8.1 Conic Sections and Parabolas

ellipse

circle - the plane has to be parallel to the base of the cone

hyperbola
Degenerate forms

Point
Line
Intersecting Lines
Parabola: set of all points in a plane equidistant from a particular line (directrix) and a particular point (focus)

axis of symmetry is \( \perp \) to the directrix

**Latus rectum = focal width** - the segment thru the focus \( \perp \) to the axis of symmetry. Its endpts lie on the parabola & length = \( 4p \) (parallel to the directrix)

**Axis of Symmetry** - line \( \perp \) to the latus rectum & directrix. It intersects the parabola at the vertex.

measure from the focus to an endpt of the latus rectum = measure from the focus to the directrix.
**Parabola - standard form**

### up/down

\[ 4p(y - k) = (x - h)^2 \]

- **vertical axis of symmetry**
- **vertex**: \((h, k)\)
- **focus**: \((h, k + p)\)
- **directrix**: \(y = k - p\)
- **axis**: \(x = h\)
- **focal length**: \(p\)
- **focal width**: \(4p\)

### left/right

\[ 4p(x - h) = (y - k)^2 \]

- **horizontal axis of symmetry**
- **vertex**: \((h, k)\)
- **focus**: \((h + p, k)\)
- **directrix**: \(x = h - p\)
- **axis**: \(y = k\)
- **focal length**: \(p\)
- **focal width**: \(4p\)
- **(not a function)**
Graph: \[ 2(x - 2) = (y - 3)^2 \]

vertex
focus
directrix
axis
focal length
focal width

Example:
Write the equation for a parabola with V: (2, -1) and a focal width of 4, opening down.
Write the equation for a parabola with V: (4, 3) and directrix x = 6

Parabola - General Form

\[ Ax^2 + Dx + Ey + F = 0 \]
\[ Cy^2 + Dx + Ey + F = 0 \]

Steps:
1. move the variable w/o a square term to the left & everything else to the rt.
2. Complete the sq. w/ the variables that have a sq. & linear term.
3. Write the completed square in factored form
4. Simplify
Prove the graph of the equation is a parabola, find the vertex, focus and directrix

\[ y^2 - 3x + 6y + 12 = 0 \]

Prove the graph of the equation is a parabola, find the vertex, focus and directrix

\[ 3x^2 - 6x - 6y + 10 = 0 \]