10.6 Translating Conic Sections

PART 2 - WRITING EQUATIONS!

Learning Targets for today

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

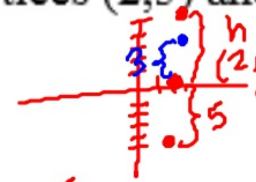
Ellipses ON THE MOVE!

Horizontal Ellipse	**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	$(\pm a, 0)$	$(h \pm a, k)$
Co-vertices	$(0, \pm b)$	$(h, k \pm b)$
Foci	$(\pm c, 0)$	$(h \pm c, k)$
a, b, c relationship	$c^2 = a^2 - b^2$	$c^2 = a^2 - b^2$

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

Writing an Equation of a Translated Ellipse

Example for you…	**Your turn to try…**
Write the equation for the ellipse given the vertices (2,5) and (2,-5) and a focus of (2,3).	Write the equation for the ellipse given the vertices (0,4) and (8,4) and a focus of (2,4).



(h, k) (2,0) ✓ center!

$c = 3$

$c^2 = 9$

$a = 5$

$a^2 = 25$ ✓

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

$9 = 25 - b^2$

$-25 \quad -25$

$\frac{-16}{-1} = \frac{-b^2}{-1}$

$16 = b^2$ ✓

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

h, k (4,4) ✓

$c = 2 \quad c^2 = 4$

$a = 4$

$a^2 = 16$ ✓

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

$4 = 16 - b^2$

$-16 \quad -16$

$\frac{-12}{-1} = \frac{-b^2}{-1}$

$b^2 = 12$ ✓

$$\frac{(x-4)^2}{16} + \frac{(y-4)^2}{12} = 1$$

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

Writing an Equation of a Translated Hyperbola

Example for you…

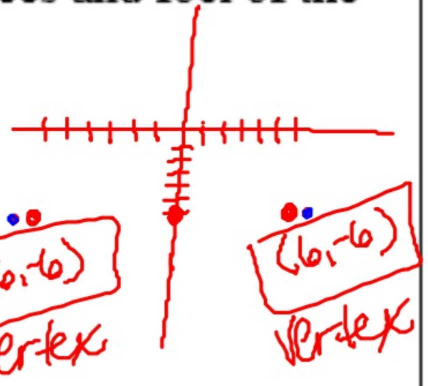
Identify the center, vertices and foci of the hyperbola.

Center (0, -6)

1. $\frac{(x)^2}{36} - \frac{(y+6)^2}{4} = 1$

$a^2 = 36$ $b^2 = 4$

$a = 6$



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

$c^2 = 36 + 4$

$\sqrt{c^2} = \sqrt{40}$

$c = 6.3$

(6.3, -6)

(-6.3, -6)

foci

Your turn to try…

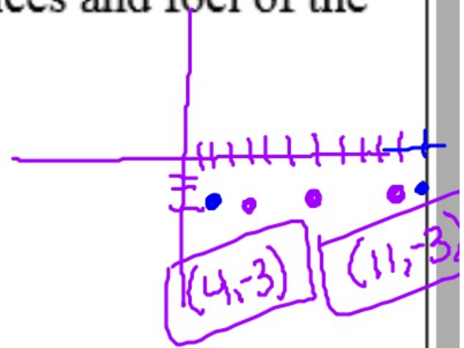
Identify the center, vertices and foci of the hyperbola.

Center (7, -3)

1. $\frac{(x-7)^2}{16} - \frac{(y+3)^2}{9} = 1$

$a^2 = 16$ $b^2 = 9$

$a = 4$



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

$c^2 = 16 + 9$

$\sqrt{c^2} = \sqrt{25}$

$c = 5$ (units from center)

(2, -3)

(12, -3)

foci