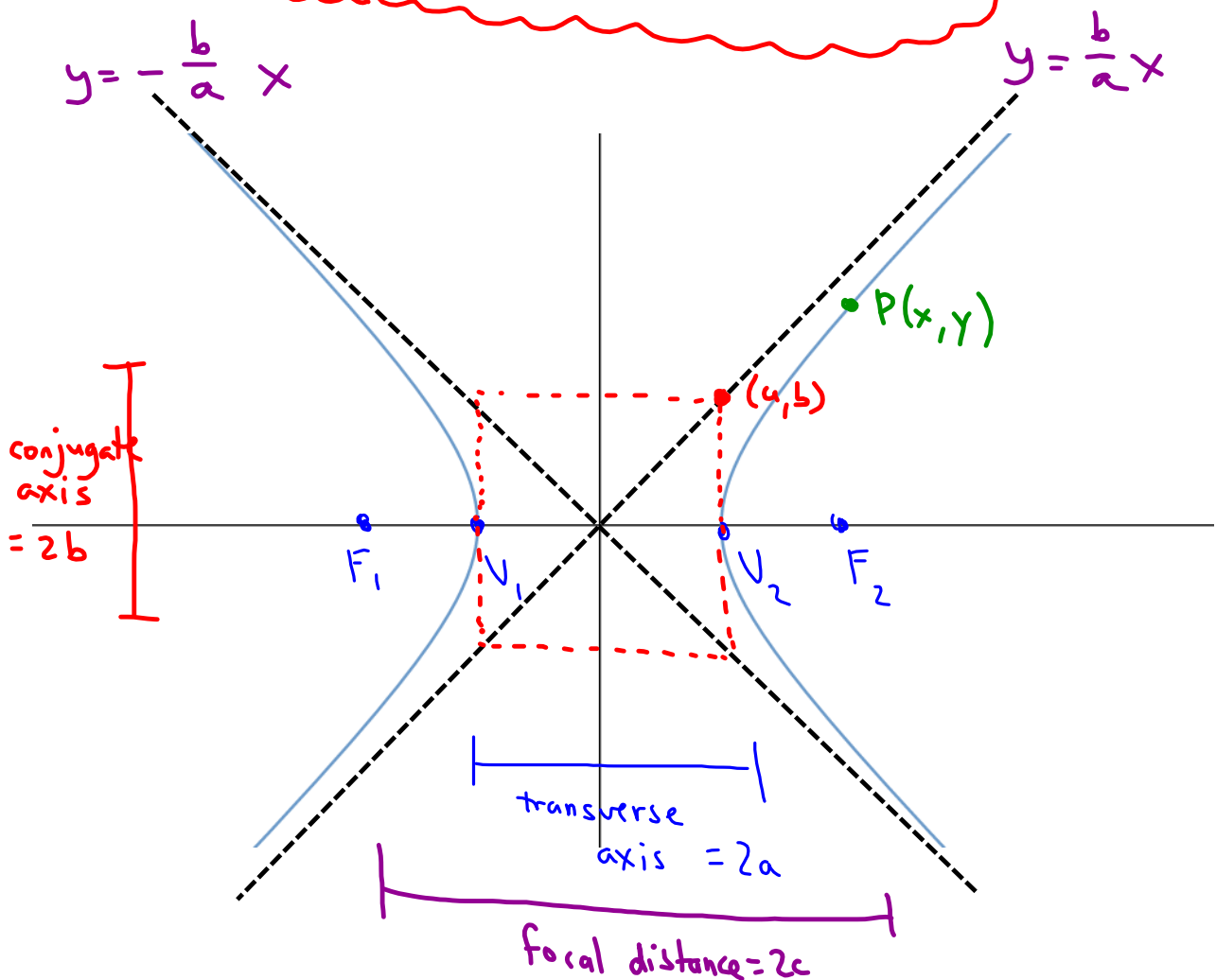
Vertical Transverse Axis



**Hyperbola** definition: A set of points where the difference of the distances between two fixed points, called foci, is fixed.

$$d(PF_1) - d(PF_2) = \text{constant}$$

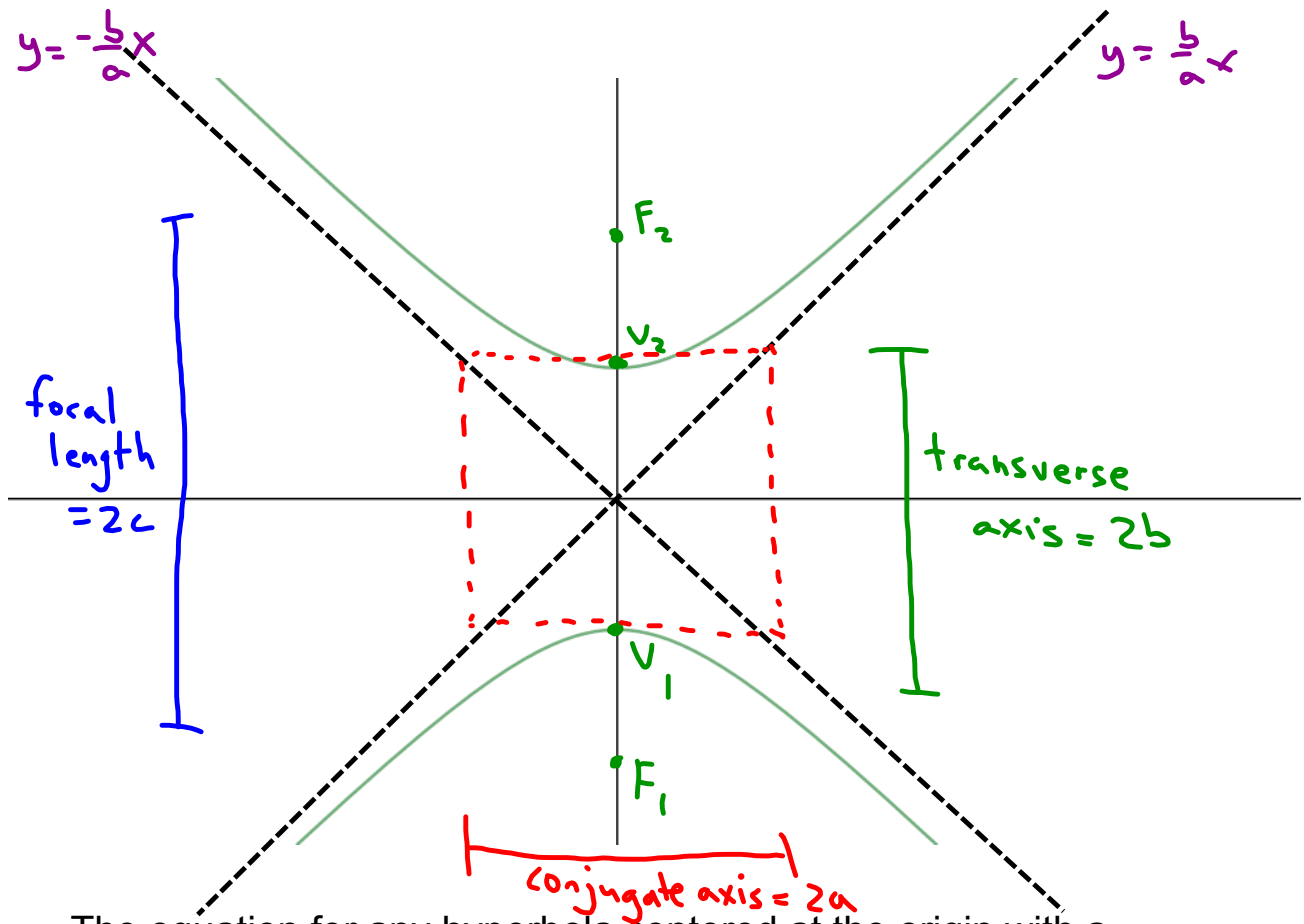
$$|d(PF_1) - d(PF_2)| = \text{transverse axis}$$



The equation for any hyperbola centered at the origin with a horizontal transverse axis can be written as:

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

$$\text{and } c^2 = a^2 + b^2$$



The equation for any hyperbola centered at the origin with a vertical transverse axis can be written as:

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

$$c^2 = a^2 + b^2$$

OR

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

Sketch  $\frac{x^2}{16} - \frac{y^2}{9} = 1$ ,

$$\begin{aligned} a^2 &= 16 & a &= \pm 4 \\ b^2 &= 9 & b &= \pm 3 \\ c^2 &= 25 & c &= \pm 5 \end{aligned}$$

find the coordinates of the foci, vertices, the length of the transverse axis and the length of the conjugate axis.

