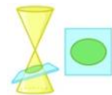
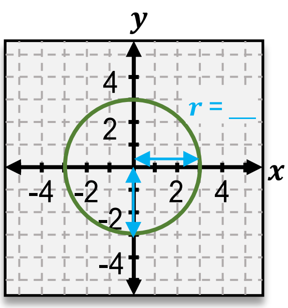
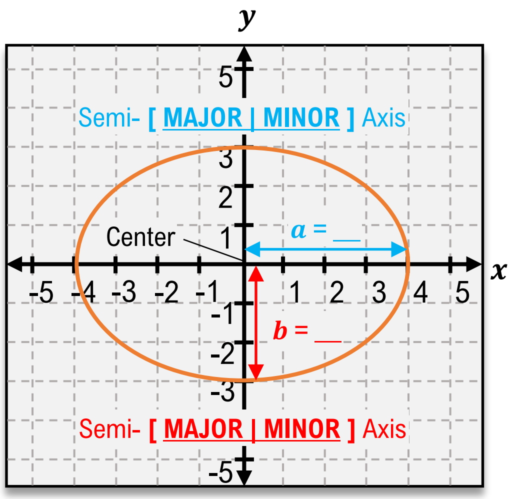
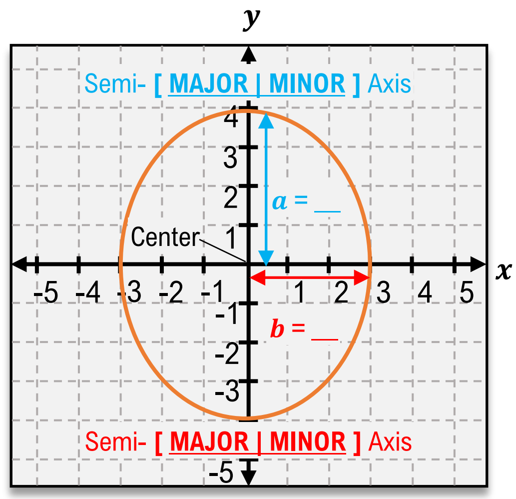
Circle	Ellipse	Parabola	Hyperbola



TOPIC: ELLIPSES IN STANDARD FORM
Graph Ellipses at the Origin

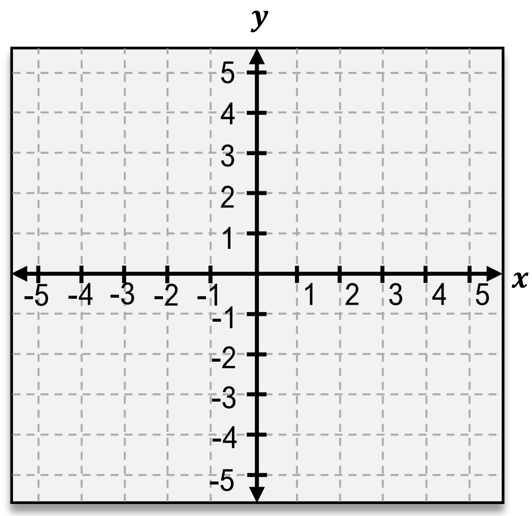
- The equation for a circle depends on its radius.
  - The equation for an ellipse depends on ____ special distances: **semi-major** & **semi-minor axes**.

Circle	Horizontal Ellipse	Vertical Ellipse
		
$x^2 + y^2 = r^2$		
$\frac{x^2}{r^2} + \frac{y^2}{r^2} = 1$	$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$	$\frac{x^2}{\_^2} + \frac{y^2}{\_^2} = 1$

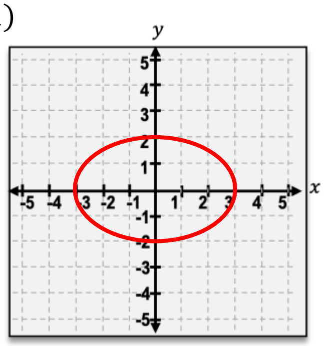
- No matter the orientation, a is always the ____________ distance from the center to the ellipse.

TOPIC: ELLIPSES IN STANDARD FORM

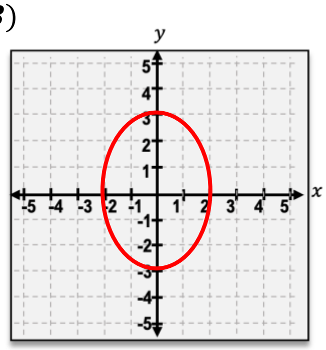
PRACTICE: Given the equation $\frac{x^2}{4} + \frac{y^2}{9} = 1$, sketch a graph of the ellipse.



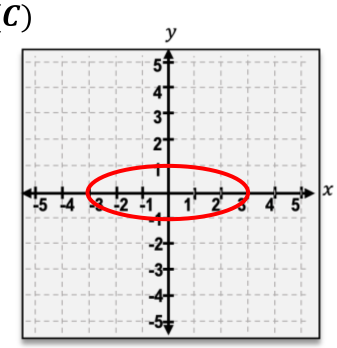
(A)



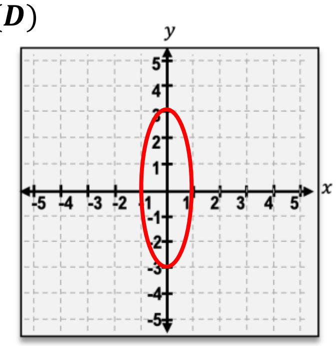
(B)



(C)



(D)



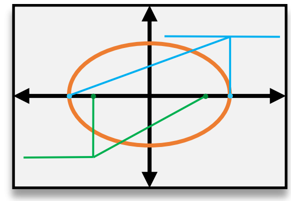
TOPIC: ELLIPSES IN STANDARD FORM

PRACTICE: Given the ellipse equation $\frac{x^2}{16} + \frac{y^2}{4} = 1$, determine the magnitude of the semi-major axis (a) and the semi-minor axis (b).

$(\boldsymbol{A})\ a = 16, b = 4$
$(\boldsymbol{B})\ a = 4, b = 16$
$(\boldsymbol{C})\ a = 4, b = 2$
$(\boldsymbol{D})\ a = 2, b = 4$

Circle	Ellipse	Parabola	Hyperbola

<u>TOPIC: ELLIPSES IN STANDARD FORM</u>
<u>Vertices and Foci of Ellipses</u>



- Every ellipse has 2 **Vertices** & 2 **Foci**, both located on the **[<u>MAJOR | MINOR</u>]** axis
  - **Vertices** are the points on the ellipse ___________ from the center

    Distance between center & **Vertex** = **[<u>a | b | c</u>]**
  - **Foci** are points inside the ellipse, and the sum of any distance from the **foci** to a single point is ____________

    Distance between center & **Focus** = **[<u>a | b | c</u>]**

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

$$c^2 = a^2 - b^2$$

<u>EXAMPLE</u>: Find the vertices & foci of the ellipse in the graph.

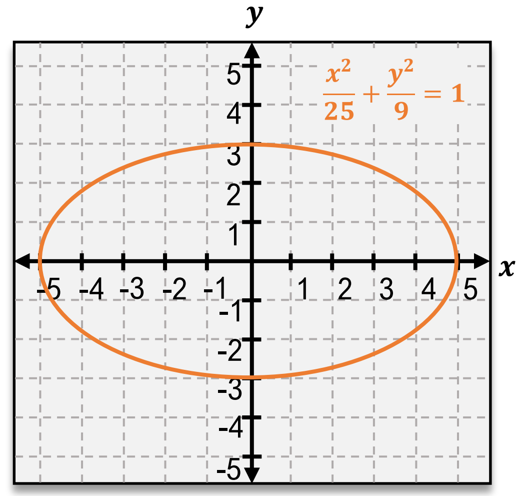
$a =$

$b =$

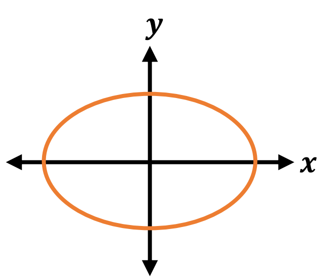
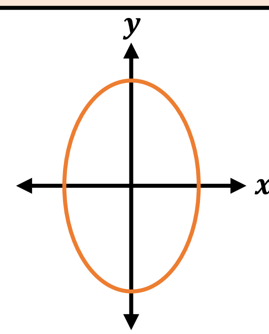
$c =$

Vertices: (__, 0) & (__, 0)

Foci: (__, 0) & (__, 0)



- For a *vertical* ellipse, the coordinates of vertices & foci are different

Horizontal Ellipse	Vertical Ellipse
	
Vertices: (a , 0) & ($-a$, 0)	Vertices: (0 , ___) & (0 , ___)
Foci: (c , 0) & ($-c$, 0)	Foci: (0, ___) & (0, ___)
Vertices & Foci on **[<u>x | y</u>]** axis	Vertices & Foci on **[<u>x | y</u>]** axis

TOPIC: ELLIPSES IN STANDARD FORM

PRACTICE: Determine the vertices and foci of the following ellipse: $\frac{x^2}{49}+\frac{y^2}{36}=1$.

$(\boldsymbol{A})$ Vertices: $(7,0),(-7,0)$
Foci: $(6,0),(-6,0)$
$(\boldsymbol{B})$ Vertices: $(6,0),(-6,0)$
Foci: $(7,0),(-7,0)$
$(\boldsymbol{C})$ Vertices: $(7,0),(-7,0)$
Foci: $(\sqrt{13},0),(-\sqrt{13},0)$
$(\boldsymbol{D})$ Vertices: $(0,7),(0,-7)$
Foci: $(0,\sqrt{13}),(0,-\sqrt{13})$

PRACTICE: Determine the vertices and foci of the following ellipse: $\frac{x^2}{9}+\frac{y^2}{16}=1$.

$(\boldsymbol{A})$ Vertices: $(4,0),(-4,0)$
Foci: $(\sqrt{7},0),(-\sqrt{7},0)$
$(\boldsymbol{B})$ Vertices: $(0,4),(0,-4)$
Foci: $(0,\sqrt{7}),(0,-\sqrt{7})$
$(\boldsymbol{C})$ Vertices: $(4,0),(-4,0)$
Foci: $(3,0),(-3,0)$
$(\boldsymbol{D})$ Vertices: $(0,4),(0,-4)$
Foci: $(0,3),(0,-3)$

TOPIC: ELLIPSES IN STANDARD FORM

PRACTICE: Find the standard form of the equation for an ellipse with the following conditions.

Foci $= (-5,0), (5,0)$

Vertices $= (-8,0), (8,0)$

$(\boldsymbol{A})\ \frac{x^2}{64} + \frac{y^2}{25} = 1$

$(\boldsymbol{B})\ \frac{x^2}{25} + \frac{y^2}{64} = 1$

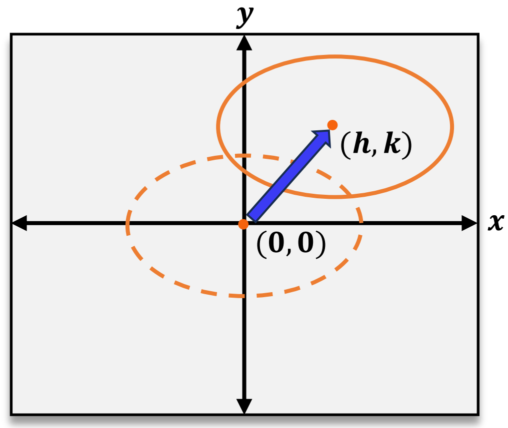
$(\boldsymbol{C})\ \frac{x^2}{8} + \frac{y^2}{5} = 1$

$(\boldsymbol{D})\ \frac{x^2}{64} + \frac{y^2}{39} = 1$

Circle	**Ellipse**	Parabola	Hyperbola

TOPIC: ELLIPSES IN STANDARD FORM
Graph Ellipses NOT at the Origin

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



Horizontal Ellipse

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

EXAMPLE: Graph the following ellipse.

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

TO GRAPH

1) Determine the major and minor axis

$a =$ ____ & $b =$ ____

2) Ellipse is [VERTICAL | HORIZONTAL]

3) Center (h, k): (__ , __)

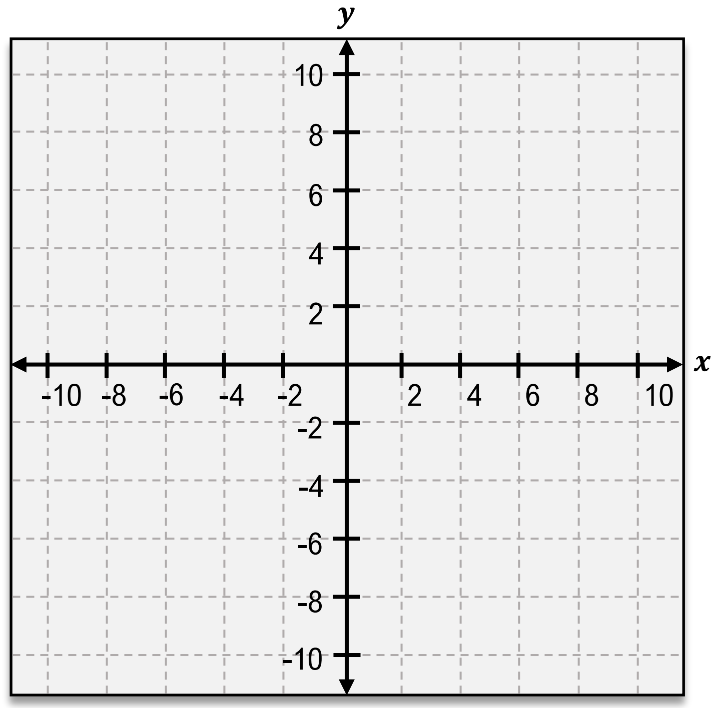
4) Vertices, vert. → $(h, k \pm a)$ *OR* horiz. → $(h \pm a, k)$:

(__ , __) & (__ , __)

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

(__ , __) & (__ , __)

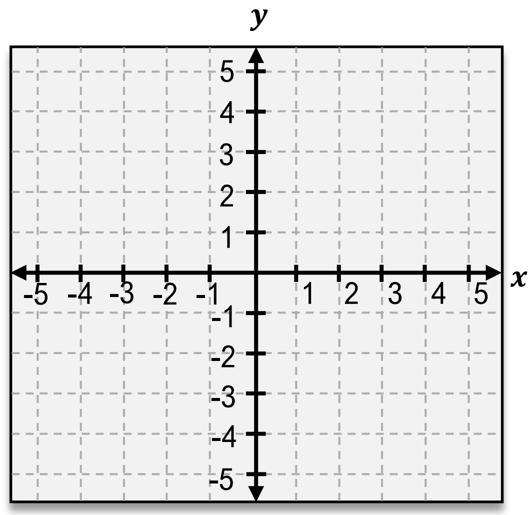
6) Connect outside points with a smooth curve



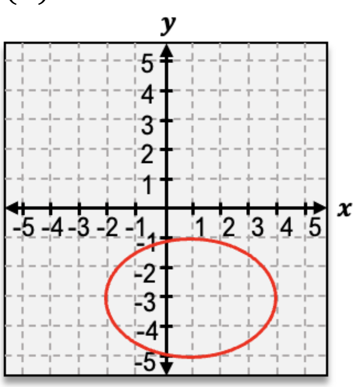
- To find the foci, use $(h, k \pm c)$ for a **[VERT. | HORIZ.]** ellipse, and $(h \pm c, k)$ for a **[VERT. | HORIZ.]** ellipse.

TOPIC: ELLIPSES IN STANDARD FORM

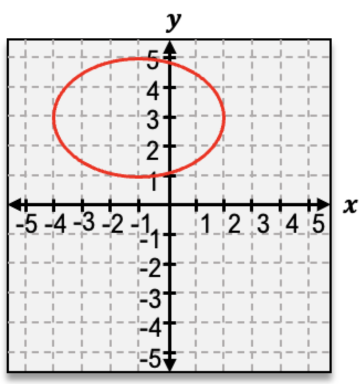
PRACTICE: Graph the ellipse $\frac{(x-1)^2}{9}+\frac{(y+3)^2}{4}=1$.



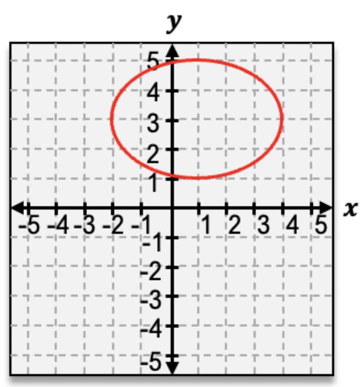
(A)



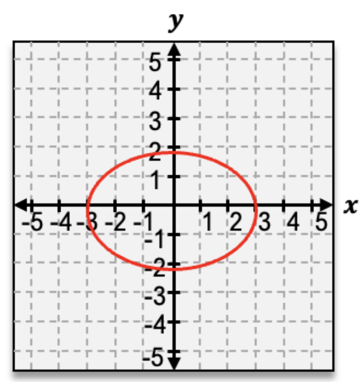
(B)



(C)



(D)



TOPIC: ELLIPSES IN STANDARD FORM

PRACTICE**:** Determine the vertices and foci of the ellipse $(x+1)^2+\frac{(y-2)^2}{4}=1$.

$(\boldsymbol{A})$ Vertices: $(-1,4),(-1,0)$
Foci: $(-1,2+\sqrt{3}),(-1,2-\sqrt{3})$

$(\boldsymbol{B})$ Vertices: $(-1,4),(-1,0)$
Foci: $(-2,2),(0,2)$

$(\boldsymbol{C})$ Vertices: $(-2,2),(0,2)$
Foci: $(1,2+\sqrt{3}),(1,2-\sqrt{3})$

$(\boldsymbol{D})$ Vertices: $(-2,2),(0,2)$
Foci: $(2+\sqrt{3},1),(2-\sqrt{3},1)$