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: $y = k + p$

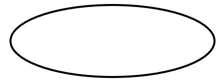
3) Parabola opens right: $(y-k)^2 = 4p(x-h)$

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

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

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

Ellipse Elongated Horizontally



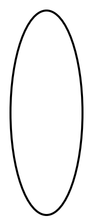
Equation: $\dfrac{(x-h)^2}{a^2}+\dfrac{(y-k)^2}{b^2}=1$; $a>b$

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

Center of Ellipse: (h,k)

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

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



Ellipse Elongated Vertically

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

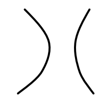
$a^2=b^2+c^2$

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

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

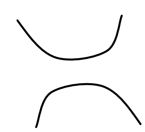
Center of Hyperbola: (h, k)

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

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

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

Hyperbola with Branches Opening Up and Down



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

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

Center of Hyperbola: (h, k)

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

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

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