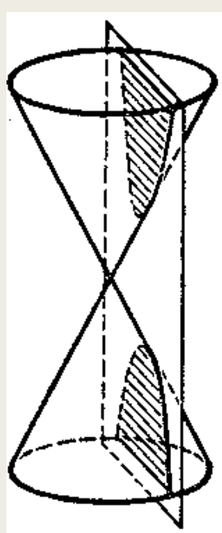
7-3: HYPERBOLAS

CP Precalculus

Mr. Gallo

Slice a cone with a plane parallel to the vertical axis and get a hyperbola.



HYPERBOLAS

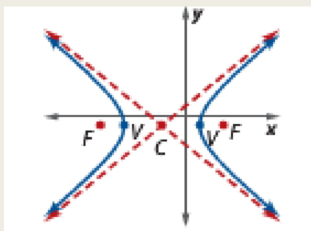
Equations:

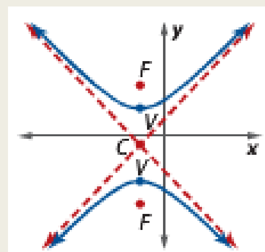
$$\frac{(x-h)^2}{a^2}-\frac{(y-k)^2}{b^2}=1 \quad \text{OR} \quad \frac{(y-k)^2}{b^2}-\frac{(x-h)^2}{a^2}=1$$

- lies horizontally
- opens to the left and right

lies vertically
opens up and down

WHICHEVER VARIABLE COMES FIRST AFFECTS DIRECTION OF HYPERBOLA!





The Hyperbola

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

- Center = (h, k)
- a = how far to count horizontally
- b = how far to count vertically

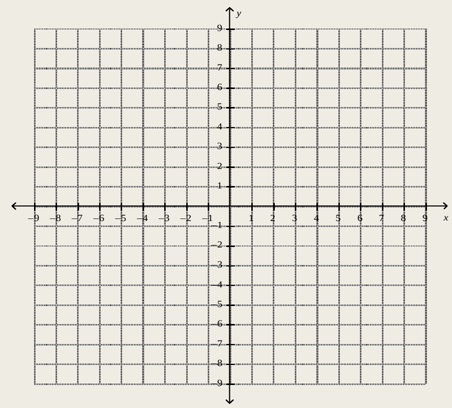
Example 1:

- Given $$\frac{x^2}{25} - \frac{y^2}{4} = 1$$

Center = $(0,0)$

a = $\sqrt{25} = 5$

b = $\sqrt{4} = 2$

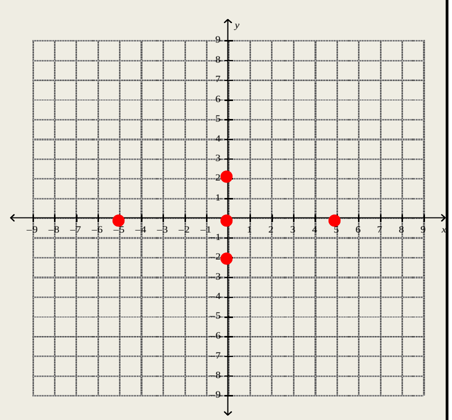


Graphing the Hyperbola

- To graph, **draw the rectangle and its diagonals!**

1. Locate center
2. Count out a and b (as you would for an ellipse)

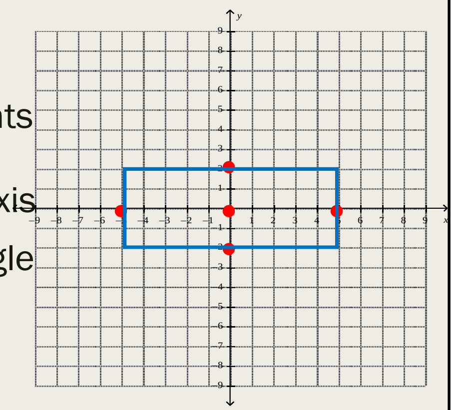
(h, k) = (0, 0)
a = 5 b = 2



Graphing the Hyperbola

3. Extend vertical segments through the points **a** units from the center on the x-axis.
4. Extend horizontal segments through the points **b** units from the center on the y-axis
5. Connect to form a rectangle

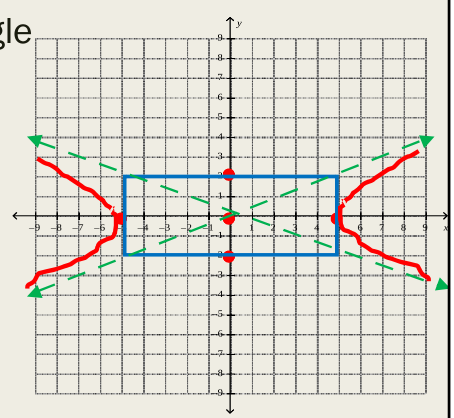
(h, k) = (0, 0)
a = 5 b = 2



Graphing the Hyperbola

6. Draw and extend the diagonals of the rectangle.
7. Fit hyperbola onto rectangle so it fits within diagonals (asymptotes)

(h, k) = (0, 0)
a = 5 b = 2

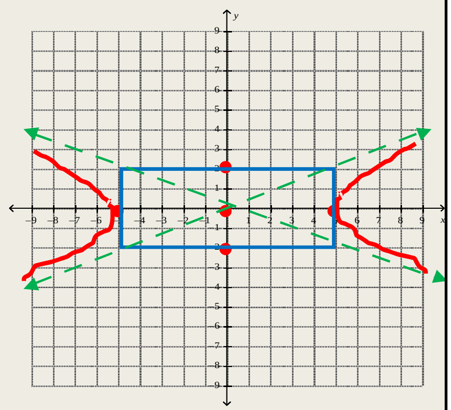


Graphing the Hyperbola

(h, k) = (0, 0)
a = 5   b = 2

- Vertices of the hyperbola are $(-5,0)(5,0)$
- Asymptotes of the hyperbola are

$$y=\pm\frac{b}{a}x \qquad y=\pm\frac{2}{5}x$$



Example 2:

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

Center = $(4,-2)$

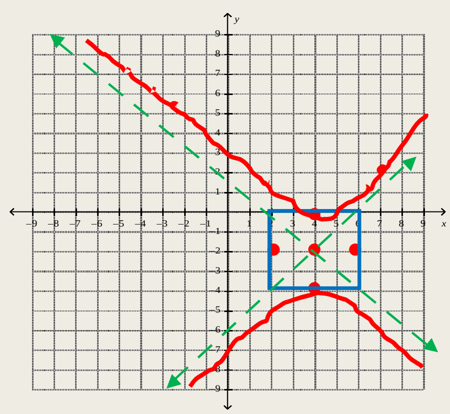
a = $\sqrt{9}=3$

b = $\sqrt{4}=2$

Vertices = $(4,-4)(4,0)$

Asymptotes = ______

$$y+2=\pm\frac{2}{3}(x-4)$$



Example 3

Given $16y^2 - 4x^2 = 400$

Center = $(0,0)$

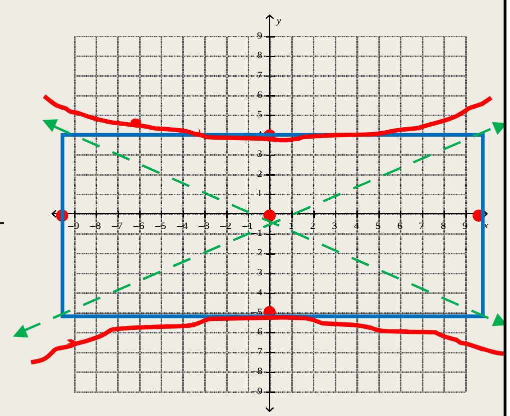
a = 10

b = 5

Vertices = $(0,5)(0,-5)$

Asymptotes = ______

$y = \pm\frac{1}{2}x$



Homework: 7-3 Hyperbola Homework WS