Conic Sections

General Form

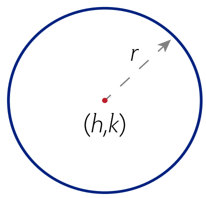
$Ax^2 + By^2 + Cx + Dy + E = 0$

Parabola	x or y is squared, but not both	*Ellipse*	x^2 & y^2 have the same signs
Circle	x^2 & y^2 have the same coefficient	*Hyperbola*	x^2 & y^2 have different signs

Circle

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

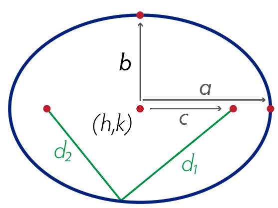
- eccentricity $= 0$



Ellipse

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

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



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

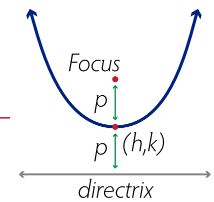
Terminology

- 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? $e = \dfrac{c}{a}$

Parabola

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



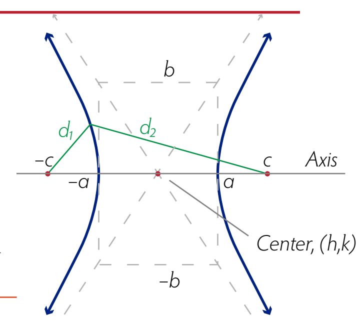
- p is the distance from the vertex to the focus.
- The directrix and focus are the same distance from the vertex.
- eccentricity $= 1$

Hyperbola

Horizontal axis

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

Asympt: $y = \pm \dfrac{b}{a}(x-h) + k$



Vertical axis

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

Asympt: $y = \pm \dfrac{a}{b}(x-h) + k$

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

Rev. 5/23/18