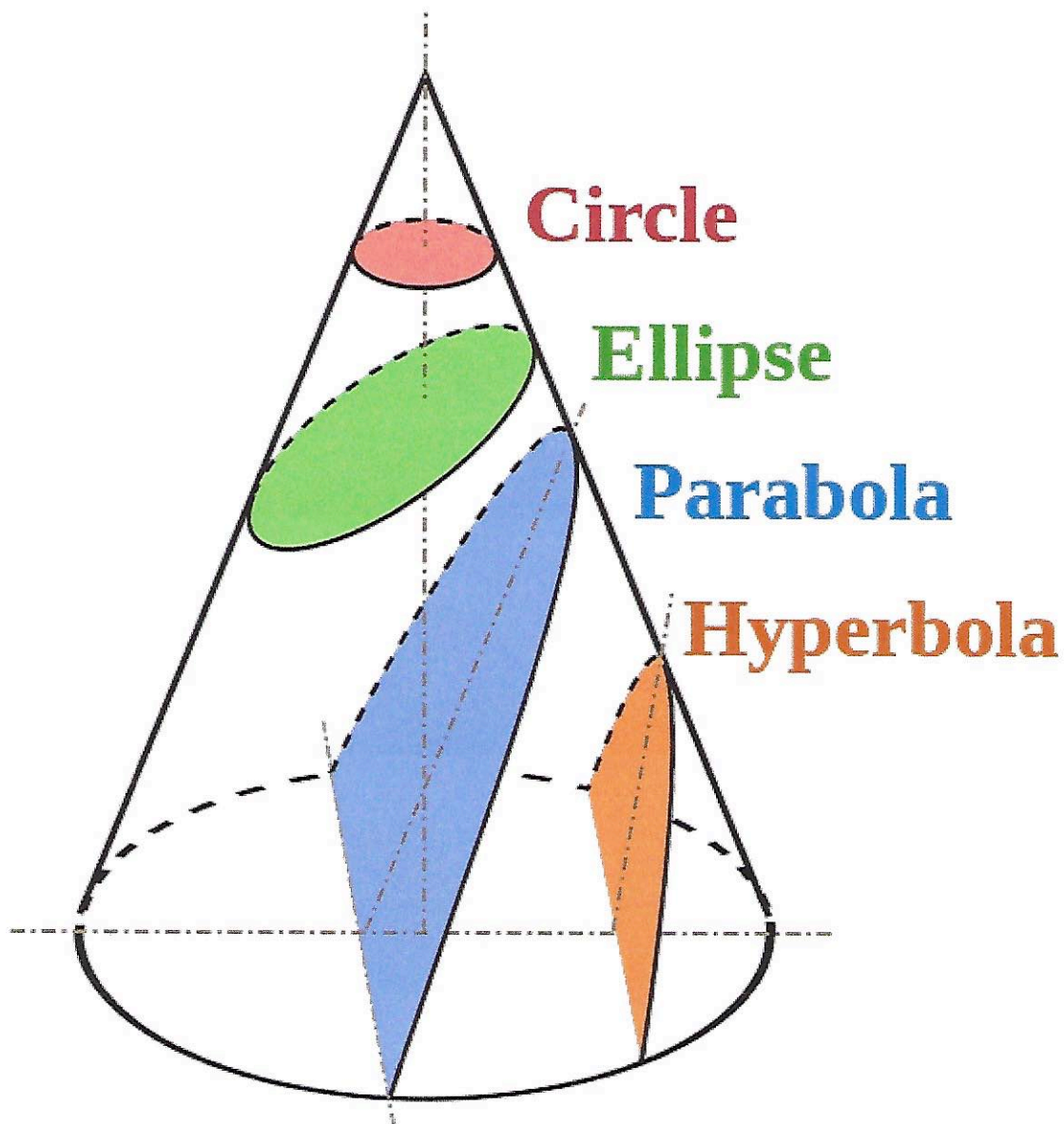


SUMMARY OF THE CONIC SECTIONS

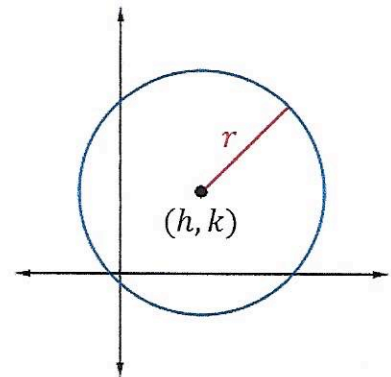


CIRCLES & ELLIPSES

Definition of a Circle: A circle is the set of all points in the plane equidistant from a fixed point.

Standard Equation for Circles: $(x - h)^2 + (y - k)^2 = r^2$

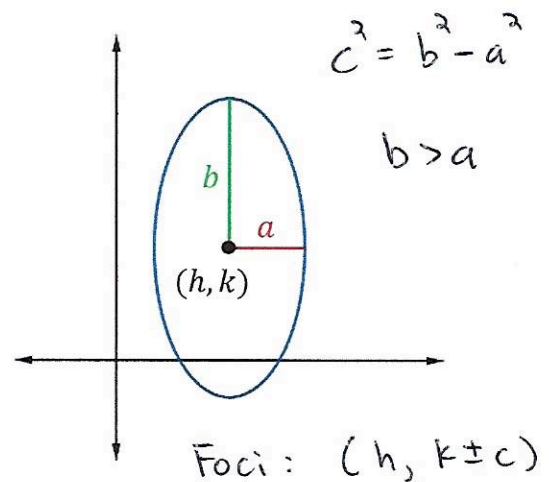
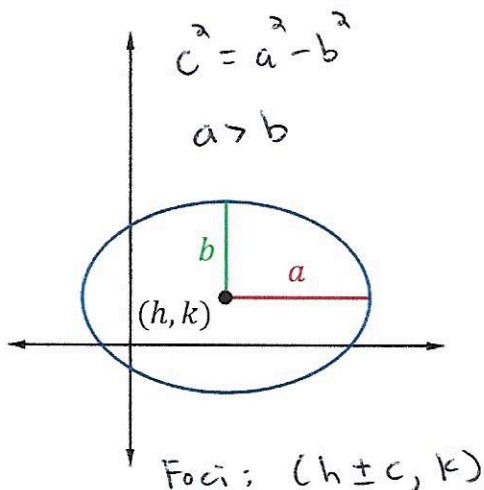
(h, k) is the center
 r is the radius



Definition of an Ellipse: An ellipse is the set of all points in the plane the sum of whose distances from two fixed points (the foci) is constant.

Standard Equation for Ellipses:

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



For both types of ellipses, the center is (h, k) , and the vertices are the endpoints of the **major** axis.

Use the value of c to find the coordinates of each focus. The foci are always located on the major axis and are each c units away from the center.

If $a = b$, then the ellipse is a circle, and a and b will both be equal to the radius r . The foci of a circle are located at the same point—the center.

$e = \frac{c}{a}$ is called the eccentricity ($e=0$ for circle)

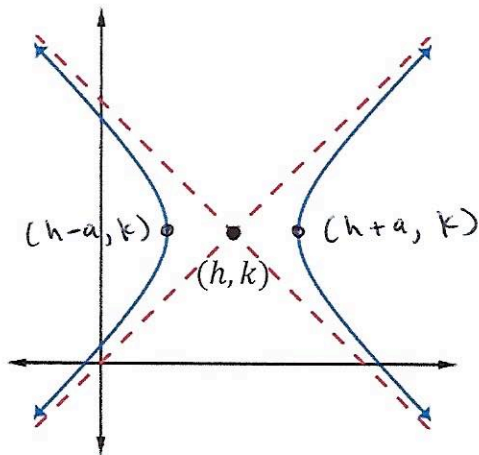
HYPERBOLAS

Definition of a Hyperbola: A hyperbola is the set of all points in the plane the difference of whose distances from two fixed points (the foci) is constant.

Standard Equations for Hyperbolas:

For hyperbolas that open left and right, the standard equation is

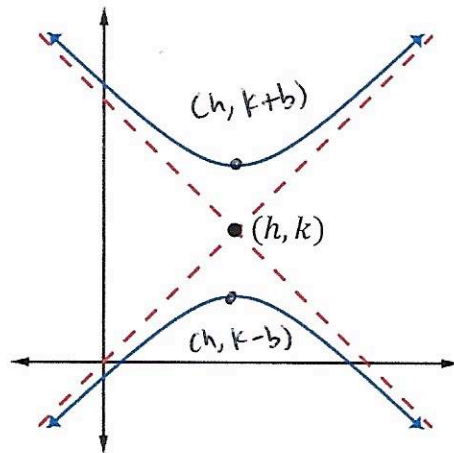
$$\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1$$



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

For hyperbolas that open up and down, the standard equation is

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



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

For both types of hyperbolas, the center is (h, k) , and the vertices are the turning points of the branches of the hyperbola.

Use the values of a and b to create the central rectangle around the center of the hyperbola. The diagonals of this rectangle form the asymptotes. The equations of the asymptotes are

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

$$c > a, \quad c > b$$

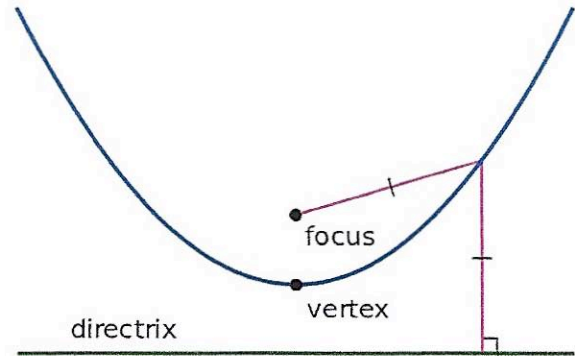
Use the value $c = \sqrt{a^2 + b^2}$ to find the coordinates of each focus. The branches of a hyperbola will always bend towards the foci and away from the center.

PARABOLAS

Definition: A parabola is the set of all points in the plane equidistant from a fixed line (the directrix) and a fixed point (the focus).

The graph of a parabola will always bend towards its focus and away from its directrix.

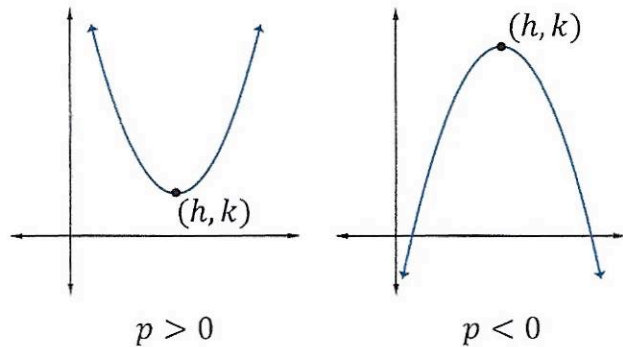
The coordinates of the vertex are (h, k) . The distance from the vertex to both the focus and directrix is given by $|p|$.



Standard Equations for Parabolas:

For a parabola that opens up or down, the standard equation is

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



For a parabola that opens left or right, the standard equation is

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

