

Conic Sections Formulas Sheet

Circles

Centered at Origin	Centered at (h, k)
$x^2 + y^2 = r^2$	$(x - h)^2 + (y - k)^2 = r^2$
Key Points: Center: $(0, 0)$ or (h, k) Radius: r	

Ellipses centered at the origin

EQUATION	$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ $a > b > 0$	$\frac{x^2}{b^2} + \frac{y^2}{a^2} = 1$ $a > b > 0$
VERTICES	$(\pm a, 0)$	$(0, \pm a)$
MAJOR AXIS	Horizontal, length $2a$	Vertical, length $2a$
MINOR AXIS	Vertical, length $2b$	Horizontal, length $2b$
FOCI	$(\pm c, 0), c^2 = a^2 - b^2$	$(0, \pm c), c^2 = a^2 - b^2$

Hyperbolas centered at the origin

EQUATION	$\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1 \quad a > 0, b > 0$	$\frac{y^2}{a^2} - \frac{x^2}{b^2} = 1 \quad a > 0, b > 0$
VERTICES	$(\pm a, 0)$	$(0, \pm a)$
TRANSVERSE AXIS	Horizontal, length $2a$	Vertical, length $2a$
ASYMPTOTES	$y = \pm \frac{b}{a}x$	$y = \pm \frac{a}{b}x$
FOCI	$(\pm c, 0), c^2 = a^2 + b^2$	$(0, \pm c), c^2 = a^2 + b^2$

Parabolas

PARABOLA WITH VERTICAL AXIS

The graph of the equation

$$x^2 = 4py$$

is a parabola with the following properties.

VERTEX $V(0, 0)$

FOCUS $F(0, p)$

DIRECTRIX $y = -p$

The parabola opens upward if $p > 0$ or downward if $p < 0$.

PARABOLA WITH HORIZONTAL AXIS

The graph of the equation

$$y^2 = 4px$$

is a parabola with the following properties.

VERTEX $V(0, 0)$

FOCUS $F(p, 0)$

DIRECTRIX $x = -p$

The parabola opens to the right if $p > 0$ or to the left if $p < 0$.

Notice: conics formulas with center different than the origin are not provided but you need to know how to get them from the ones centered at the origin.