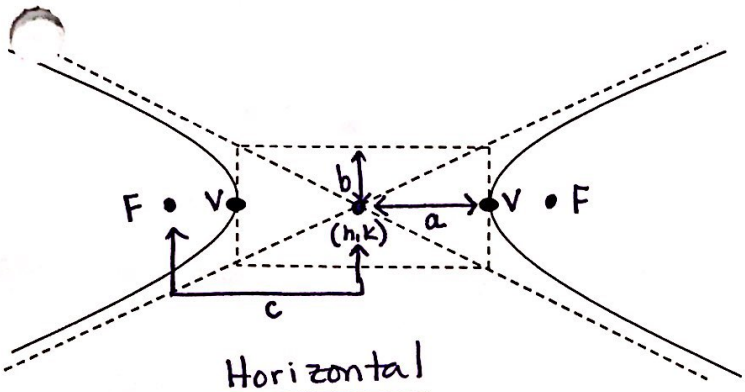
Notes: Hyperbolas

"a" is always the distance from the center to a vertex



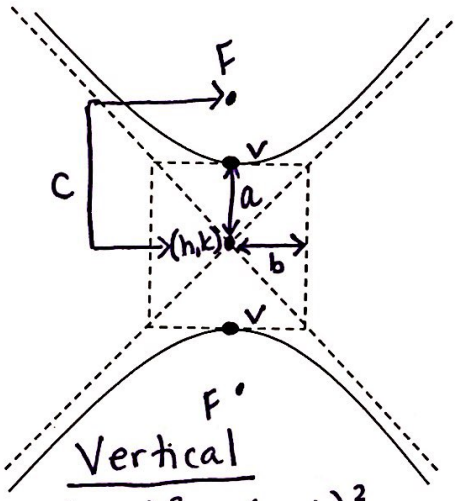
Horizontal

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

$$c = \sqrt{a^2+b^2}$$

Asymptotes

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



Vertical

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

Asymptotes

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

ex: $\frac{x^2}{4} - \frac{y^2}{16} = 1$ *horizontal

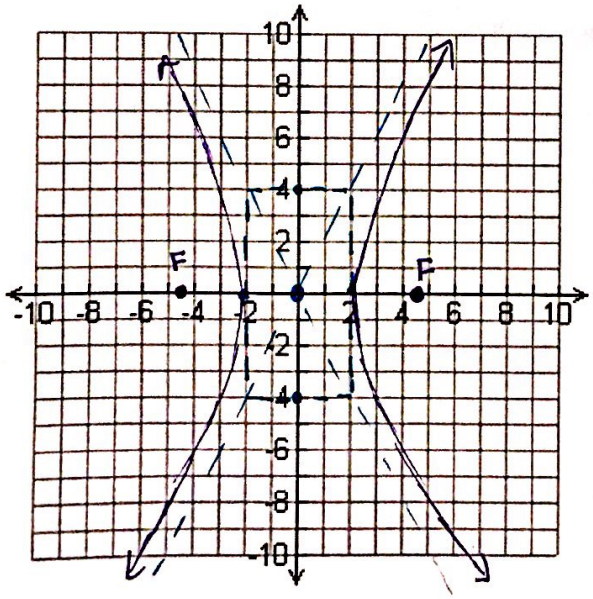
center (0,0)

$a = 2 \quad b = 4 \quad c = \sqrt{4+16} = \sqrt{20} = 2\sqrt{5} \approx 4.5$

V: (-2,0) + (2,0)

F: $(\pm 2\sqrt{5}, 0) \approx (\pm 4.5, 0)$

A: $y = \pm\frac{4}{2}(x-0)+0 \Rightarrow y = \pm 2x$



ex: $\frac{(y-2)^2}{25} - \frac{(x+1)^2}{9} = 1$ *Vertica

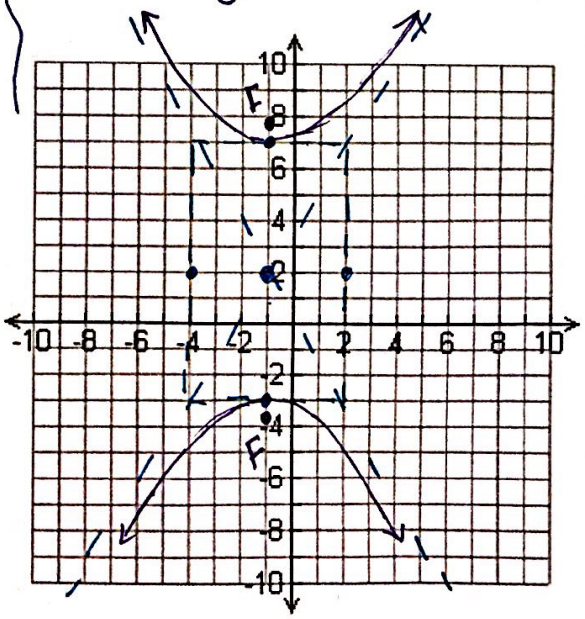
center (-1, 2)

$a = 5 \quad b = 3 \quad c = \sqrt{25+9} = \sqrt{34} \approx 5.8$

V: (-1,7) + (-1,-3)

F: (-1,7.8) + (-1,-3.8) $[(-1, 2\pm\sqrt{34})]$

A: $y = \pm\frac{5}{3}(x+1)+2$



$Ax^2 + By^2 + \ldots$ $A + B$ have opposite signs

ex: Write in Standard Form

$$\frac{16x^2 - 4y^2 + 96x - 40y + 108 = 0}{4}$$

$$4x^2 - y^2 + 24x - 10y + 27 = 0$$

$$4(x^2 + 6x + \underline{9}) - (y^2 + 10y + \underline{25}) = -27$$

$$+\underline{36} + \underline{-25}$$

$$\frac{4(x+3)^2 - (y+5)^2 = -16}{-16}$$

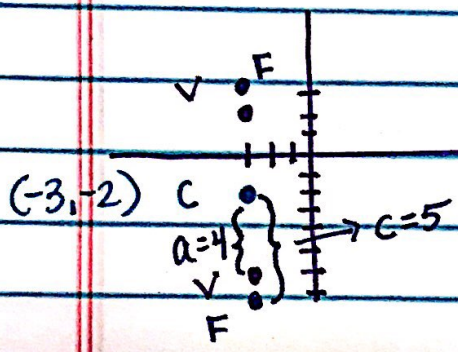
$$-\frac{(x+3)^2}{4} + \frac{(y+5)^2}{16} = 1$$

$$\frac{(y+5)^2}{16} - \frac{(x+3)^2}{4} = 1$$

*Vertical

ex: V: $(-3,-6)$ & $(-3,2)$

F: $(-3,-7)$ & $(-3,3)$



$$\frac{(y+2)^2}{16} - \frac{(x+3)^2}{9} = 1$$

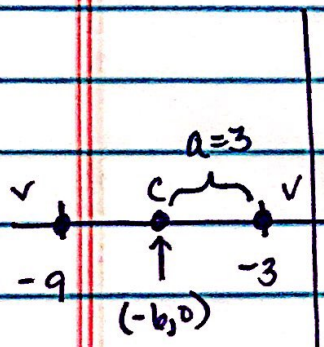
$5 = \sqrt{16 + b^2}$

$25 = 16 + b^2$

$9 = b^2$

ex: V: $(-3,0)$ & $(-9,0)$

Asymptotes: $y = 2x - 12$ and $y = -2x + 12$



Horizontal

$$\frac{(x+6)^2}{9} - \frac{y^2}{36} = 1$$

slope $= \pm 2 = \frac{b}{a} \Rightarrow 2 = \frac{b}{3} \Rightarrow b = 6 \Rightarrow b^2 = 36$