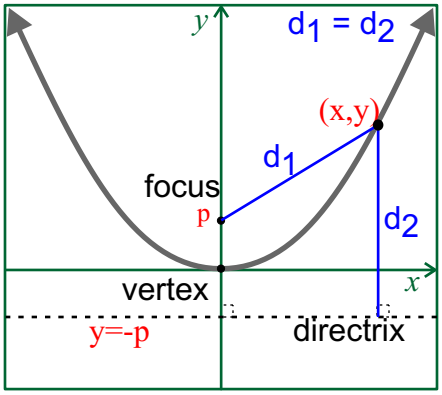
Conic Sections

Parabola



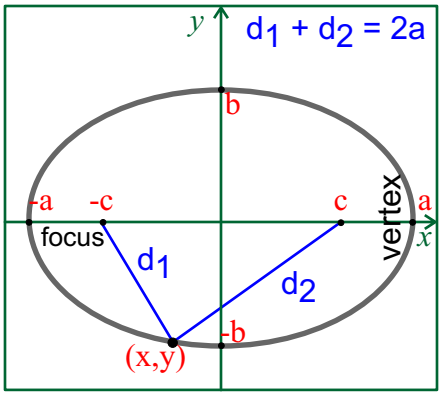
Parabola:

The set of all points in a plane equidistant from a fixed point (focus) and a line (directrix)

You can identify a parabola from the general form of a conic section because only one variable will be squared and the other variable will be linear.

$$x^2 = 4py$$

Ellipse



Ellipse:

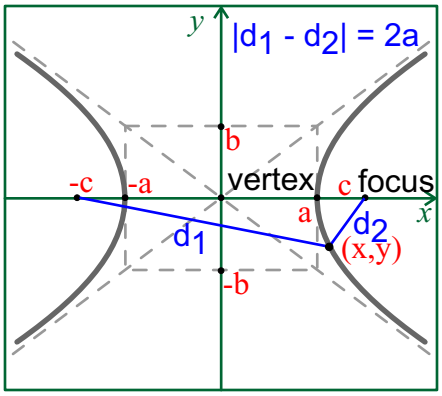
The set of all points in a plane such that the sum of the distances from two fixed points (foci) is constant.

That constant is the length of the major axis.

In the general form of a conic section, the squared terms will be the same sign. A circle is a special case of the ellipse that occurs when the coefficients on the squared terms are the same.

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

Hyperbola



Hyperbola:

The set of all points in a plane such that the difference of the distances from two fixed points (foci) is constant.

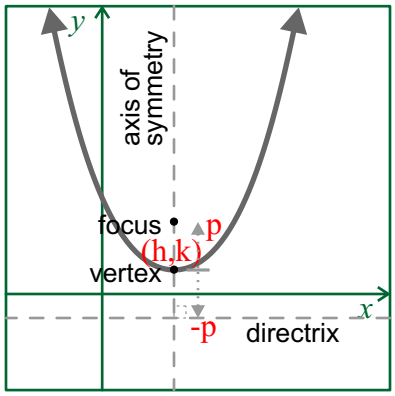
That constant is the length of the transverse axis.

In the general form of a conic section, the squared terms will have different signs.

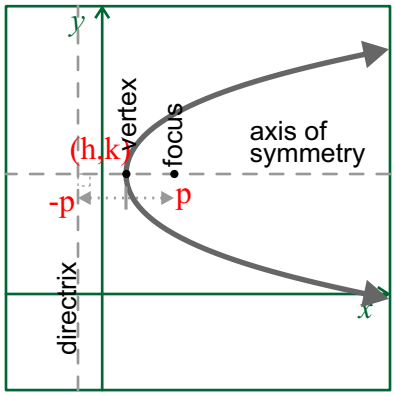
$$\frac{x^2}{\Delta x^2} - \frac{y^2}{\Delta y^2} = 1$$

Conic Sections

Parabola



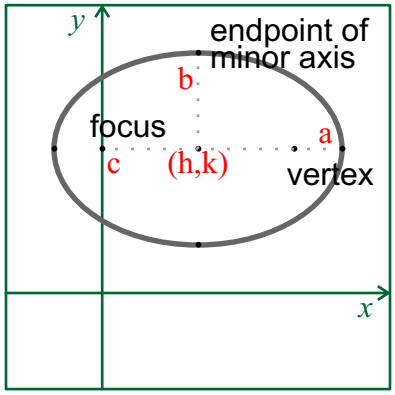
$$(x-h)^2 = 4p(y-k)$$



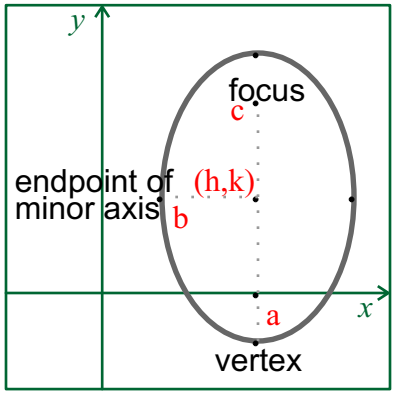
$$(y-k)^2 = 4p(x-h)$$

The starting point is the vertex.
There is an axis (of symmetry) which contain the focus and the vertex and is perpendicular to the directrix.
Move p units along the axis of symmetry from the vertex to the focus.
Move -p units along the axis of symmetry from the vertex to the directrix (which is a line).
The focus is within the curve.

Ellipse



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

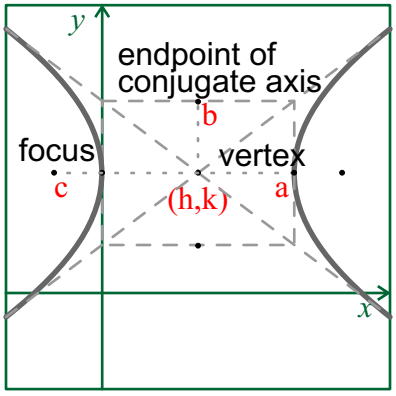


$$\frac{(y-k)^2}{a^2} + \frac{(x-h)^2}{b^2} = 1$$

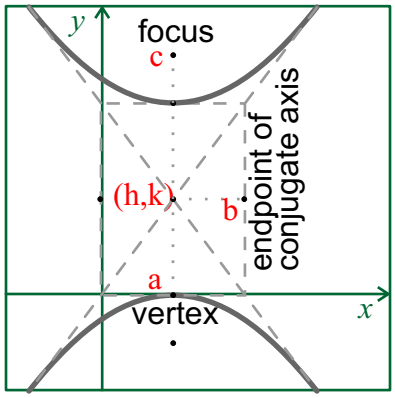
The center is the starting point.
The major axis contains the foci and vertices.
Major axis length = 2a
Minor axis length = 2b
Distance between foci = 2c
The foci are within the curve.
Since the vertices are the furthest away from the center, the pythagorean relationship is ...

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

Hyperbola



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



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

The center is the starting point.
The transverse axis contains the foci and vertices.
Transverse axis length = 2a
Conjugate axis length = 2b
Distance between foci = 2c
The foci are within the curve.
Since the foci are the furthest away from the center, the pythagorean relationship is ...

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

The equations of the asymptotes are $(y-k) = \pm\frac{\Delta y}{\Delta x}(x-h)$