Name: _____

Algebra 2: Section 7-5, Hyperbolas

Equations of Hyperbolas: A **hyperbola** is the set of all points in a plane such that the absolute value of the *difference* of the distances from any point on the hyperbola to any two given points in the plane, called the **foci**, is constant (2a). In the table, the lengths *a*, *b*, and *c* are related by the formula, $c^2 = a^2 + b^2$

Standard Form of Equation	$\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1$	$\frac{(y-k)^2}{a^2} - \frac{(x-h)^2}{b^2} = 1$
Equations of the Asymptotes	y = +/- $\frac{b}{a}$ (x − h) + k	y = +/- $\frac{a}{b}$ (x − h) + k
Center	(h, k)	(h, k)
Transverse Axis	Horizontal	Vertical
Foci	(h − c, k) & (h + c, k)	(h, k − c) & (h, k + c)
Vertices	(h − a, k) & (h + a, k)	(h, k − a) & (h, k + a)

The midpoint of the segment containing the foci of a hyperbola is the **center** of the hyperbola. The point on each "branch" of the hyperbola that is nearest the center is a **vertex**. As a hyperbola curves away from the center, the branches approach lines called the **asymptotes**.

The distance from the center to a vertex is *a* units. The distance from the center to a focus is *c* units. There are two axes of symmetry. The **transverse axis is a segment of length 2a** whose endpoints are the vertices of the hyperbola. The **conjugate axis is a segment of length 2b** units that is perpendicular to the transverse axis at the center.

When the transverse axis is horizontal (in other words, when the center, foci, and vertices line up side by side, parallel to the *x*-axis), then the a^2 goes with the *x* part of the hyperbola's equation, and the *y* part is subtracted.

When the transverse axis is vertical (in other words, when the center, foci, and vertices line up above and below each other, parallel to the *y*-axis), then the a^2 goes with the *y* part of the hyperbola's equation, and the *x* part is subtracted.

[1]To graph a hyperbola, graph the center first. [2]Determine the orientation. [3]Next, use the value of *a* (from the center) to plot the vertices. [4]Use the value of *b* and plot points in the other direction from the center. [5]Draw a box to enclose the four points you just plotted. [6]Sketch in the asymptotes through the diagonals of the box. [7]Sketch in the branches of the hyperbola! [8]Find the value of c and plot the foci (from the center).