

Conic Section Formulas

Parabola: (Vertical Axis)

Standard Form: $(x - h)^2 = 4p(y - k)$

Vertex: (h, k)

Directrix: $y = k - p$

Focus: $(h, k + p)$

Axis: $x = h$

Parabola: (Horizontal Axis)

Standard Form: $(y - k)^2 = 4p(x - h)$

Vertex: (h, k)

Directrix: $x = h - p$

Focus: $(h + p, k)$

Axis: $y = k$

Ellipse: (Horizontal Major Axis)

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

Center: (h, k)

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

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

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

Minor Vertices: $(h, k \pm b)$

Eccentricity: $e = \frac{c}{a}$

Ellipse: (Vertical Major Axis)

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

Center: (h, k)

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

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

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

Minor Vertices: $(h \pm b, k)$

Eccentricity: $e = \frac{c}{a}$

Hyperbola: (Horizontal Transverse Axis)

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

Center: (h, k)

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

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

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

Minor Vertices: $(h, k \pm b)$

Eccentricity: $e = \frac{c}{a}$

Asymptotes: $y = k \pm \frac{b}{a}(x - h)$
 where $a = x, b = y$

Hyperbola: (Vertical Transverse Axis)

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

Center: (h, k)

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

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

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

Minor Vertices: $(h \pm b, k)$

Eccentricity: $e = \frac{c}{a}$

Asymptotes: $y = k \pm \frac{a}{b}(x - h)$
 where $a = y, b = x$