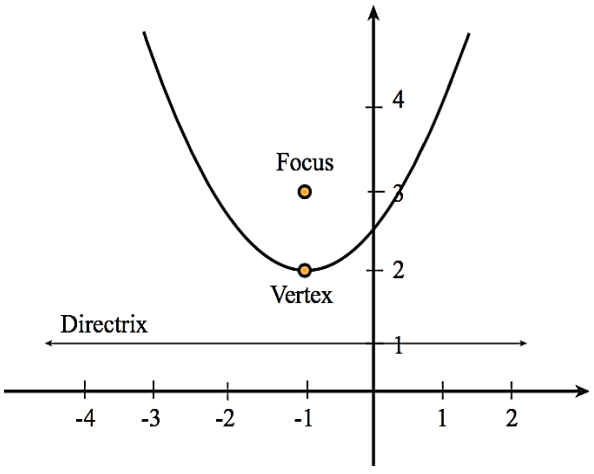
Conic Sections

PARABOLAS

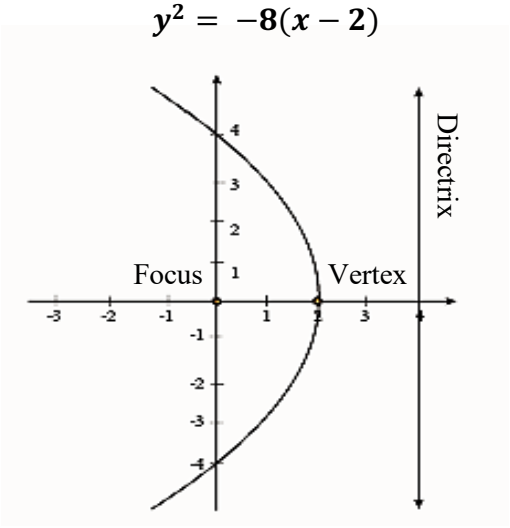
Equation	$(x-h)^2 = 4p(y-k)$	$(y-k)^2 = 4p(x-h)$
Vertex	(h, k)	(h, k)
Focus	$(h, p+k)$	$(p+h, k)$
Directrix	$y = -p+k$	$x = -p+h$
Focal Diameter	$\|4p\|$	$\|4p\|$
If p > 0	opens UP	opens RIGHT
If p < 0	opens DOWN	opens LEFT

Examples:

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



$y^2 = -8(x-2)$

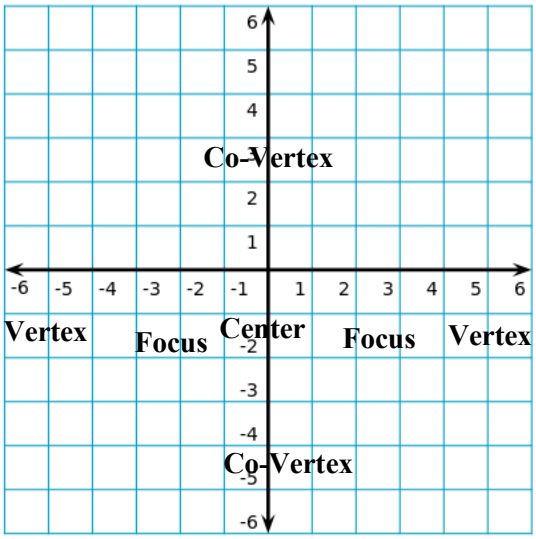


ELLIPSES

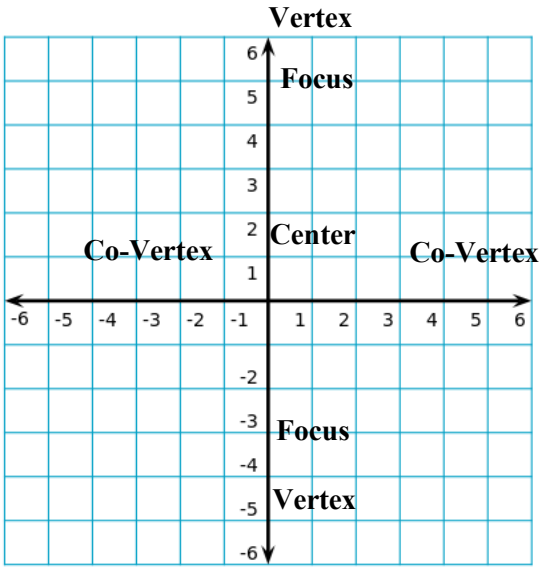
Equation	$\frac{(x-h)^2}{a^2}+\frac{(y-k)^2}{b^2}=1$ where a > b > 0	$\frac{(x-h)^2}{b^2}+\frac{(y-k)^2}{a^2}=1$ where a > b > 0
Center	(h, k)	(h, k)
Vertices	$(h \pm a, k)$	$(h, k \pm a)$
Co-Vertices	$(h, k \pm a)$	$(h \pm a, k)$
Foci	$(h \pm c, k)$ where $c^2 = a^2 - b^2$	$(h, k \pm c)$ where $c^2 = a^2 - b^2$
Major Axis	Horizontal with length 2a	Vertical with length 2a
Minor Axis	Vertical with length 2b	Horizontal with length 2b
Eccentricity	$e = \frac{c}{a}$	$e = \frac{c}{a}$

Examples:

$\boldsymbol{x^2}$ $\boldsymbol{(y+1)^2}$



$\boldsymbol{(x-1)^2}$ $\boldsymbol{(y-1)^2}$

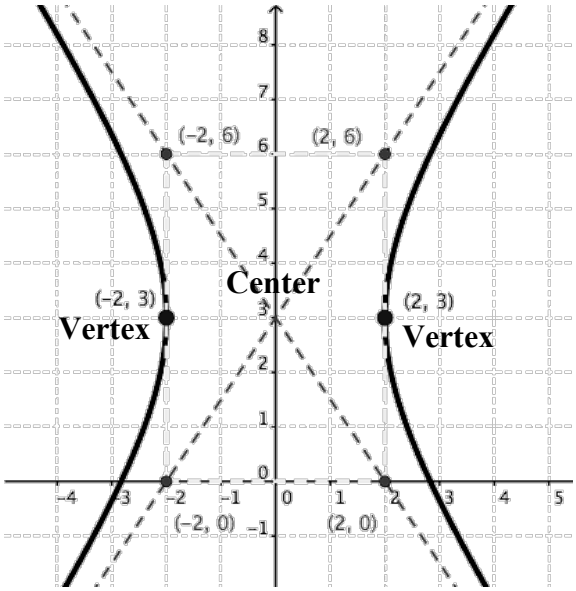


HYPERBOLAS

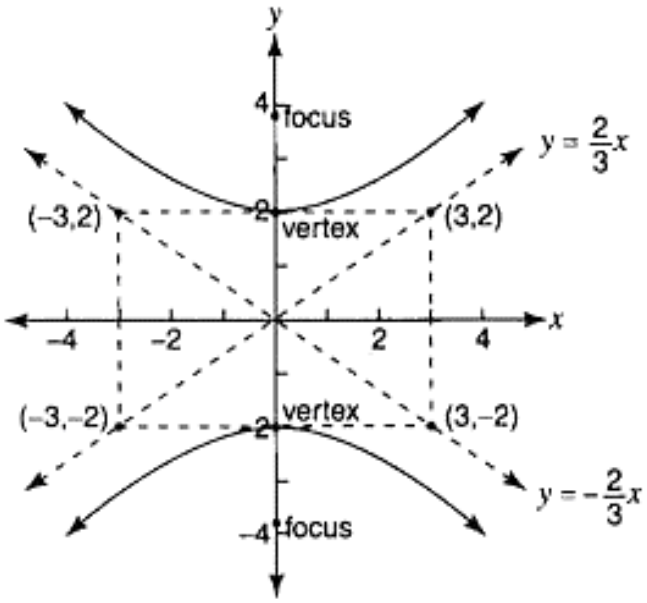
Equation	$\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1$ where a > 0, b > 0	$\frac{(y-k)^2}{a^2} - \frac{(x-h)^2}{b^2} = 1$ where a > 0, b > 0
Center	(h, k)	(h, k)
Vertices	$(h \pm a, k)$	$(h, k \pm a)$
Foci	$(h \pm c, k)$ where $c^2 = a^2 + b^2$	$(h, k \pm c)$ where $c^2 = a^2 + b^2$
Transverse Axis	Horizontal with length 2a	Vertical with length 2a
Minor Axis	Vertical with length 2b	Horizontal with length 2b
Asymptotes	$y - k = \pm\frac{b}{a}(x-h)$	$y - k = \pm\frac{a}{b}(x-h)$

Examples:

$x^2 \quad (y-3)^2$



$y^2 \quad x^2$

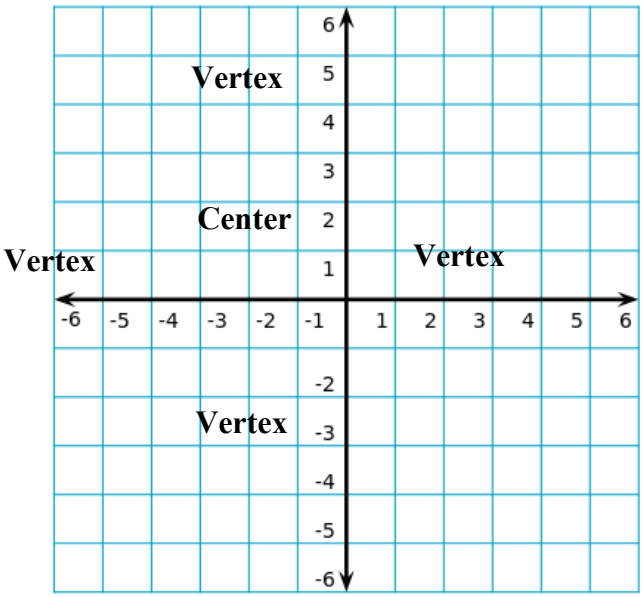


CIRCLES

Equation	$(x-h)^2 + (y-k)^2 = r^2$
Center	(h, k)
Vertices	$(h \pm r, k), (h, k \pm r)$

Examples:

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



$(x-2)^2 + (y-3)^2 = 4$