

## Precalc 10.4

Use and determine standard and general forms for hyperbolas  
Graph hyperbolas

hyperbola

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

focus (foci)

center  $(x-h)^2 - (y-k)^2$

vertex

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

asymptotes

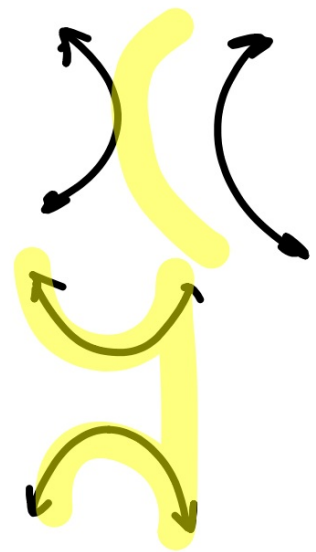
transverse axis

includes vert, foci, center

conjugate axis

center

eccentricity



Desmos

$$\frac{x^2}{9} + \frac{y^2}{4} = 1$$

+-

What is different?

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

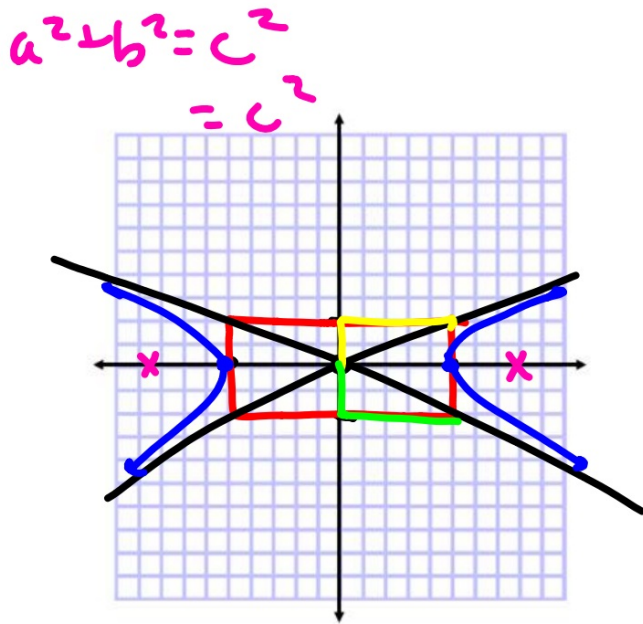
$y = \pm \frac{2}{5}x$

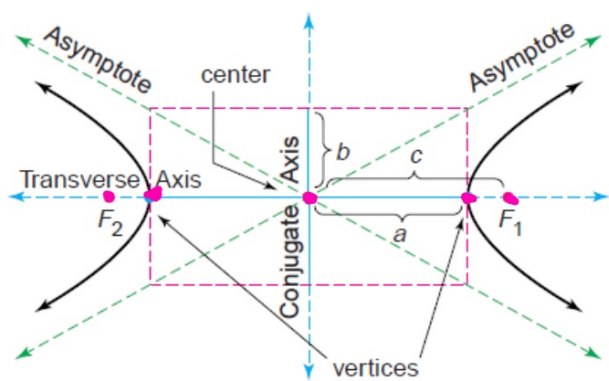
$y = -\frac{2}{5}x$

$y = \frac{2}{5}x$

Asymptotes:  $y = mx + b$

What if the center is not at (0,0)?  
Wider, narrower, etc.?





*Note that  $c > a$  for the hyperbola.*

which variable is positive?  
determines which way to open

stupid Kroon trick:

$$6. \frac{(y-3)^2}{16} - \frac{(x-2)^2}{4} = 1$$

$$y - y_1 = m(x - x_1)$$

$$m = \pm \frac{4}{2}$$

$$C(2,3) \quad y - 3 = \pm 2(x - 2)$$

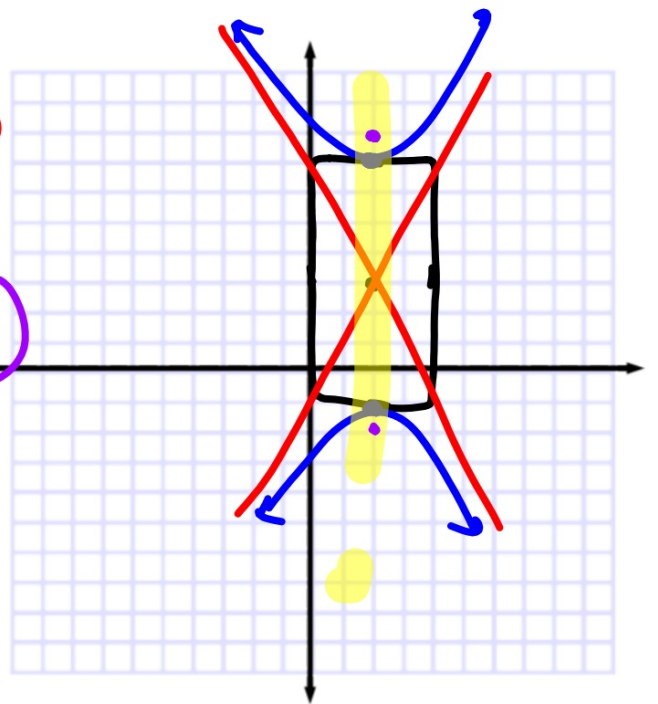
$$16 + 4 = c^2$$

$$20 = c^2$$

$$\pm 2\sqrt{5} = c$$

$$F(2, 3 \pm 2\sqrt{5})$$

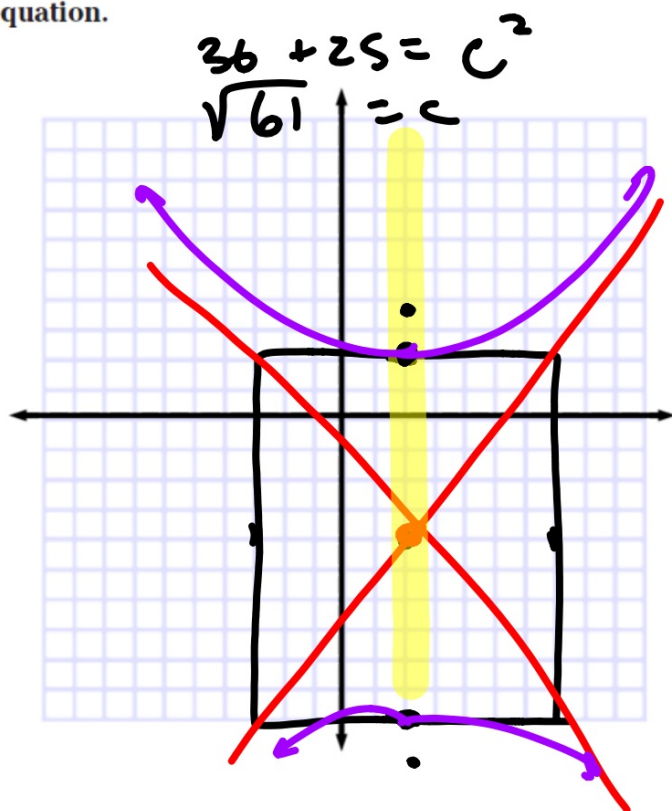
Asymptotes: point-slope form



point-slope form

⌋

- 2 Find the coordinates of the center, foci, and vertices, and the equations of the asymptotes of the graph of  $\frac{(y+4)^2}{36} - \frac{(x-2)^2}{25} = 1$ . Then graph the equation.



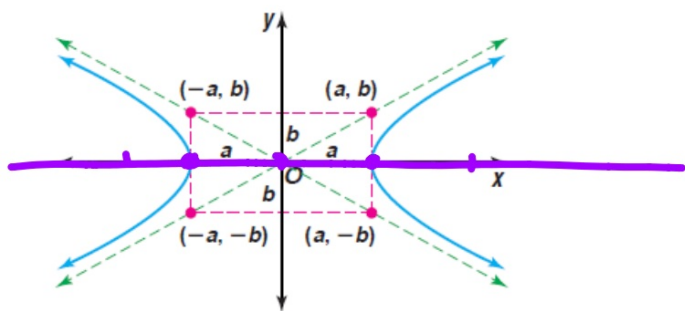
C (2, -4)

F (2, -4 + sqrt(61))

V (2, 2) (2, -10)

$y - y_1 = \pm \frac{b}{a}(x - x_1)$

$y + 4 = \pm \frac{6}{5}(x - 2)$



transverse axis  
conjugate axis

- 1 Find the equation of the hyperbola with foci at  $(7, 1)$  and  $(-3, 1)$  whose transverse axis is 8 units long.

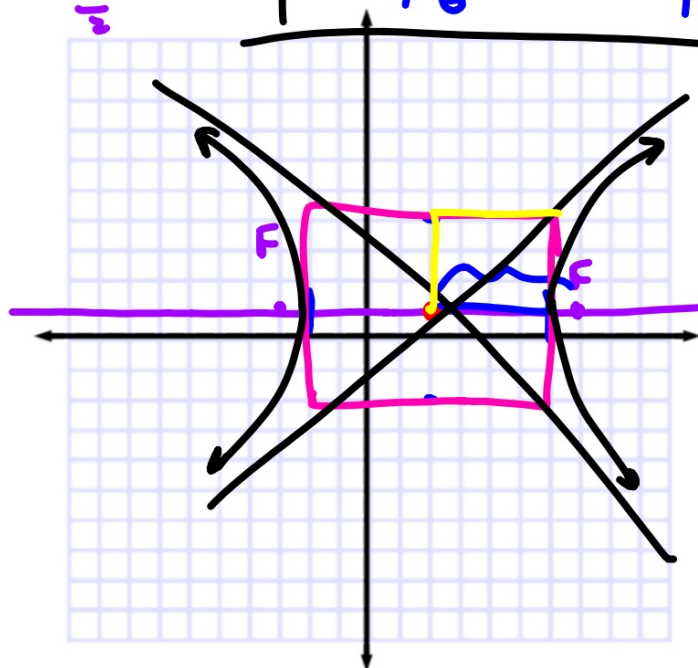
$$\frac{7 + (-3)}{2} = 2$$

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

One picture is worth 1000 words...

$$16 + ? = 25$$

$$? = 9$$



$$y - 1 = \pm \frac{3}{4}(x - 2)$$

---

$$e = \frac{c}{a}$$