

Conic Section Formulas

Parabola:

$$y = a(x-h)^2 + k$$

If $a > 0$, opens up

If $a < 0$, opens down

Vertex: (h, k)

Focus: $(h, k+p)$

Directrix: $y = k-p$

Axis of Symmetry: $x = h$

$$a = \frac{1}{4p}$$

$$p = \frac{1}{4a}$$

$$x = a(y-k)^2 + h$$

If $a > 0$, opens right

If $a < 0$, opens left

Vertex: (h, k)

Focus: $(h+p, k)$

Directrix: $x = h-p$

Axis of Symmetry: $y = k$

Ellipse:

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

Center: $(0, 0)$

Foci: $(c, 0), (-c, 0)$

Vertices: $(a, 0), (-a, 0)$

y Intercepts: $(0, b), (0, -b)$

Major Axis: x axis

Minor Axis: y axis

Length of Major Axis: $2a$

Length of Minor Axis: $2b$

$$c^2 = a^2 - b^2, \quad a > b > 0$$

$$\frac{x^2}{b^2} + \frac{y^2}{a^2} = 1$$

Center: $(0, 0)$

Foci: $(0, c), (0, -c)$

Vertices: $(0, a), (0, -a)$

x Intercepts: $(b, 0), (-b, 0)$

Major Axis: y axis

Minor Axis: x axis

Length of Major Axis: $2a$

Length of Minor Axis: $2b$

Hyperbola:

Transverse Axis: Horizontal

$$\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$$

Center: $(0, 0)$

Foci: $(c, 0), (-c, 0)$

Vertices: $(a, 0), (-a, 0)$

Asymptotes: $y = \pm \frac{b}{a}x$

Transverse Axis: Vertical

$$\frac{y^2}{a^2} - \frac{x^2}{b^2} = 1$$

Center: $(0, 0)$

Foci: $(0, c), (0, -c)$

Vertices: $(0, a), (0, -a)$

Asymptotes: $y = \pm \frac{a}{b}x$

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

Circle:

$$(x-h)^2 + (y-k)^2 = r^2$$

Center: (h, k)

Radius: r