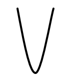
Conic Sections Formulas

Equations of Parabola:

1) Parabola opens up: $(x-h)^2 = 4p(y-k)$ 

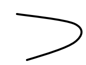
vertex $=(h,k)$; focus $=(h,k+p)$; directrix: $y=k-p$

2) Parabola opens down: $(x-h)^2 = -4p(y-k)$ 

vertex $=(h,k)$; focus $=(h,k-p)$; directrix: $y=k+p$

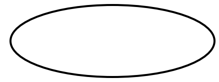
3) Parabola opens right: $(y-k)^2 = 4p(x-h)$ 

vertex $=(h,k)$; focus $=(h+p,k)$; directrix: $x=h-p$

4) Parabola opens left: $(y-k)^2 = -4p(x-h)$ 

vertex $=(h,k)$; focus $=(h-p,k)$; directrix: $x=h+p$

Ellipse Elongated Horizontally



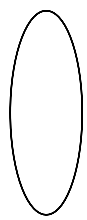
Equation: $\frac{(x-h)^2}{a^2}+\frac{(y-k)^2}{b^2}=1$; $a>b$

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

Center of Ellipse: (h,k)

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

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



Ellipse Elongated Vertically

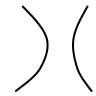
Equation: $\frac{(x-h)^2}{b^2}+\frac{(y-k)^2}{a^2}=1$; $a>b$

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

Center of Ellipse: (h,k)

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

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

Hyperbola with Branches Opening Left and Right 

Equation of Hyperbola: $\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1$

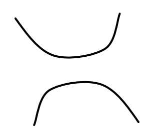
$c^2 = a^2 + b^2$

Center of Hyperbola: (h, k)

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

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

Equations of asymptotes: $y = \pm\frac{b}{a}(x-h)+k$

Hyperbola with Branches Opening Up and Down 

Equation of Hyperbola: $\frac{(y-k)^2}{a^2} - \frac{(x-h)^2}{b^2} = 1$

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

Center of Hyperbola: (h, k)

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

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

Equations of asymptotes: $y = \pm\frac{a}{b}(x-h)+k$