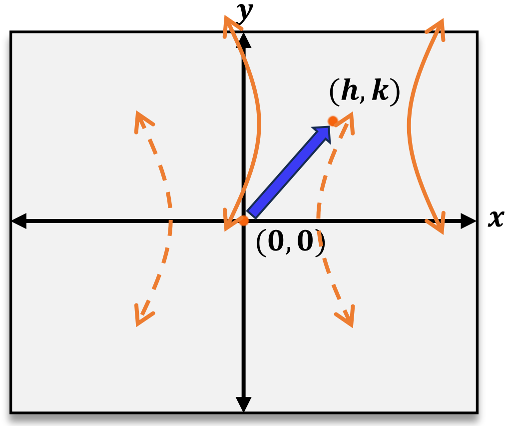
Circle	Ellipse	Parabola	**Hyperbola**

TOPIC: HYPERBOLAS NOT AT THE ORIGIN
Graphing Hyperbolas NOT At The Origin

- To graph hyperbolas NOT at the origin, shift points by (h, k)

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



EXAMPLE: Graph the following hyperbola.

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

TO GRAPH

1) Hyperbola is **[HORIZONTAL | VERTICAL]**

2) Center (h, k): (____ , ____)

3) **Vertices** horiz. → $(h \pm a, k)$, *OR* vert. → $(h, k \pm a)$:

(__ , __) & (__ , __)

4) ***b* points** horiz. → $(h, k \pm b)$, *OR* vert. → $(h \pm b, k)$:

(__ , __) & (__ , __)

5) Asymptotes:

(A) draw a box through **vertices** & ***b* points**

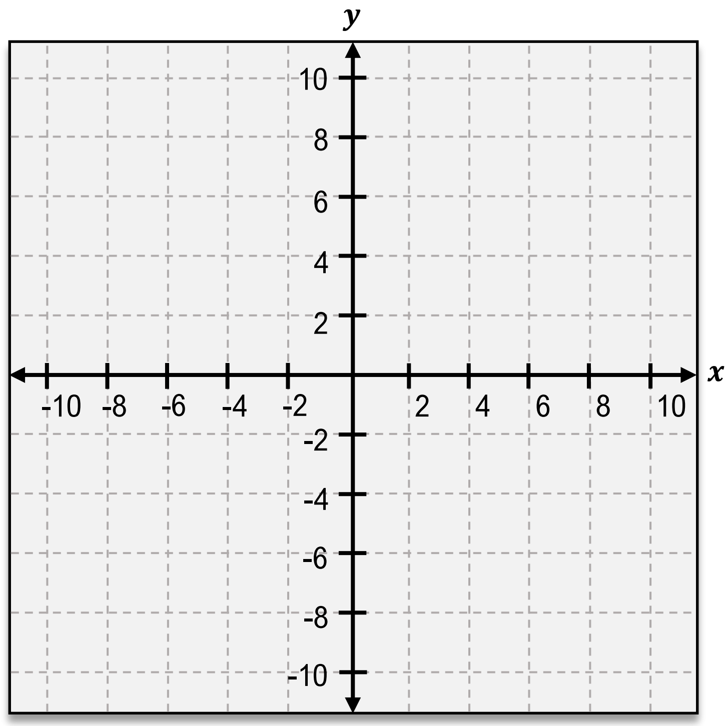
(B) draw lines through box corners

6) Draw branches at **vertices** & approaching asym.

FROM GRAPH

6) Foci horiz. → $(h \pm c, k)$, *OR* vert. → $(h, k \pm c)$:

(__ , __) & (__ , __)



Circle	Ellipse	Parabola	**Hyperbola**

TOPIC: HYPERBOLAS NOT AT THE ORIGIN

PRACTICE: Describe the hyperbola $\frac{(x+2)^2}{9} - \frac{(y-4)^2}{16} = 1$.

($\boldsymbol{A}$) This is a *vertical* hyperbola centered at $(-2,4)$ with vertices at $(4,2), (4,-6)$ and foci at $(4,4), (4,-8)$.
($\boldsymbol{B}$) This is a *vertical* hyperbola centered at $(2,-4)$ with vertices at $(4,1), (4,-5)$ and foci at $(4,3), (4,-7)$.
($\boldsymbol{C}$) This is a *horizontal* hyperbola centered at $(-2,4)$ with vertices at $(2,4), (-6,4)$ and foci at $(4,4), (-8,4)$.
($\boldsymbol{D}$) This is a *horizontal* hyperbola centered at $(-2,4)$ with vertices at $(1,4), (-5,4)$ and foci at $(3,4), (-7,4)$.

PRACTICE: Describe the hyperbola $y^2 - \frac{(x-1)^2}{4} = 1$.

($\boldsymbol{A}$) This is a *vertical* hyperbola centered at $(1,0)$ with vertices at $(1,1), (1,-1)$ and foci at $(1,\sqrt{5}), (1,-\sqrt{5})$.
($\boldsymbol{B}$) This is a *vertical* hyperbola centered at $(1,0)$ with vertices at $(1,2), (1,-2)$ and foci at $(1,1), (1,-1)$.
($\boldsymbol{C}$) This is a *horizontal* hyperbola centered at $(-1,0)$ with vertices at $(0,0), (-2,0)$ and foci at $(\sqrt{5}-1,0), (-\sqrt{5}-1,0)$.
($\boldsymbol{D}$) This is a *horizontal* hyperbola centered at $(1,0)$ with vertices at $(0,0), (-2,0)$ and foci at $(1,\sqrt{5}), (1,-\sqrt{5})$.