

## 9.3 Hyperbolas

Homework:

Warm-Up:

1. What were your findings from the Folding Activity about the hyperbola?
2. And ↓. Skip #113

**True or False?** In Exercises 111–117, determine whether the statement is true or false. Justify your answer.

111. The equation  $x^2 + (y + 5)^2 = 25$  represents a circle with its center at the origin and a radius of 5.
  112. The graph of the equation  $x^2 + y^2 = r^2$  will have  $x$ -intercepts  $(\pm r, 0)$  and  $y$ -intercepts  $(0, \pm r)$ .
  113. A circle is a degenerate conic.
  114. It is possible for a parabola to intersect its directrix.
  115. The point which lies on the graph of a parabola closest to its focus is the vertex of the parabola.
-

## 9.3 Hyperbolas

Homework: Finish Worksheet *none*

Warm-Up:

1. What were your findings from the Folding Activity about the hyperbola?
2. And ↓. Skip #113

**True or False?** In Exercises 111–117, determine whether the statement is true or false. Justify your answer.

111. The equation  $x^2 + (y + 5)^2 = 25$  represents a circle with its center at the origin and a radius of 5.
112. The graph of the equation  $x^2 + y^2 = r^2$  will have  $x$ -intercepts  $(\pm r, 0)$  and  $y$ -intercepts  $(0, \pm r)$ .
113. A circle is a degenerate conic.
114. It is possible for a parabola to intersect its directrix.
115. The point which lies on the graph of a parabola closest to its focus is the vertex of the parabola.

# Standard Form Equation of a Hyperbola

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

Horizontal  
Hyperbola

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

Vertical  
Hyperbola

★ The **center** of a hyperbola is at the point  $(h, k)$  in either form

★ For either hyperbola,  $c^2 = a^2 + b^2$

Where  $c$  is the distance from the center to a focus point.

★ The equations of the **asymptotes** are

$$y = \frac{b}{a}(x - h) + k$$

$$y = -\frac{b}{a}(x - h) + k$$

**Example 1:** Find the standard form equation of the hyperbola with foci  $(-1, 2)$  and  $(5, 2)$  and vertices  $(0, 2)$  and  $(4, 2)$ .

$$c^2 = a^2 + b^2$$

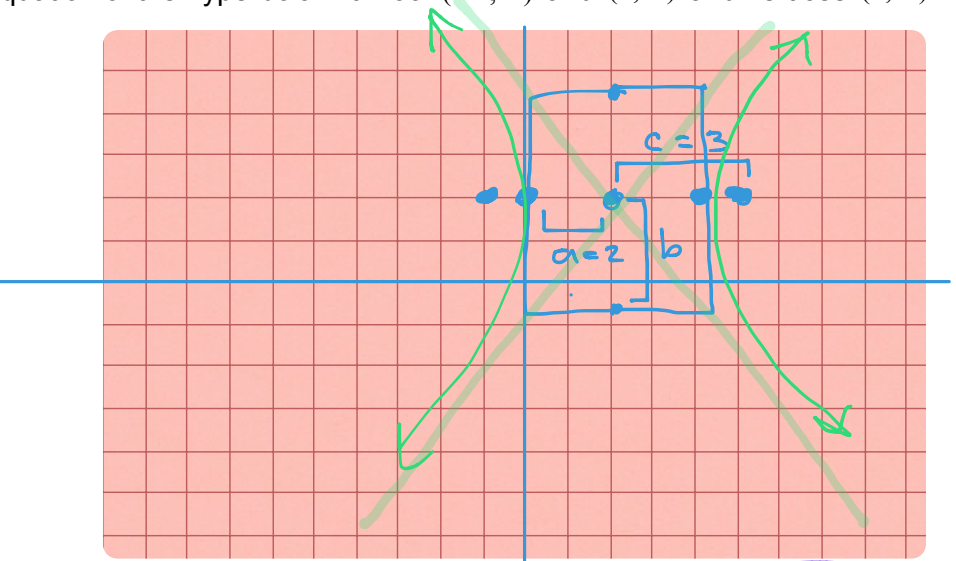
$$9 = 4 + b^2$$

$$5 = b^2$$

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

Horizontal Hyperbola

$$\frac{(x-2)^2}{4} - \frac{(y-2)^2}{5} = 1$$



Center =  $(2, 2)$   $y = 2 \pm \frac{\sqrt{5}}{2}(x-2)$   
= asymptotes

**Example 2:** Sketch the hyperbola whose equation is  $4x^2 - y^2 = 16$

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

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

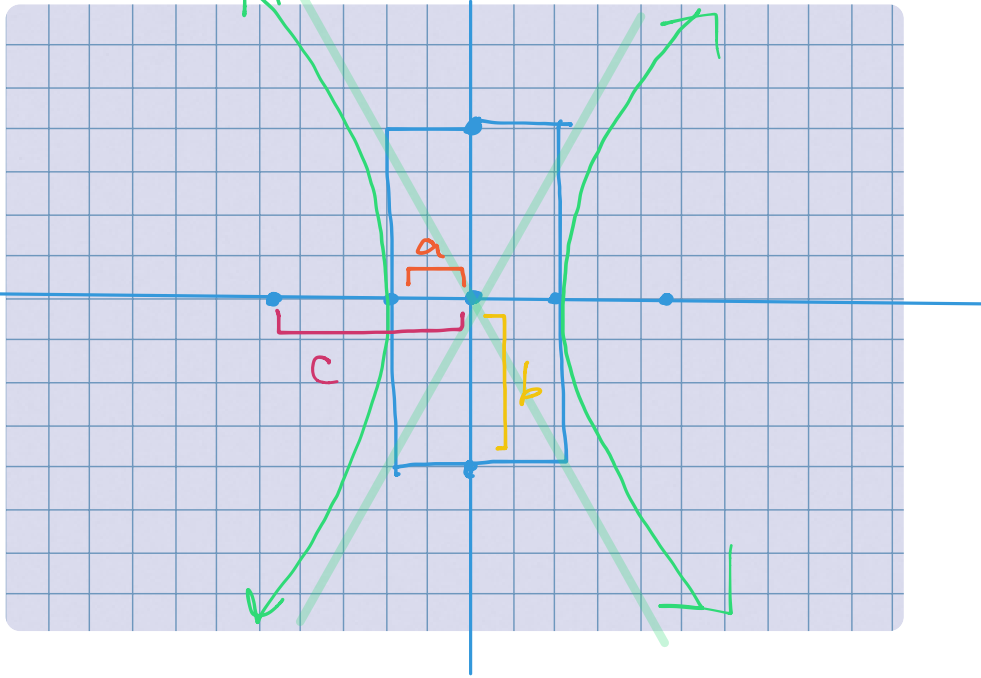
Center =  $(0, 0)$

$$a = 2$$

$$b = 4$$

$$c^2 = a^2 + b^2$$

$$c^2 = 20 = 2\sqrt{5}$$



Asymptotes for a Hyperbola

Horizontal Hyperbola  
 $y = k \pm \frac{b}{a}(x-h)$

Vertical Hyperbola  
 $y = k \pm \frac{a}{b}(x-h)$

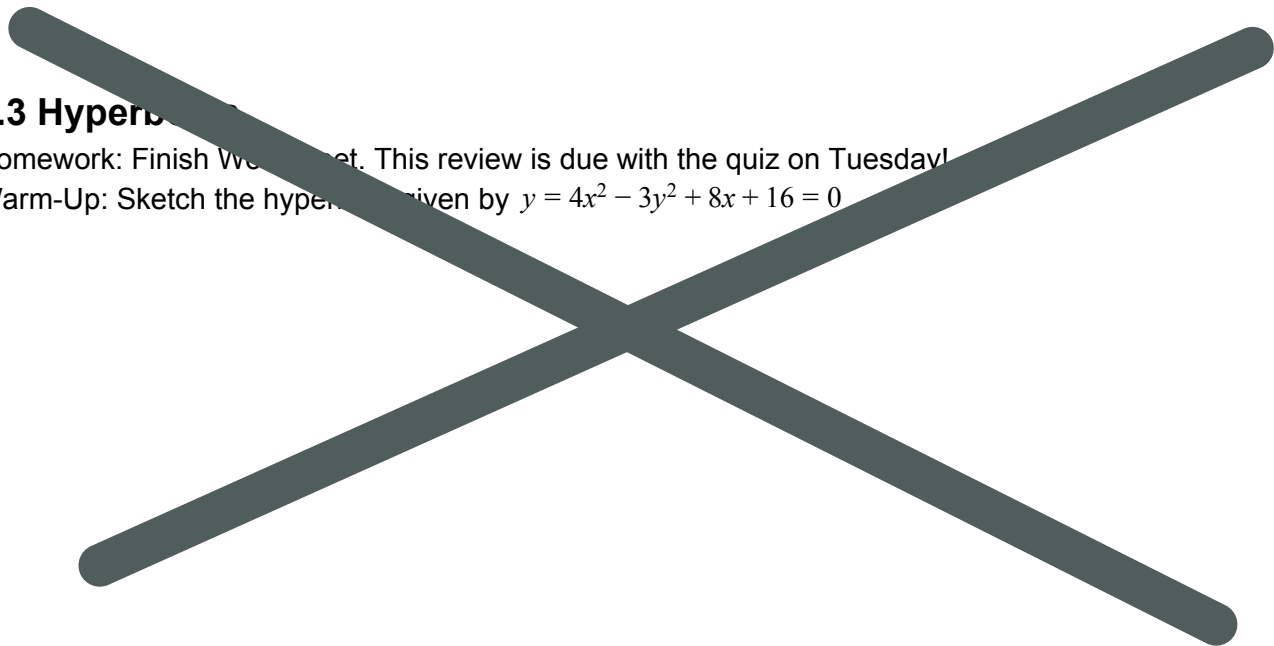
$$y = 0 \pm \frac{4}{2}(x-0)$$

$$y = \pm 2x$$

### 9.3 Hyperbolas

Homework: Finish Worksheet. This review is due with the quiz on Tuesday!

Warm-Up: Sketch the hyperbola given by  $y = 4x^2 - 3y^2 + 8x + 16 = 0$



## Asymptotes for a Hyperbola

Horizontal Hyperbola

$$y = k \pm \frac{b}{a}(x - h)$$

Vertical Hyperbola

$$y = k \pm \frac{a}{b}(x - h)$$