

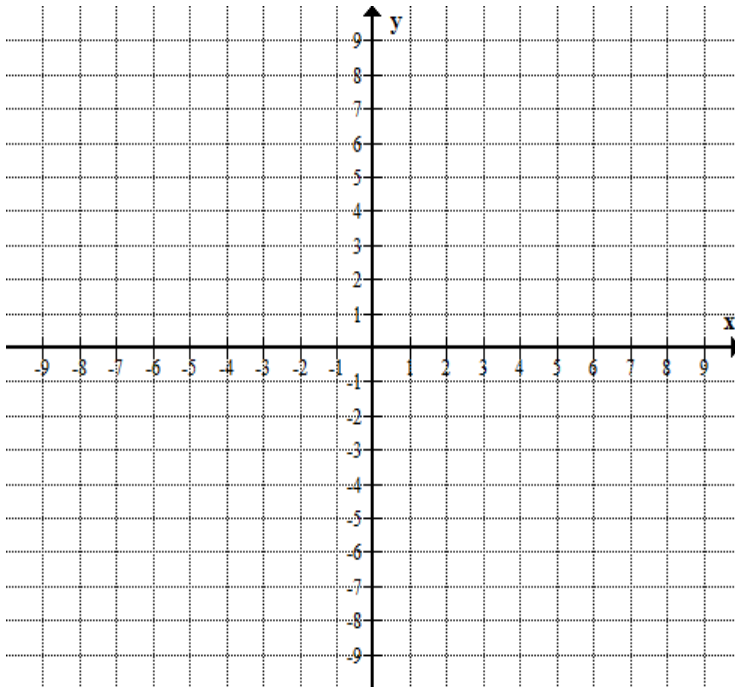
Cypress College Math Review: The Hyperbola

Math 40 students – only the first two examples apply to your course. Recall that the standard form for the equation of a hyperbola is

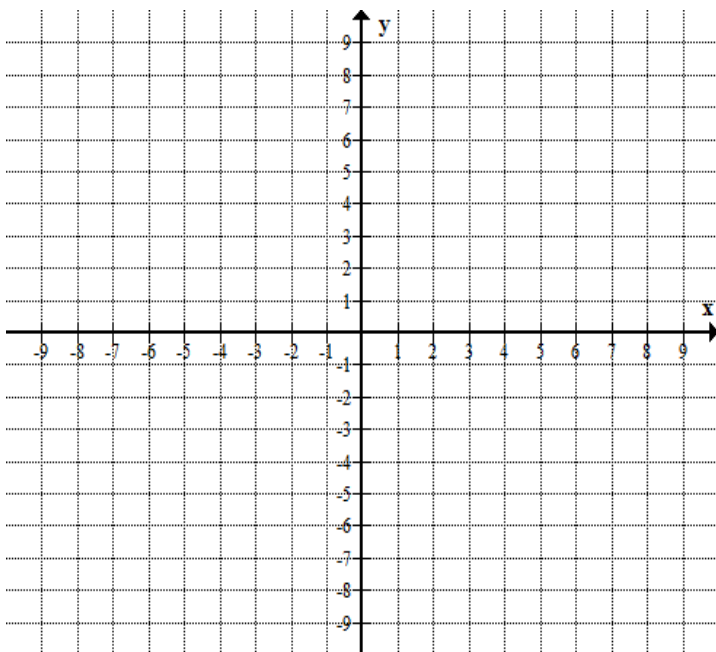
$$\boxed{\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1} \quad \boxed{\frac{y^2}{a^2} - \frac{x^2}{b^2} = 1} \quad \text{center } (0,0)$$

$$\boxed{\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1} \quad \boxed{\frac{(y-k)^2}{a^2} - \frac{(x-h)^2}{b^2} = 1} \quad \text{center } (h,k)$$

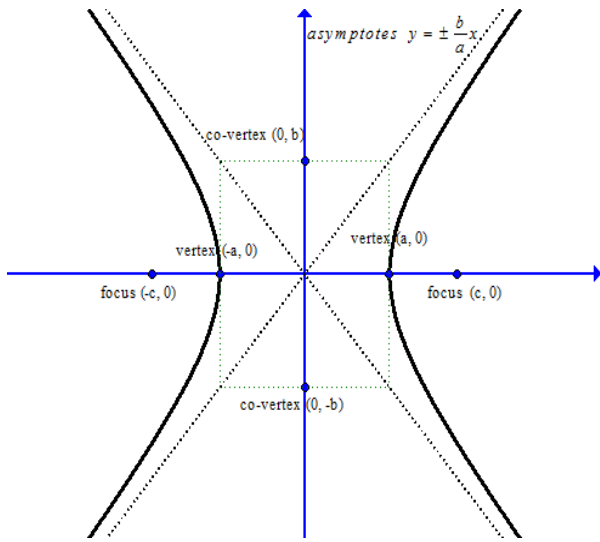
Example) $\frac{(x-3)^2}{16} - \frac{(y+2)^2}{9} = 1$



Example) $9y^2 = 144 + 16x^2$



In our Math 141 classes you will also need to find and graph the foci of the hyperbola and determine the equation of the asymptotes. First, recall that the transverse axis is the line that goes through the center, the vertices and the foci.



“a” is the distance from the center to a vertex

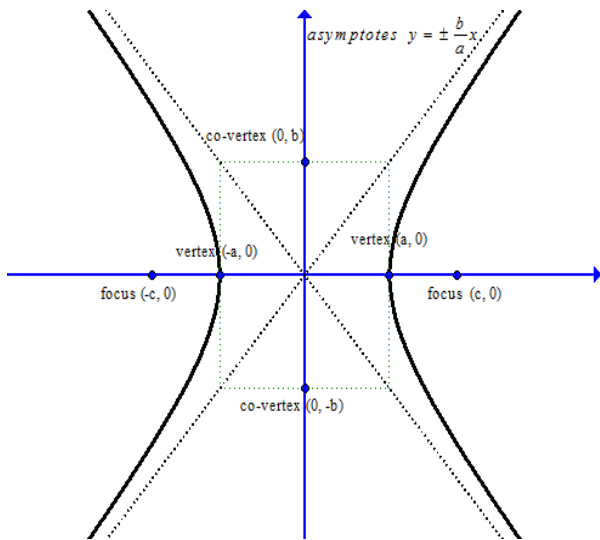
“b” is the distance from the center to a co-vertex

“c” is the distance from the center to a focus

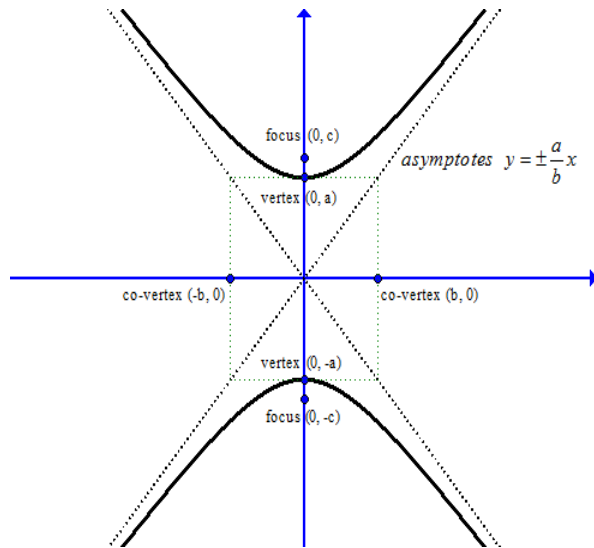
The conjugate axis is the line that goes through the center that is perpendicular to the transverse axis.

The Pythagorean identity for hyperbolas is $a^2 + b^2 = c^2$.

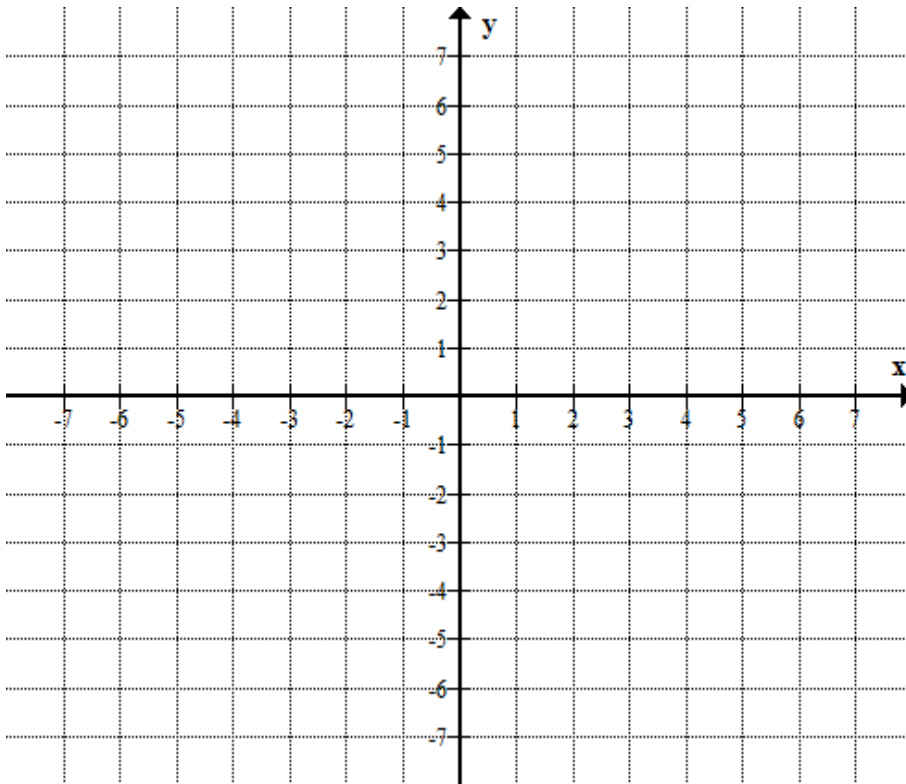
Horizontal transverse axis:



Vertical transverse axis:

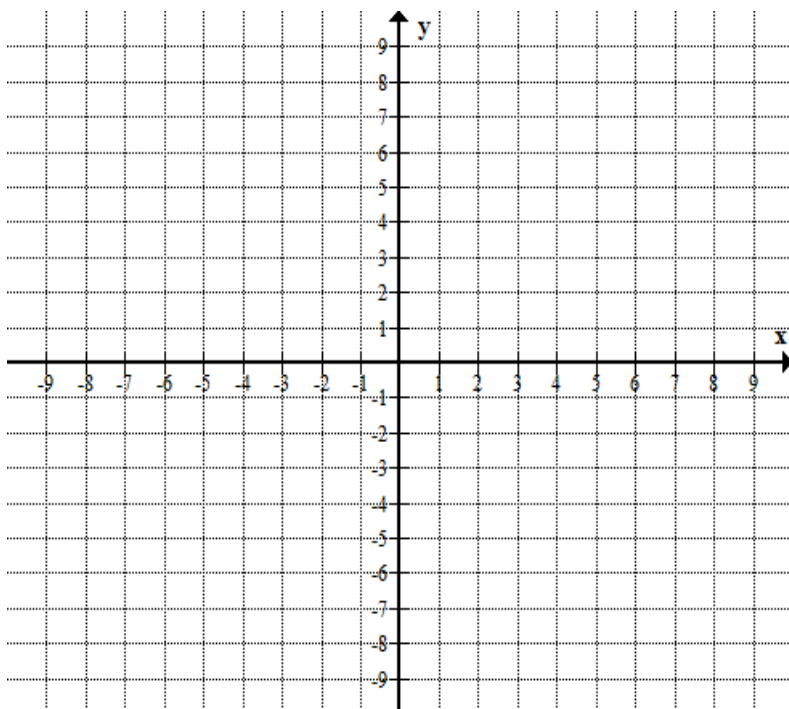


Example) $\frac{(x-1)^2}{4} - \frac{(y+2)^2}{9} = 1$

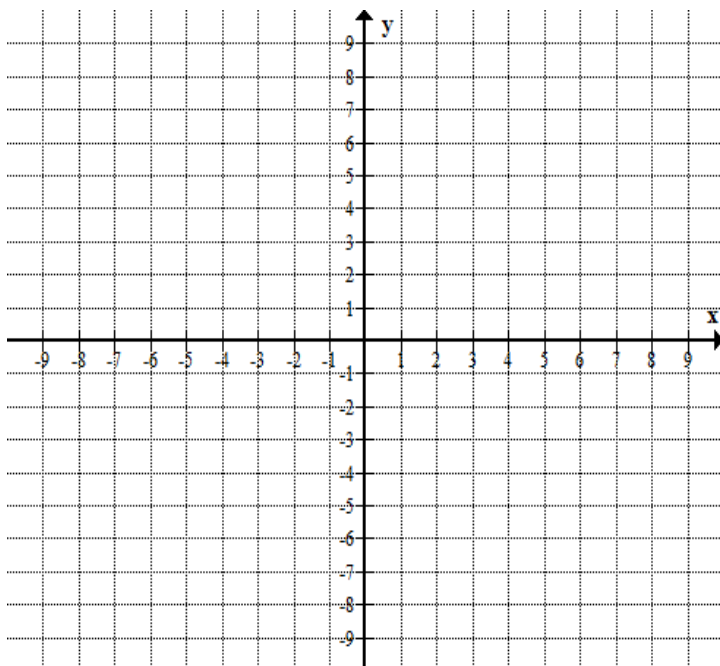


Example) $16y^2 - 9x^2 - 64y - 54x - 161 = 0$

$$\frac{(y-2)^2}{9} - \frac{(x+3)^2}{16} = 1$$

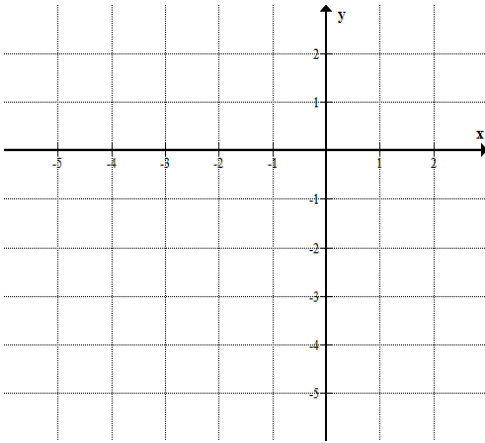


Example) Find the equation of the hyperbola with vertices $(0, \pm 6)$, and asymptotes $y = \pm \frac{3}{2}x$



Example) Find the equation of the hyperbola with vertices $\left(\frac{1}{2}, -3\right)$ and $\left(\frac{-9}{2}, -3\right)$, and asymptotes

$$y + 3 = \pm \frac{6}{5}(x + 2)$$



Example) Find the equation of the hyperbola with focus at $(1, 7)$ and vertices at $(9, 7)$ and $(7, 7)$.

