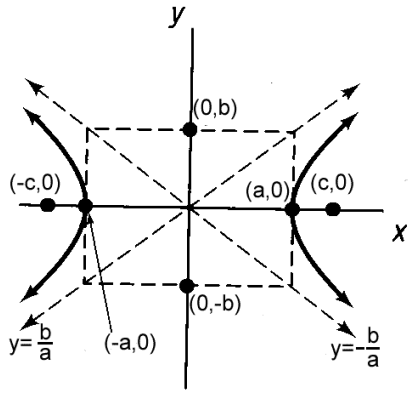
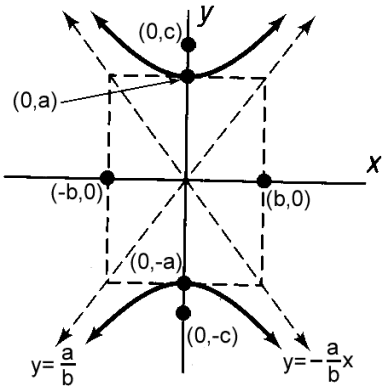
10.4 The Hyperbola

Hyperbolas centered at (0, 0).



(a) $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ Asymptotes: $y=\pm\frac{b}{a}x$



(b) $\frac{y^2}{a^2}-\frac{x^2}{b^2}=1$ Asymptotes: $y=\pm\frac{a}{b}x$

In both of these cases the length of the **transverse** axis is 2a. The length of the **conjugate** axis is 2b. To find the c value in any of these graphs, use the equation $c=\sqrt{a^2+b^2}$. This is used to find the foci. To find the **eccentricity** use the formula is $e=\frac{c}{a}$. The larger the e the wider the hyperbola is.

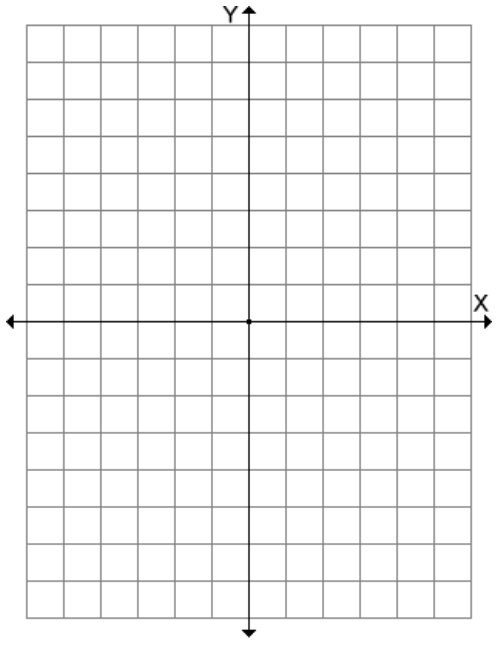
EXAMPLE: Graph $\frac{x^2}{9}-\frac{y^2}{4}=1$ and identify the foci, eccentricity, center, length of the transverse and conjugate axis, vertices, and the equations of the asymptotes.

Center:_____ Vertices:_____

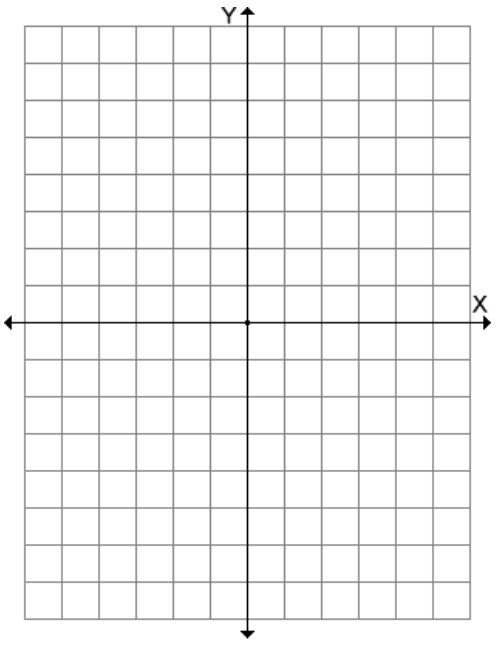
Foci:_____ Eccentricity:_____

Transverse:_____ Conjugate:_____

Asymptotes:_____



EXAMPLE: Graph $4y^2 - 16x^2 = 64$ and identify the foci, eccentricity, center, length of the transverse and conjugate axis, vertices, and the equations of the asymptotes.



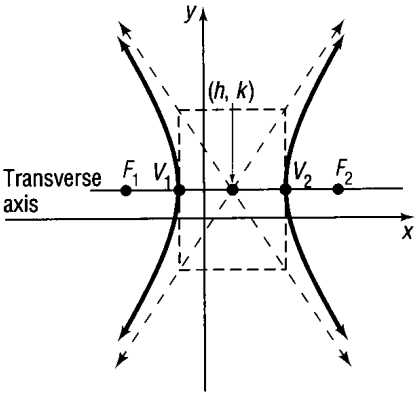
Center:_____ Vertices:_____

Foci:_____ Eccentricity:_____

Transverse:_____ Conjugate:_____

Asymptotes:_____

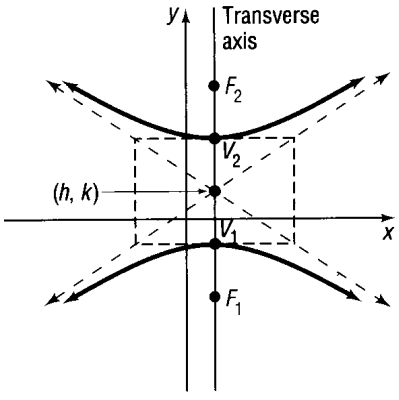
Hyperbolas centered at (h, k).



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

Asymptotes: $y - k = \pm\dfrac{b}{a}(x-h)$

Vertices: $(h \pm a,\ k)$, Foci: $(h \pm c,\ k)$

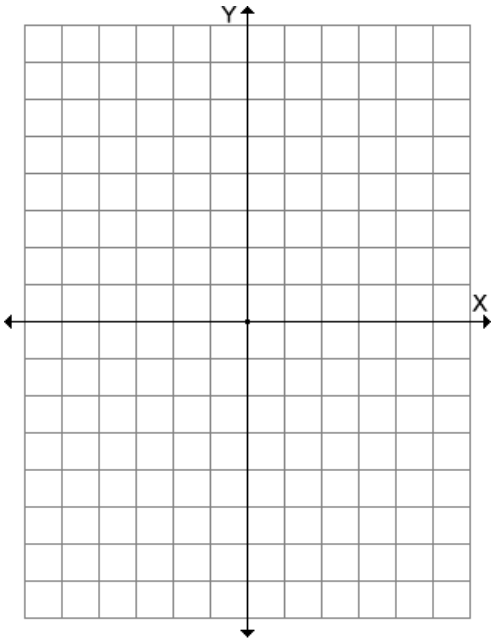


(b) $\dfrac{(y-k)^2}{a^2} - \dfrac{(x-h)^2}{b^2} = 1$

Asymptotes: $y - k = \pm\dfrac{a}{b}(x-h)$

Vertices: $(h,\ k \pm a)$, Foci: $(h,\ k \pm c)$

EXAMPLE: Graph $\frac{(x-3)^2}{1}-\frac{(y+1)^2}{4}=1$ and identify the foci, eccentricity, center, length of the transverse and conjugate axis, vertices, and the equations of the asymptotes.



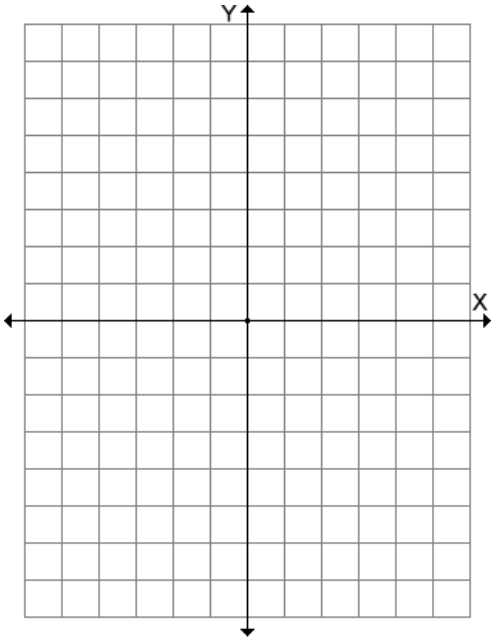
Center:_____ Vertices:_____

Foci:_____ Eccentricity:_____

Transverse:_____ Conjugate:_____

Asymptotes:_____

EXAMPLE: Graph $16x^2-9y^2-32x+90y-353=0$ and identify the foci, eccentricity, center, length of the transverse and conjugate axis, vertices, and the equations of the asymptotes.



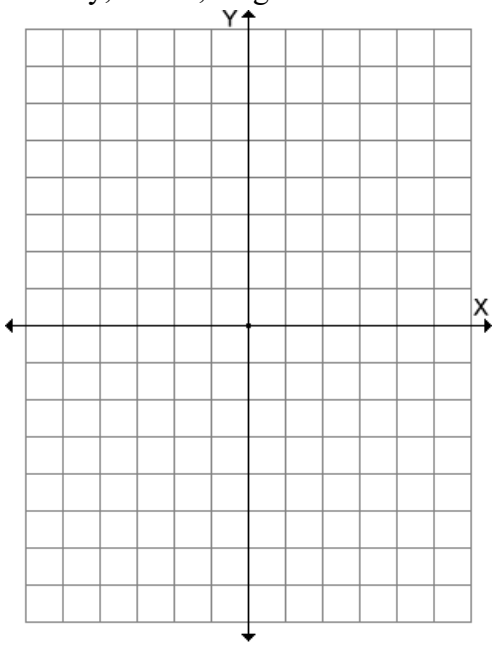
Center:_____ Vertices:_____

Foci:_____ Eccentricity:_____

Transverse:_____ Conjugate:_____

Asymptotes:_____

EXAMPLE: Graph $9y^2 - 18y - 4x^2 - 16x - 43 = 0$ and identify the foci, eccentricity, center, length of the transverse and conjugate axis, vertices, and the equations of the asymptotes.



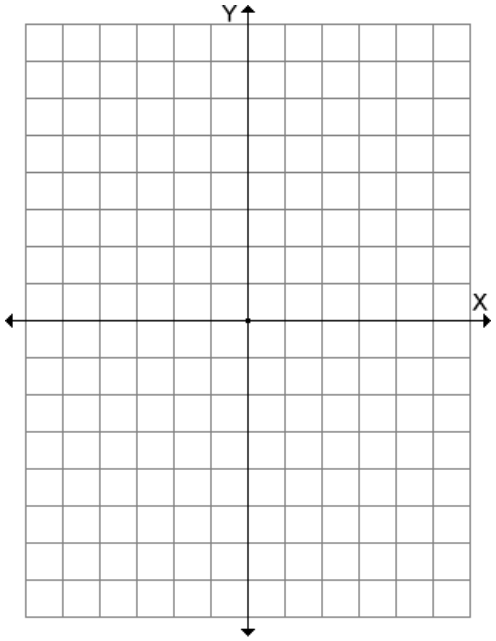
Center:_____ Vertices:_____

Foci:_____ Eccentricity:_____

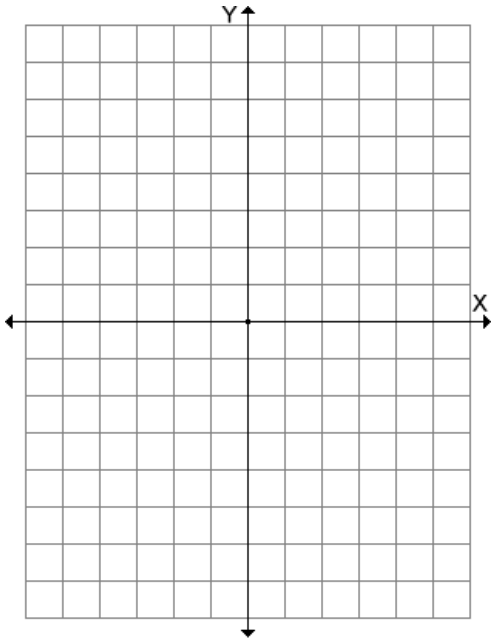
Transverse:_____ Conjugate:_____

Asymptotes:_____

EXAMPLE: Find an equation for the hyperbola centered at the origin with focus at (-3, 0) and vertex at (2, 0).



EXAMPLE: Find an equation for the hyperbola with a focus at (0, 6) and vertex at $(0, \pm 2)$.



EXAMPLE: Find an equation for the hyperbola with foci at $(0, \pm 2)$ and with an asymptote of $y = x$.