Acumen Tutoring

General Form

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

Parabola   *x* or *y* is squared, but not both

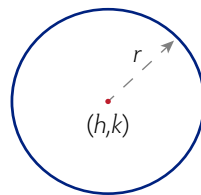*Circle* x^2 & y^2 have the same coefficient

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

Hyperbola x^2 & y^2 have different signs
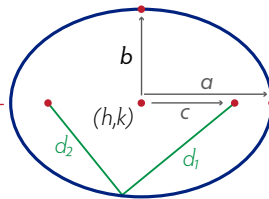
Circle

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

- eccentricity = 0

Ellipse

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

- The semi-major axis is the larger of *a* or *b*.
- $d_1 + d_2 = 2(semi\text{-}major\ axis)$
- $c^2 = |a^2 - b^2|$
- 0 < eccentricity < 1 (closer to 0 means rounder)

Terminology

- *c*   Distance to the focus (plural: *foci*)

- Long axis   Major axis
  Long radius   Semi-major axis
  Short axis   Minor axis
  Short radius   Semi-minor axis
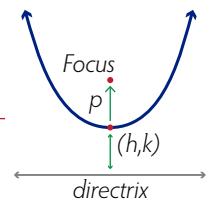
What's Eccentricity? $e = \dfrac{c}{semi\text{-}major\ axis}$

Parabola

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

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

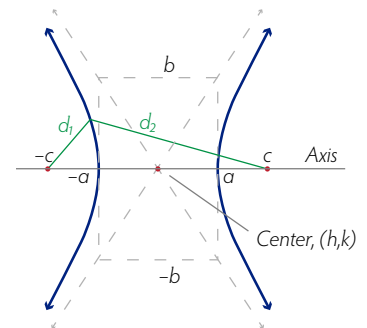## Hyperbola   *Centered at (0,0)*

Horizontal axis

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

Vertical axis

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

Asymptotes

$$y = \pm \frac{b}{a} x$$

Notes

- Vertical if *y* is positive
  Horizontal if *x* is positive
- $c^2 = a^2 + b^2$