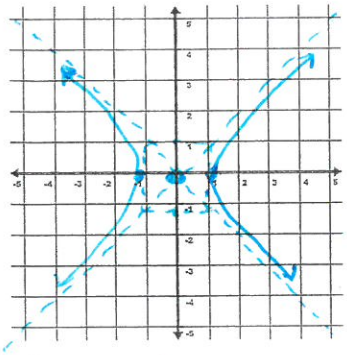
Section 12-2 Hyperbola

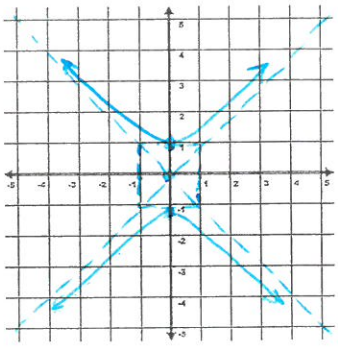
Def: the set of all points such that the absolute value of the *difference* of the distances from the foci is constant

Unit Hyperbola

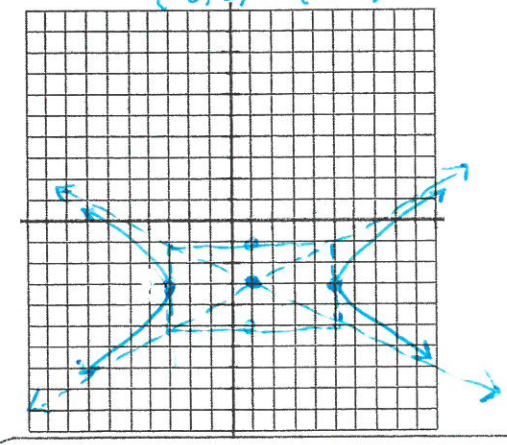
$x^2 - y^2 = 1$
--opens in the x-direction (left and right)
because x^2 is positive
--x radius = 1 and y radius = 1 center (0, 0)
--asymptotes at $y = \pm x$ from center
--vertices left 1 and right 1 from center



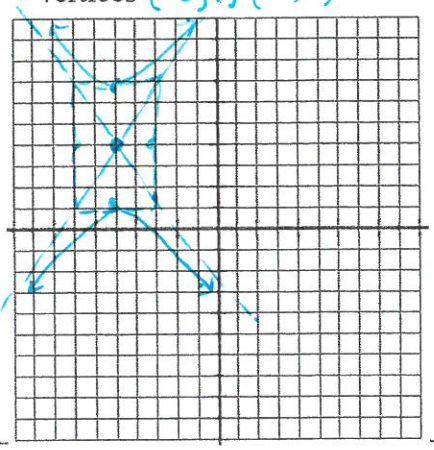
$-x^2 + y^2 = 1$
--opens in the y-direction (up and down)
because y^2 is positive
--x radius = 1 and y radius = 1 center(0, 0)
-- asymptotes at $y = \pm x$ from center
--vertices up 1 and down 1 from center



$\left(\frac{x-1}{4}\right)^2 - \left(\frac{y+3}{2}\right)^2 = 1$
--opens x direction
--center (1, -3)
--asymptotes $\pm\frac{2}{4}$ or $\frac{1}{2}$
--vertices (-3, -3) & (5, -3)



$-\left(\frac{x+5}{2}\right)^2 + \left(\frac{y-4}{3}\right)^2 = 1$
--opens y direction
--center (-5, 4)
--asymptotes $\pm\frac{3}{2}$
--vertices (-5, 1) (-5, 7)



Standard Equation

$\left(\frac{x-h}{a}\right)^2 - \left(\frac{y-k}{b}\right)^2 = 1$
center (h, k) opens left/right
asymptotes $y = \pm\frac{b}{a}x$
transverse radius a (horizontal)
conjugate radius b

(axis where vertices are)
(other axis)

$-\left(\frac{x-h}{b}\right)^2 + \left(\frac{y-k}{a}\right)^2 = 1$
center (h, k) opens up/down
asymptotes $y = \pm\frac{a}{b}x$
transverse radius a (vertical)
conjugate radius b

Foci (c) will be on concave side (inside the bowl) $c^2 = a^2 + b^2$ **note $e > 1$