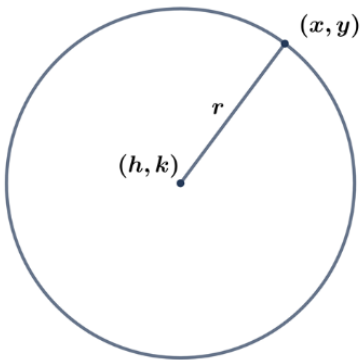
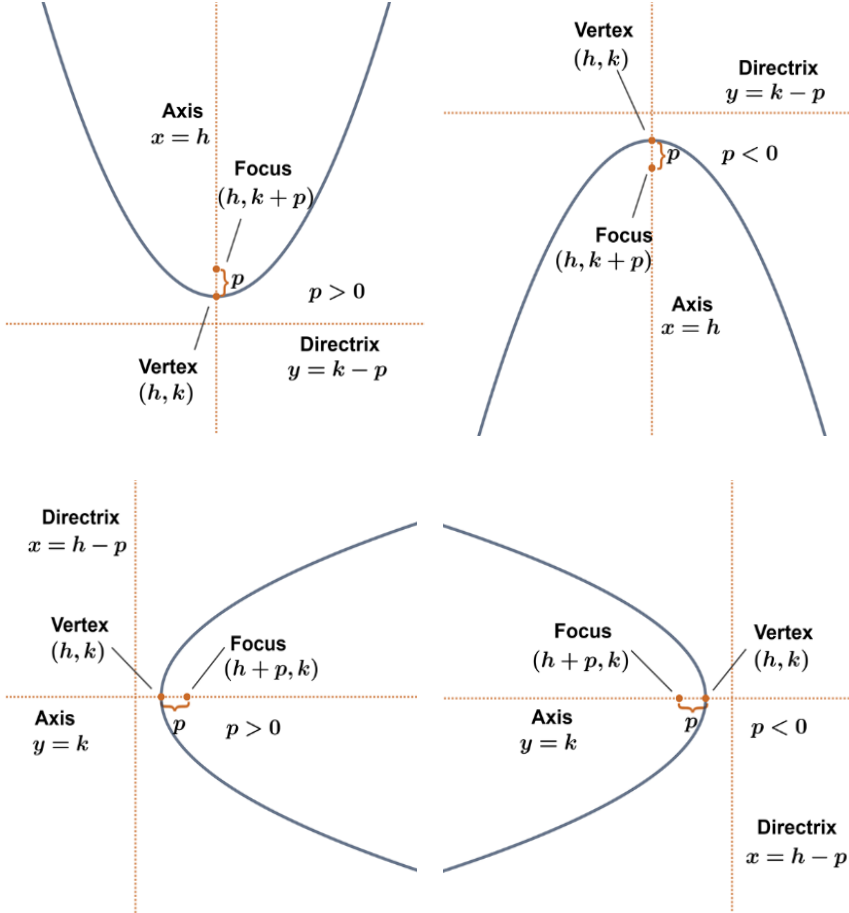


Formulas for Conic Sections

<p style="text-align: center;">Circle</p> <p>For circle with radius r :</p> <p>Center (h, k):</p> $(x - h)^2 + (y - k)^2 = r^2$ <p>Center $(0, 0)$: $x^2 + y^2 = r^2$</p> <p>Eccentricity: $e = 0$</p>	
<p style="text-align: center;">Parabola</p> <p>For parabola with vertical axis and directrix $y = k - p$, where p is a nonzero real number:</p> <p>Vertex (h, k):</p> $(x - h)^2 = 4p(y - k)$ <p>Vertex $(0, 0)$: $x^2 = 4py$</p> <p>For parabola with horizontal axis and directrix $x = h - p$, where p is a nonzero real number:</p> <p>Vertex (h, k):</p> $(y - k)^2 = 4p(x - h)$ <p>Vertex $(0, 0)$: $y^2 = 4px$</p> <p>Eccentricity: $e = 1$</p>	

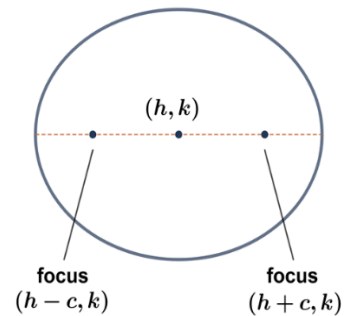
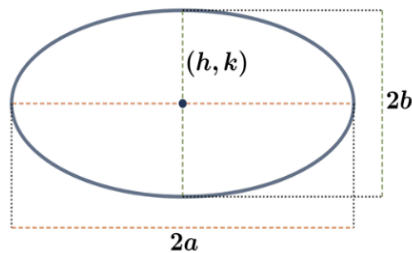
Ellipse

For ellipse with horizontal major axis, where $a > b > 0$:

Center (h, k) :

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

Center $(0, 0)$: $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

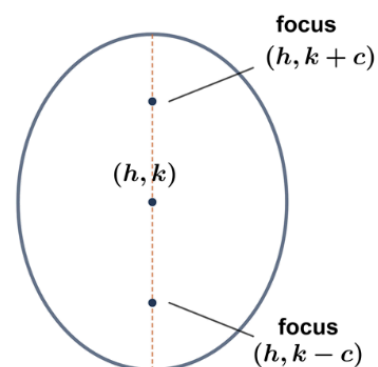
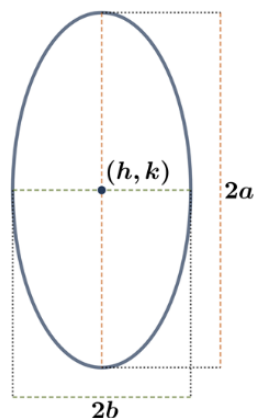


For ellipse with vertical major axis, where $a > b > 0$:

Center (h, k) :

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

Center $(0, 0)$: $\frac{y^2}{a^2} + \frac{x^2}{b^2} = 1$



Eccentricity: $0 < e < 1$, $e = \frac{c}{a}$,
where $c^2 = a^2 - b^2$

Hyperbola

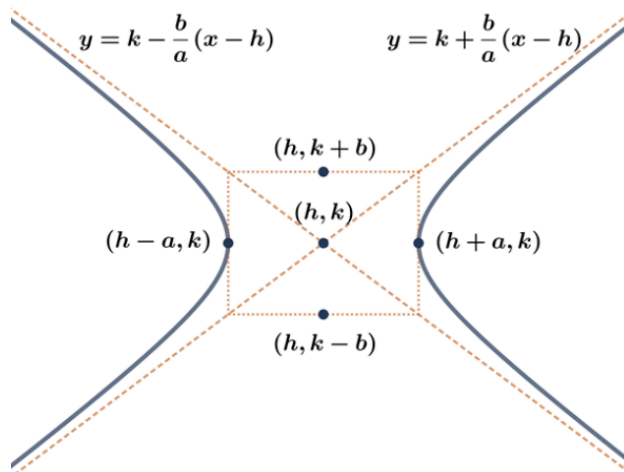
For hyperbola with horizontal transverse axis, where $a > 0$, $b > 0$:

Center (h, k) :

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

Center $(0, 0)$: $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$

Foci $(h \pm c, k)$,
where $c^2 = a^2 + b^2$



For hyperbola with a vertical transverse axis, where $a > 0$, $b > 0$:

Center (h, k) :

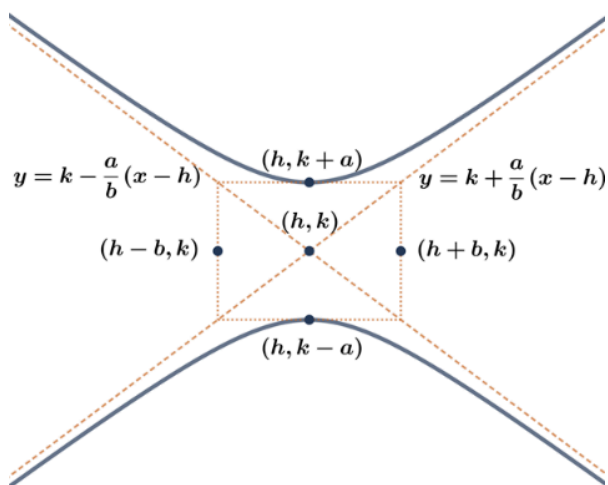
$$\frac{(y-k)^2}{a^2} - \frac{(x-h)^2}{b^2} = 1$$

Center $(0, 0)$: $\frac{y^2}{a^2} - \frac{x^2}{b^2} = 1$

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

Eccentricity: $e > 1$,

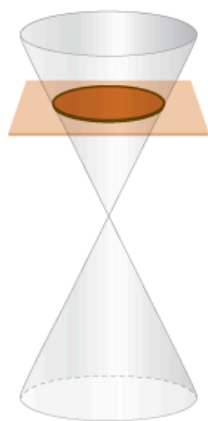
$e = \frac{c}{a}$, where $c^2 = a^2 + b^2$



How are conic sections created?

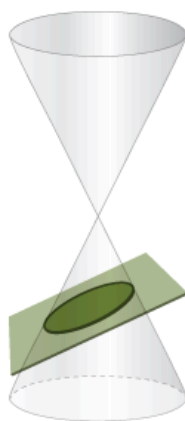
A conic section is a curve formed by intersecting a right, circular cone with a plane without going through the vertex.

CIRCLE



A **circle** is formed when the plane is parallel to the base of the cone.

ELLIPSE



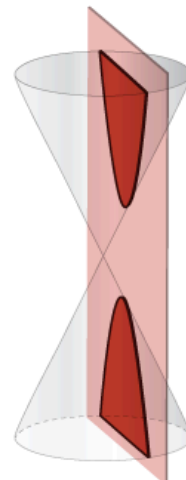
An **ellipse** is formed when the plane is at a slight angle with respect to the base of the cone, but not parallel to its slant edge.

PARABOLA



A **parabola** is formed when the plane is parallel to the slant edge of the cone and intersects its base.

HYPERBOLA



A **hyperbola** is formed when the plane intersects both cones.