

General Form

$$Ax^2 + By^2 + Cx + Dy + E = 0$$

Parabola x or y is squared, but not both

Circle x^2 & y^2 have the same coefficient

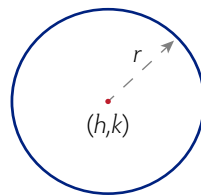
Ellipse x^2 & y^2 have the same signs

Hyperbola x^2 & y^2 have different signs

Circle

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

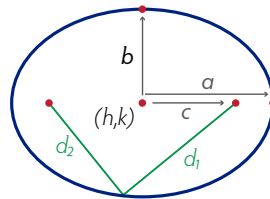
- eccentricity = 0



Ellipse

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

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



- a is always the larger number (and therefore the longer axis).
- $d_1 + d_2 = 2a$
- $c^2 = a^2 - b^2$
- $0 < \text{eccentricity} < 1$ (closer to 0 means rounder)

Terminology

- c & $-c$ Distance to the **focus** (plural: *foci*)
- Long axis **Major axis**
 a Major radius, **semi-major axis**
- Short axis **Minor axis**
 b Minor radius, **semi-minor axis**

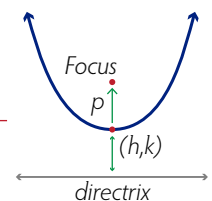
What's Eccentricity? $e = \frac{c}{a}$

Parabola

$$\text{Vertical } (x - h)^2 = 4p(y - k)$$

$$\text{Horizontal } (y - k)^2 = 4p(x - h)$$

- p is the distance from the vertex to the focus.



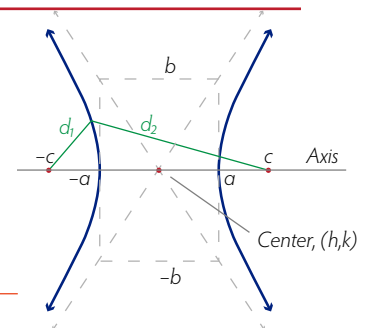
- The directrix and focus are the same distance from the vertex.
- eccentricity = 1

Hyperbola

Horizontal axis

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

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



Vertical axis

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

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

The slope is always the y radius over the x radius.

Notes

- a is always under the positive element
- Vertical if y is positive
Horizontal if x is positive
- $c^2 = a^2 + b^2$