

## 10.6 Translating Conic Sections

*Learning Targets for today*

- ① To be able to write the equation of a translated conic section.
- ① To be able to identify a translated conic section from an equation.

## *Ellipses ON THE MOVE!*

### **Horizontal Ellipse**

Standard-Form Equation

Center (0, 0)

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

Vertices

$$(\pm a, 0)$$

Co-vertices

$$(0, \pm b)$$

Foci

$$(\pm c, 0)$$

$a, b, c$  relationship

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



Center (h, k)

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

$$(h \pm a, k)$$

$$(h, k \pm b)$$

$$(h \pm c, k)$$

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

### **Vertical Ellipse**

Standard-Form Equation

Center (0, 0)

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

Vertices

$$(0, \pm a)$$

Co-vertices

$$(\pm b, 0)$$

Foci

$$(0, \pm c)$$

$a, b, c$  relationship

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



Center (h, k)

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

$$(h, k \pm a)$$

$$(h \pm b, k)$$

$$(h, k \pm c)$$

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

## Graphing a Translated Ellipse

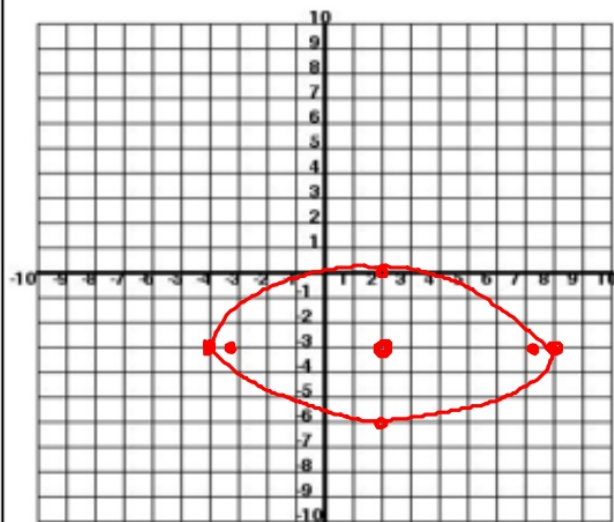
### Example for you...

Graph the following Ellipse and label the center, vertices, co-vertices, and foci.

$$1. \frac{(x-2)^2}{36} + \frac{(y+3)^2}{9} = 1$$

$a^2=36$     $b^2=9$   
 $a=6$     $b=3$

Center  $(2, -3)$   
 foci?  
 $c^2 = a^2 - b^2$   
 $c^2 = 36 - 9$   
 $\sqrt{c^2} = \sqrt{27}$   
 $c = 5.1$



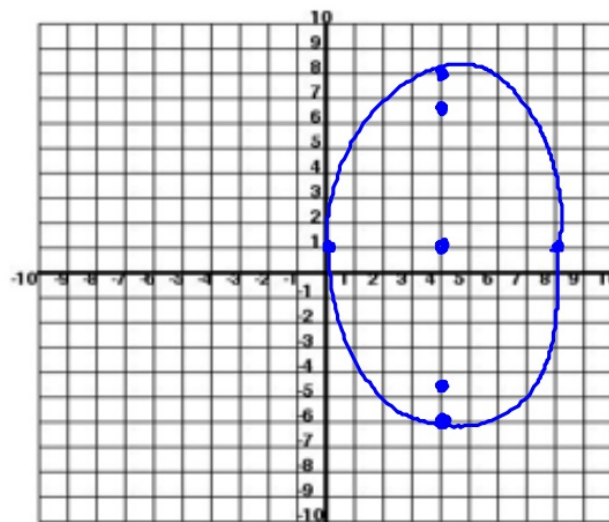
### Your turn to try...

Graph the following Ellipse and label the center, vertices, co-vertices, and foci.

$$1. \frac{(x-4)^2}{16} + \frac{(y-1)^2}{49} = 1$$

$b^2=16$     $a^2=49$   
 $b=4$     $a=7$

Center  $(4, 1)$   
 foci?  
 $c^2 = 49 - 16$   
 $\sqrt{c^2} = \sqrt{33}$   
 $c = 5.7$



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

$$b^2 = 1 \quad a^2 = 16$$

$$b = 1 \quad a = 4$$

Center  $(-6, -3)$

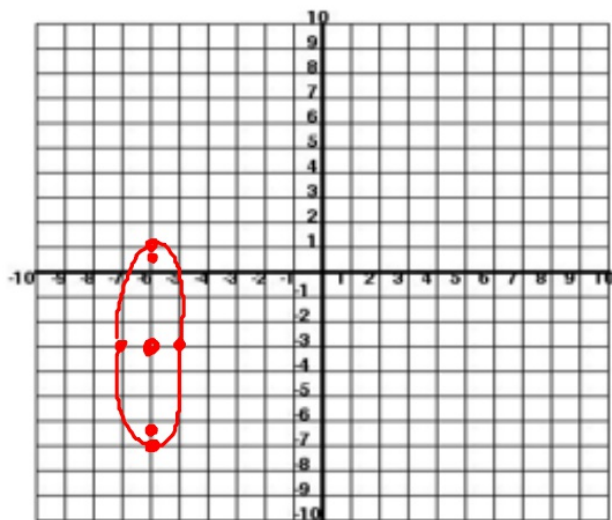
foci?

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

$$c^2 = 16 - 1$$

$$c^2 = 15$$

$$c = 3.9$$



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

$$a^2 = 25 \quad b^2 = 4$$

$$a = 5 \quad b = 2$$

Center  $(-2, 5)$

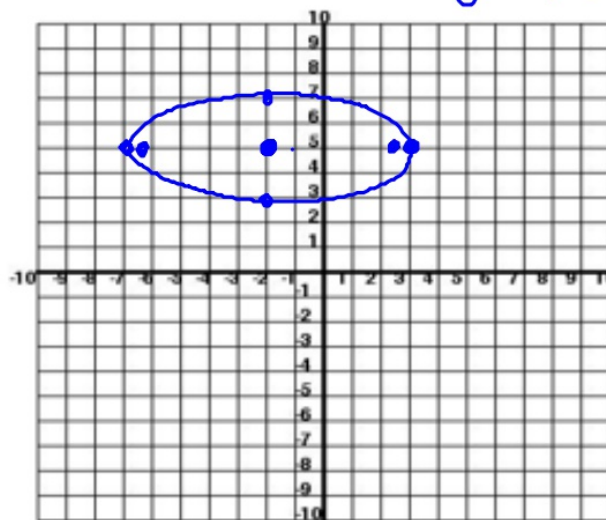
foci?

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

$$c^2 = 25 - 4$$

$$\sqrt{c^2} = \sqrt{21}$$

$$c = 4.5$$



## Hyperbolas ON THE MOVE!

### Horizontal Hyperbola

	Center (0, 0)	Center (h, k)
Standard-Form Equation	$\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$	$\frac{(x - h)^2}{a^2} - \frac{(y - k)^2}{b^2} = 1$
Vertices	$(\pm a, 0)$	$(h \pm a, k)$
Foci	$(\pm c, 0)$	$(h \pm c, k)$
Asymptotes	$y = \pm \frac{b}{a}x$	$y - k = \pm \frac{b}{a}(x - h)$
a, b, c relationship	$c^2 = a^2 + b^2$	$c^2 = a^2 + b^2$

### Vertical Hyperbola

	Center (0, 0)	Center (h, k)
Standard-Form Equation	$\frac{y^2}{a^2} - \frac{x^2}{b^2} = 1$	$\frac{(y - k)^2}{a^2} - \frac{(x - h)^2}{b^2} = 1$
Vertices	$(0, \pm a)$	$(h, k \pm a)$
Foci	$(0, \pm c)$	$(h, k \pm c)$
Asymptotes	$y = \pm \frac{a}{b}x$	$y - k = \pm \frac{a}{b}(x - h)$
a, b, c relationship	$c^2 = a^2 + b^2$	$c^2 = a^2 + b^2$



## Graphing a Translated Hyperbola

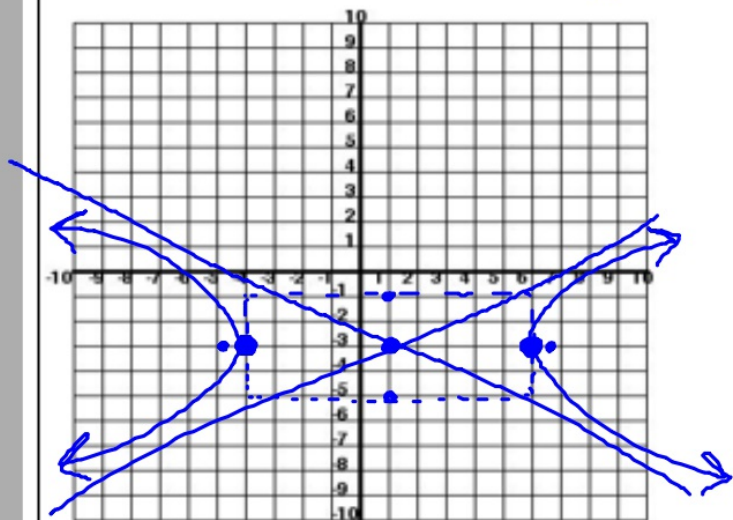
### Example for you.. ~~ellipse~~ hyperbola

Graph the following ~~ellipse~~ and label the center, vertices, co-vertices, and foci.

$$1. \frac{(x-1)^2}{25} - \frac{(y+3)^2}{4} = 1$$

Center(1, -3)  
 foci?  
 $c^2 = a^2 + b^2$   
 $c^2 = 25 + 4$   
 $\sqrt{c^2 = 29}$   
 $c = 5.3$

$a^2 = 25$     $b^2 = 4$   
 $a = 5$     $b = 2$



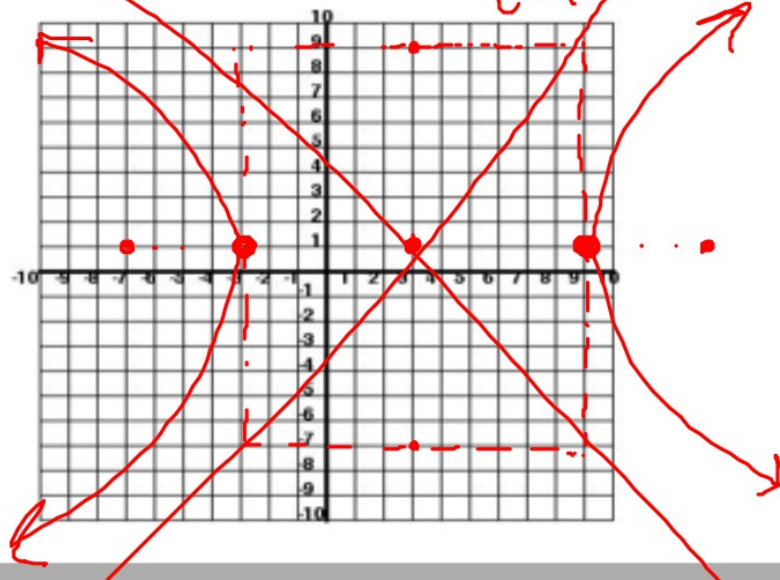
### Your turn to try.. ~~ellipse~~ hyperbola

Graph the following ~~ellipse~~ and label the center, vertices, co-vertices, and foci.

$$1. \frac{(x-3)^2}{36} - \frac{(y-1)^2}{64} = 1$$

Center(3, 1)  
 foci?  
 $c^2 = a^2 + b^2$   
 $c^2 = 36 + 64$   
 $\sqrt{c^2 = 100}$   
 $c = 10$

$a^2 = 36$     $b^2 = 64$   
 $a = 6$     $b = 8$



$$2. \frac{(y+5)^2}{1} - \frac{(x+3)^2}{16} = 1$$

$$a^2 = 1 \quad b^2 = 16$$

$$a = 1 \quad b = 4$$

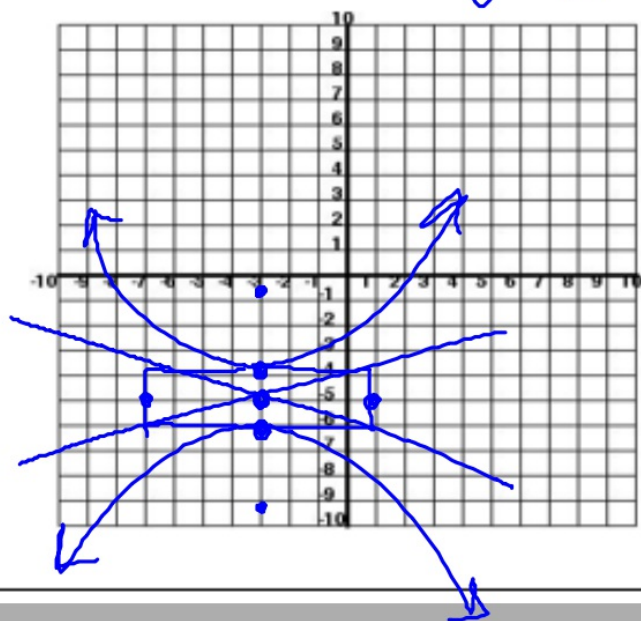
Center  $(-3, -5)$

foci?

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

$$c^2 = 1 + 16$$

$$\sqrt{c^2} = \sqrt{17}$$

$$c = 4.1$$


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

$$a^2 = 25 \quad b^2 = 49$$

$$a = 5 \quad b = 7$$

Center  $(-2, 3)$

foci?

$$c^2 = 25 + 49$$

$$c^2 = 74$$

$$c = 8.6$$
