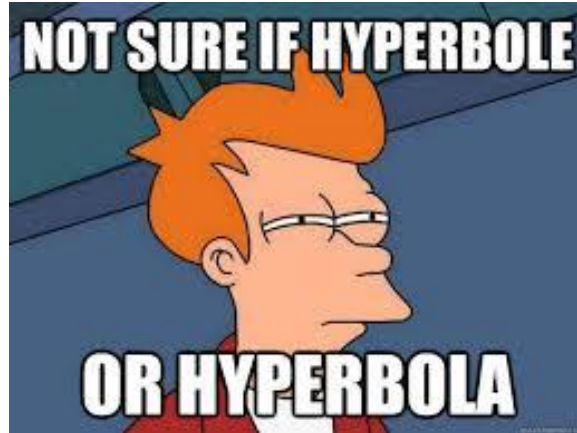


Precalculus
Lesson 10.4: The Hyperbola
Mrs. Snow, Instructor



A **hyperbola** is the collection (locus) of all points in the plane, the difference of whose distances from two fixed points, called the foci, is a constant.

Equation of a Hyperbola Centered about the origin with Transverse Axis along the x-axis

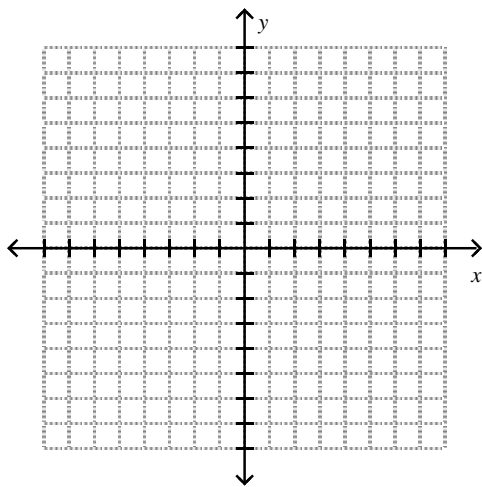
$$\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$$

where
 $b^2 = c^2 - a^2$

center at $(0, 0)$; foci at $(\pm c, 0)$; and vertices at $(\pm a, 0)$

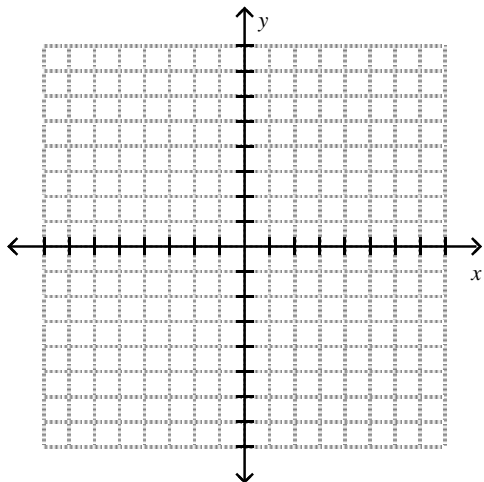
two oblique asymptotes: $y = \pm \frac{b}{a}x$

Find an equation of the hyperbola with center at the origin, one focus at $(3, 0)$ and one vertex at $(-2, 0)$. Graph



Analyze the equation; find the center, transverse axis, vertices, and foci. Graph.

$$\frac{x^2}{16} - \frac{y^2}{4} = 1$$



Equation of a Hyperbola; Center at (0, 0); Transverse Axis along the y-axis

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

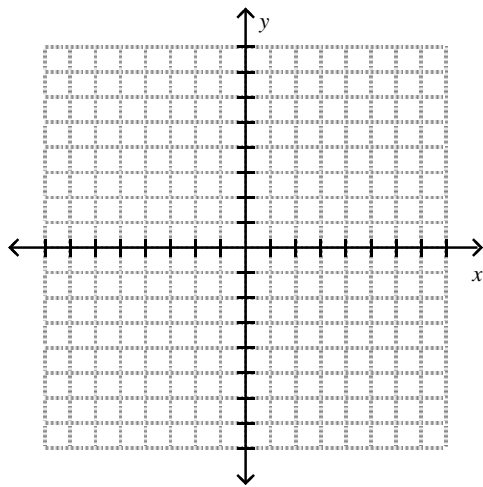
$$b^2 = c^2 - a^2$$

center at (0, 0); foci at (0, ±c); and vertices at (0, ±a)

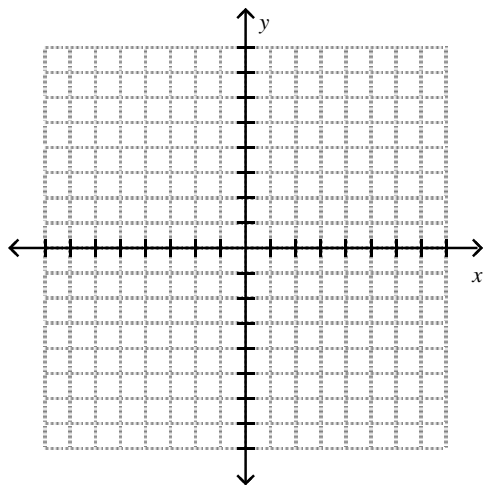
two oblique asymptotes: $y = \pm \frac{a}{b}x$

Analyze the equation, find the center, transverse axis, vertices, and foci and graph:

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

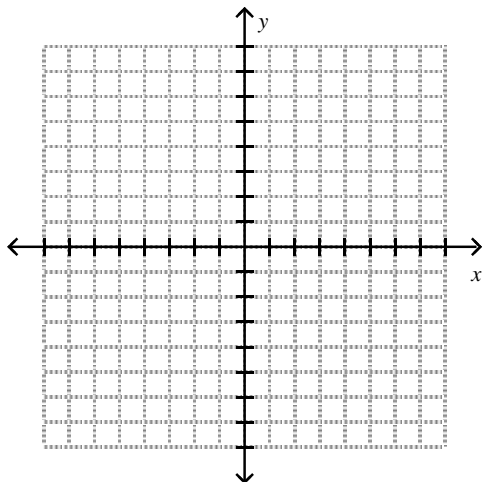


Find an equation of the hyperbola having one vertex at $(0,2)$ and foci at $(0,-3)$ and $(0,3)$. Graph.

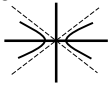
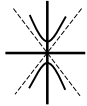


Analyze the equation, find the center, transverse axis, vertices, foci, and asymptotes and graph:

$$9x^2 - 4y^2 = 36$$

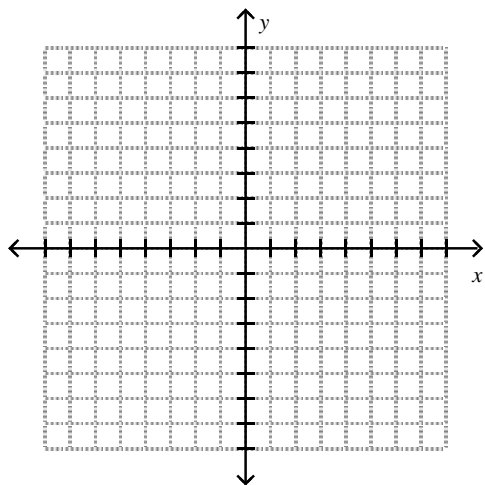


Hyperbolas at a center of (h, k)
Transverse Axis Parallel to a Coordinate Axis
 $b^2 = c^2 - a^2$

Opens	Opens left and right Transverse axis x-axis 	Opens up and down Transverse axis y-axis 
Form:	$\frac{(x - h)^2}{a^2} - \frac{(y - k)^2}{b^2} = 1$	$\frac{(y - k)^2}{a^2} - \frac{(x - h)^2}{b^2} = 1$
Center:	(h, k)	(h, k)
Vertices	$(h + a, k)$ and $(h - a, k)$	$(h, k + a)$ and $(h, k - a)$
Slope of Asymptotes	$\pm \frac{b}{a}$	$\pm \frac{a}{b}$
Equation of Asymptotes	$y - k = \pm \frac{b}{a}(x - h)^*$	$y - k = \pm \frac{a}{b}(x - h)^*$
Foci	$(h + c, k), (h - c, k)$	$(h, k + c), (h, k - c)$

*The homework will ask for the equation of the asymptote. For the quiz and test, all you will be expected to answer is the slope of the asymptote line.

Find an equation for the hyperbola with center at $(1, -2)$, one focus at $(4, -2)$, and one vertex at $(3, -2)$. Graph the equation by hand.



Analyze the equation, find the center, transverse axis, vertices, foci, and asymptotes and graph:

$$-x^2 + 4y^2 - 2x - 16y + 11 = 0$$

