1. Section 11.4 The Hyperbola

Definition 1.1. *A* **hyperbola** *is the set of all points, $P = (x, y)$, such that the difference of the distances between two points, called the* **foci** *of the hyperbola, is constant.*
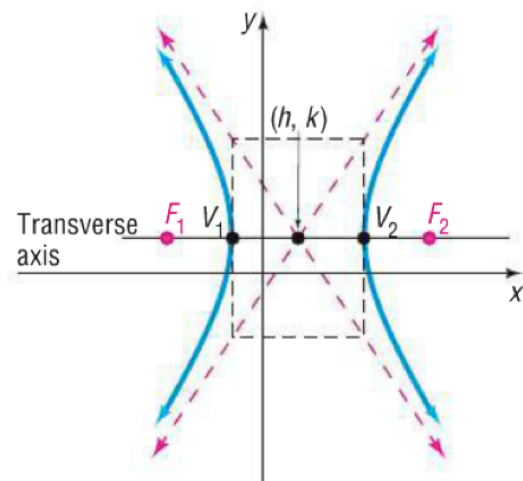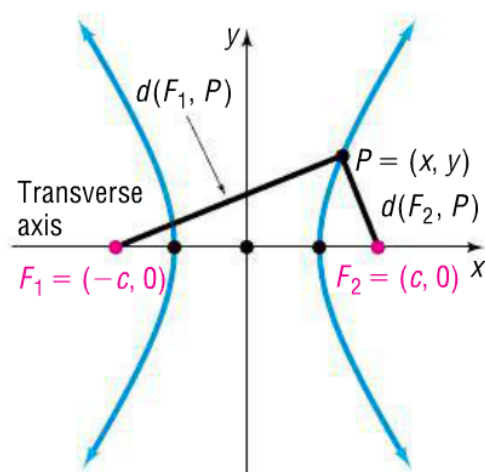
The midpoint of the line segment joining the foci is the **center** *of the hyperbola.*

The **transverse axis** *is the line through the foci, center, and vertices.*

The **conjugate axis** *is the line through the center perpendicular to the transverse axis.*

The **vertices** *of the hyperbola are the points where the hyperbola intersects the transverse axis.*
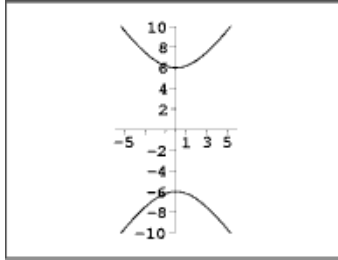
The **branches** *are the two separate curves.*

2. Equations

Equation a^2 first/positive	$\dfrac{(x-h)^2}{a^2} - \dfrac{(y-k)^2}{b^2} = 1$	$\dfrac{(y-k)^2}{a^2} - \dfrac{(x-h)^2}{b^2} = 1$
relation between a, b, and c		
Transverse Axis		
Center		
Foci		
Vertices		
Asymptotes		
Sketch		

Example 2.1. *Select the equation of the conic graphed below.*

(A) $\dfrac{x^2}{36} - \dfrac{y^2}{28} = 1$

(B) $\dfrac{x^2}{28} - \dfrac{y^2}{36} = 1$

(C) $\dfrac{y^2}{36} - \dfrac{x^2}{28} = 1$

(D) $\dfrac{y^2}{28} - \dfrac{x^2}{36} = 1$

Example 2.2. *Write (using lower case x and y) the formula for the hyperbola with center $(0,0)$, vertex at $(0,-6)$, and an asymptote $y = 2x$.*

Example 2.3. *Find the equation of the hyperbola with foci at $(-2, 2)$ and $(4, 2)$ and vertex at $(3, 2)$.*

Example 2.4. *Find the center, foci, vertices, transverse axis, conjugate axis, and the asymptotes for the conic*

$$\frac{x^2}{8} - \frac{y^2}{16} = 1.$$

Example 2.5. *Find the center, foci, vertices, transverse axis, conjugate axis, and the asymptotes for the conic*

$$2(x + 1)^2 - (y - 2)^2 = 16.$$

Example 2.6. *Analyze the equation. (In other words, find the type of conic and where applicable vertices, foci, directrix, asymptotes, etc.)*

$$4x^2 + 9y^2 - 16x - 18y = 11$$

Example 2.7. *Analyze the equation.*

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

Example 2.8. *Analyze the equation.*

$$0 = y^2 - 8x - y + 3$$