For the following exercises, write the equation for the hyperbola in standard form if it is not already, and identify the vertices and foci, and write equations of asymptotes.

$$\frac{x^2}{100} - \frac{y^2}{9} = 1$$

Center $(0,0)$

$a = 10$ $\quad b = 3$

Vertices $(\pm 10, 0)$

Co-Vertices $(0, \pm 3)$

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

$c^2 = 109$

$c = \pm\sqrt{109}$

Foci

$(\pm\sqrt{109}, 0)$

Asymptotes

$y = \pm \frac{3}{10}x$

$$\frac{(y-6)^2}{36} - \frac{(x+1)^2}{16} = 1$$

Center $(-1, 6)$

$a = \pm 6$ $\quad b = \pm 4$

Vertices

$(-1, 0)$ $(-1, 12)$

Co-Vertices

$(-5, 6)$ $(3, 6)$

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

$= 36 + 16$

$= 52$

$c = \pm\sqrt{52}$

Foci

$(-1, 6+\sqrt{52})$ $(-1, 6-\sqrt{52})$

Asymptotes

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

$\pm \frac{6}{4}(x+1) + 6$

For the following exercises, write the equation for the hyperbola in standard form if it is not already, and identify the vertices and foci, and write equations of asymptotes.

$$4x^2 - 24x - 36y^2 - 360y + 864 = 0$$

$$4(x^2 - 6x + 9) - 36(y^2 + 10y + 25) = -864 + 36 - 900$$

$$\frac{4(x-3)^2}{-1728} - \frac{36(y+5)^2}{-1728} = \frac{-1728}{-1728}$$

$$-\frac{(x-3)^2}{432} + \frac{(y+5)^2}{48} = 1$$

$$\frac{(y+5)^2}{48} - \frac{(x-3)^2}{432} = 1$$

Center $(3, -5)$

$a = \sqrt{48}$ $\quad$ $b = \pm\sqrt{432}$

Vertices $\quad$ Co-Vert

$(3, -5 \pm \sqrt{48})$ $\quad$ $(3 \pm \sqrt{432}, -5$

Foci

$c^2 = 432 + 48$ $\quad$ $(3, -5 \pm \sqrt{480})$

$c = \pm\sqrt{480}$

Asymptotes

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

$\pm \frac{\sqrt{48}}{\sqrt{432}}(x-3) - 5$

$\pm \sqrt{\frac{1}{9}}(x-3) - 5$

$\pm \frac{1}{3}(x-3) - 5$

For the following exercises, write the equation for the hyperbola in standard form if it is not already, and identify the vertices and foci, and write equations of asymptotes.

$$-9x^2 - 54x + 9y^2 - 54y + 81 = 0$$

For the following exercises, sketch a graph of the hyperbola, labeling vertices, foci, and asympotoes.

$$\frac{(y+5)^2}{9} - \frac{(x-4)^2}{25} = 1$$

Center $(4,-5)$

Vertices

$(4,-2)$ $(4,-8)$

Co-vertices

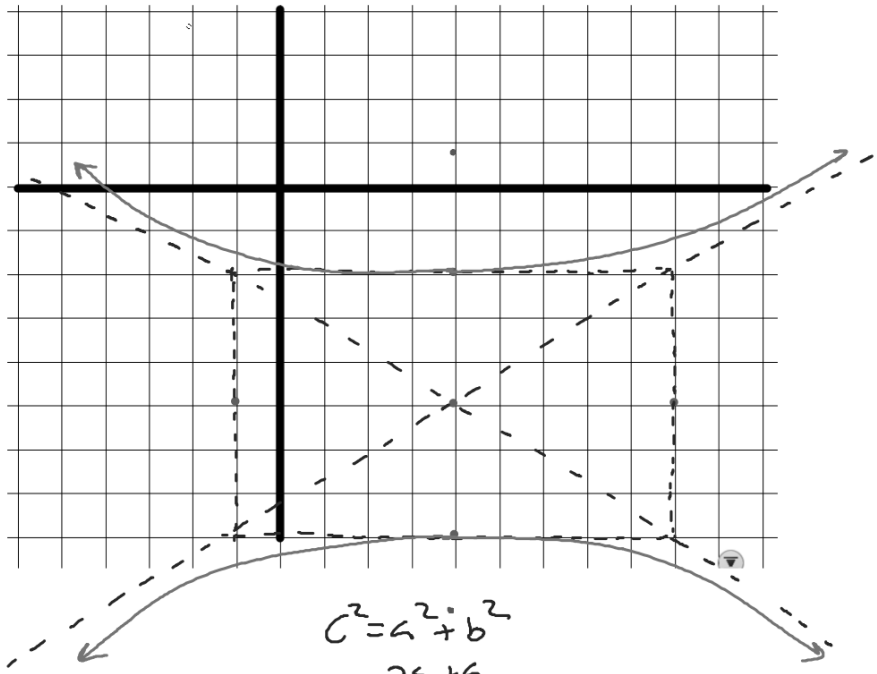
$(-1,-5)$ $(9,-5)$

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

$= \pm \frac{3}{5}(x-4)-5$

Foci

$(4, -5 \pm \sqrt{34})$



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

$25 + 9$

$c = \pm\sqrt{34}$

For the following exercises, sketch a graph of the hyperbola, labeling vertices, foci, and asympotoes.

$$64x^2 + 128x - 9y^2 - 72y - 656 = 0$$

$$64(x^2 + 2x + 1) - 9(y^2 + 8y + 16) = 656 + 64 - 144$$

$$64(x+1)^2 - 9(y+4)^2 = 576$$

$$\frac{(x+1)^2}{9} - \frac{(y+4)^2}{64} = 1$$

Center $(-1, -4)$

Ver

$(2, -4)$ $(-4, -4)$

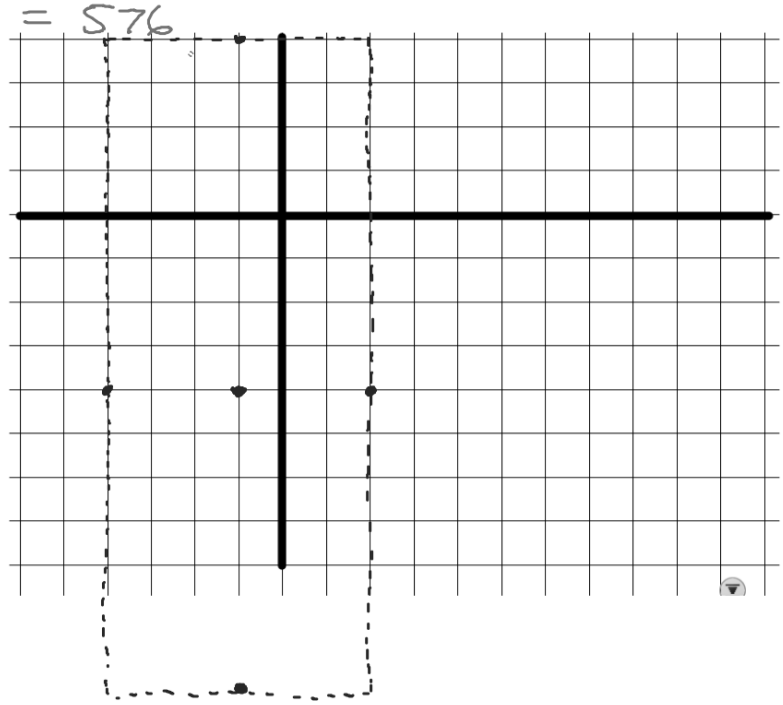
Co-Ver

$(-1, 8, -1, -12)$

Foc:

$(-1 \pm \sqrt{73}, -4)$

Asymptote $y = \pm \frac{8}{3}(x+1) - 4$



For the following exercises, given information about the graph of the hyperbola, find its equation.

45 . Vertices at $(3, 0)$ and $(-3, 0)$ and one focus at $(5, 0)$.

For the following exercises, given information about the graph of the hyperbola, find its equation.

Center: $(4, 2)$; vertex: $(9, 2)$; one focus: $\left(4 + \sqrt{26}, 2\right)$.

For the following exercises, given information about the graph of the hyperbola, find its equation.