

10.5b Hyperbolas with center (h, k)

Horizontal Hyperbola

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

Vertical Hyperbola

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

Find the center, vertices, slopes of the asymptotes and the foci for each hyperbola below. Then draw the graph.

$$\frac{(x+3)^2}{25} - \frac{(y-2)^2}{49} = 1$$

center $(-3, 2)$

$$m = \pm \frac{7}{5}$$

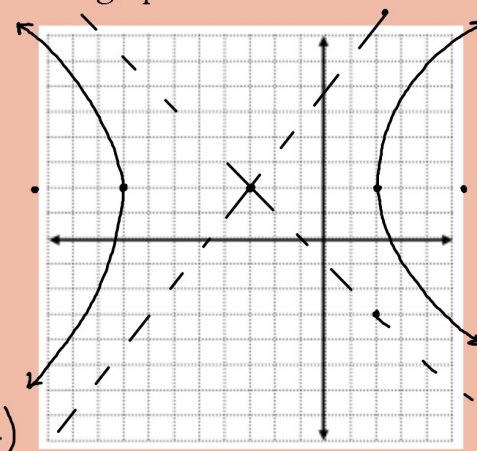
vertices $(2, 2)$ $(-8, 2)$

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

$$c^2 = 49 + 25$$

$$c^2 = 74$$

$$c = \sqrt{74} \quad (-3 \pm \sqrt{74}, 2)$$



Find the center, vertices, slopes of the asymptotes and the foci for each hyperbola below. Then draw the graph.

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

center $(-2, 1)$

$$m = \pm \frac{4}{3}$$

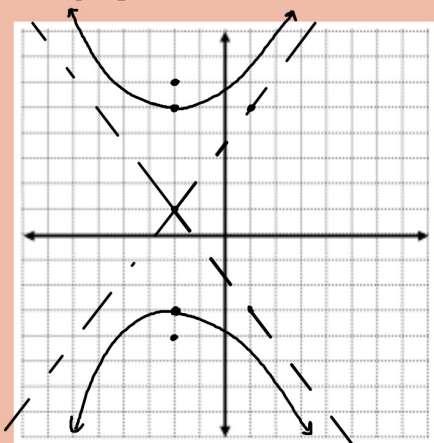
vertices $(-2, 5)$ $(-2, -3)$

foci $c^2 = 16 + 9$

$$c^2 = 25$$

$$c = 5$$

$$(-2, 6) \quad (-2, -4)$$



Find the center, vertices, slopes of the asymptotes and the foci for each hyperbola below. Then draw the graph.

$$\frac{(y-2)^2}{16} - \frac{(x-4)^2}{25} = 1$$

center $(4, 2)$

asymptotes $m = \pm \frac{4}{5}$

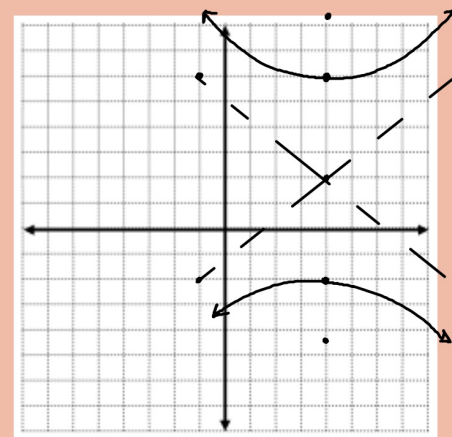
vertices $(4, 6)$ $(4, -2)$

foci $c^2 = 16 + 25$

$$c^2 = 41$$

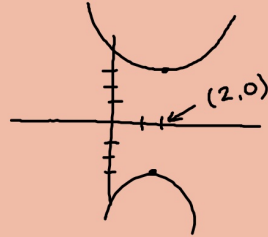
$$c = \pm \sqrt{41}$$

$$(4, 2 \pm \sqrt{41})$$



Write the equation of the hyperbola with the vertices at $(2, \pm 3)$ and the foci are at $(2, \pm 5)$

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



$$\begin{aligned} c &= 5 & c^2 &= 25 \\ a &= 3 & a^2 &= 9 \end{aligned} \quad \begin{aligned} c^2 &= a^2 + b^2 \\ 25 &= 9 + b^2 \\ 16 &= b^2 \end{aligned}$$