Quick notes on Ellipses and Hyperbolas
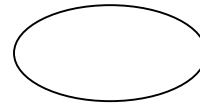
a = distance from the center to a vertex

b = up/down distance from the center

c = distance from the center to a foci

$a > b$ always for an ellipse, a always first for a hyperbola

Ellipse $\dfrac{(x-h)^2}{a^2} + \dfrac{(y-k)^2}{b^2} = 1$ with center (h,k)

Ellipse $\dfrac{(x-h)^2}{b^2} + \dfrac{(y-k)^2}{a^2} = 1$ with center (h,k)

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

Hyperbola $\dfrac{(x-h)^2}{a^2} - \dfrac{(y-k)^2}{b^2} = 1$ with center (h,k), "left/right"

$(X - h)^2$ first

Hyperbola $\dfrac{(y-k)^2}{a^2} - \dfrac{(x-h)^2}{b^2} = 1$ with center (h,k) looks like 2, "up/down"

$(y - k)^2$ first

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