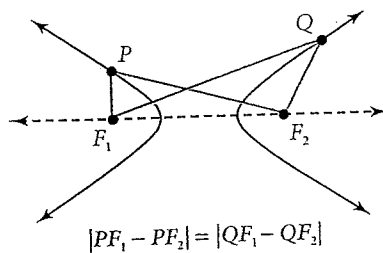


Definition of a Hyperbola

A hyperbola is the set of points $P(x, y)$ in a plane such that the absolute value of the difference between the distances from P to two fixed points in the plane, F_1 and F_2 , called the foci, is a constant.

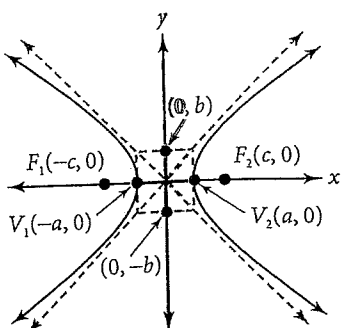


Standard Equation of a Hyperbola

The standard equation of a hyperbola centered at the origin is given below.

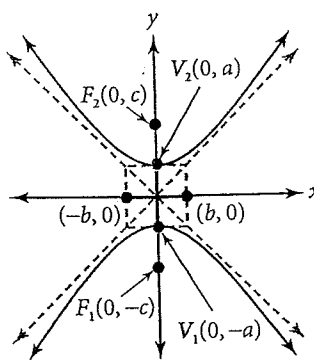
Horizontal transverse axis

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



Vertical transverse axis

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



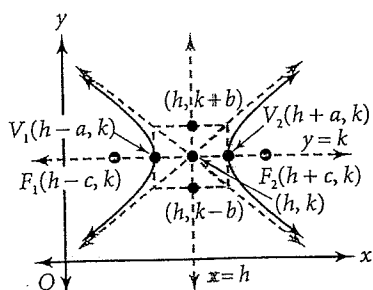
- In each case:
- $a^2 + b^2 = c^2$,
 - the length of the transverse axis is $2a$, and
 - the length of the conjugate axis is $2b$.

Standard Equation of a Translated Hyperbola

The standard equation of a hyperbola centered at (h, k) is given below.

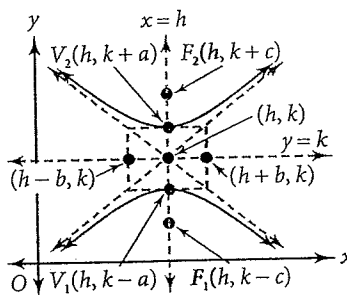
Horizontal transverse axis

$$\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1$$



Vertical transverse axis

$$\frac{(y-k)^2}{a^2} - \frac{(x-h)^2}{b^2} = 1$$



- In each case:
- $a^2 + b^2 = c^2$,
 - the length of the transverse axis is $2a$, and
 - the length of the conjugate axis is $2b$.

Asymptotes of a Hyperbola

standard equation: $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1 \rightarrow$ asymptotes: $y = \pm \frac{b}{a}x$
 standard equation: $\frac{y^2}{a^2} - \frac{x^2}{b^2} = 1 \rightarrow$ asymptotes: $y = \pm \frac{a}{b}x$

$$y - k = \pm \frac{b}{a}(x - h)$$

$$y - k = \pm \frac{a}{b}(x - h)$$