

Hyperbolas – Graphing

Hyperbola

A hyperbola is the set of all points (x, y) the difference of whose distances from two distinct fixed points (foci) is a positive constant.

The foci of a hyperbola lie on the transverse axis, c units from the center where $c^2 = a^2 + b^2$.

Horizontal Hyperbola

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

center: $(0, 0)$

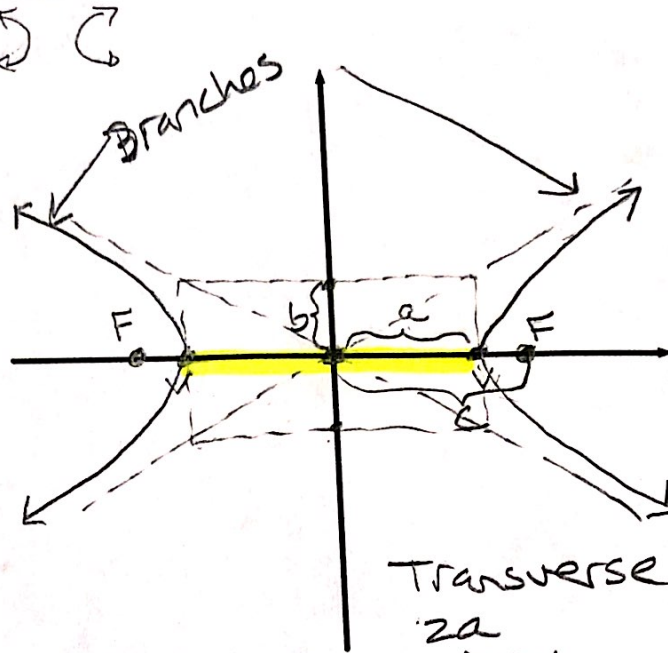
$a =$

$b =$

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

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

$(h \pm c, k)$



Transverse Axis

$2a$

- distance from

vertex to vertex

Vertical Hyperbola

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

center $(0, 0)$

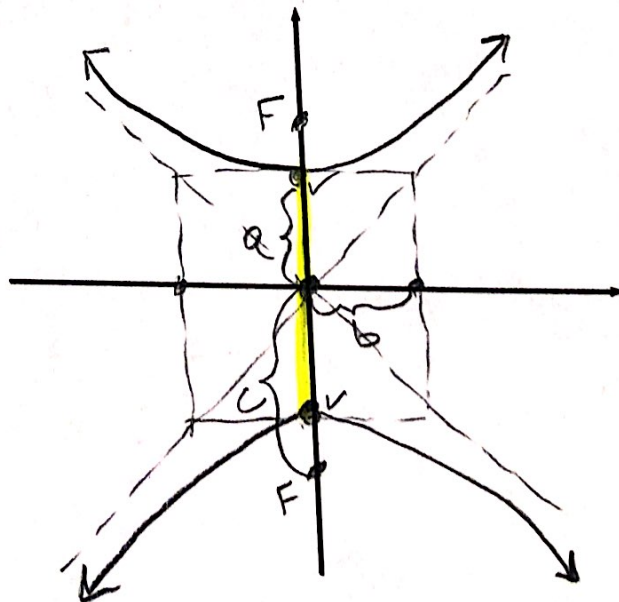
$a =$

$b =$

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

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

$(h, k \pm c)$



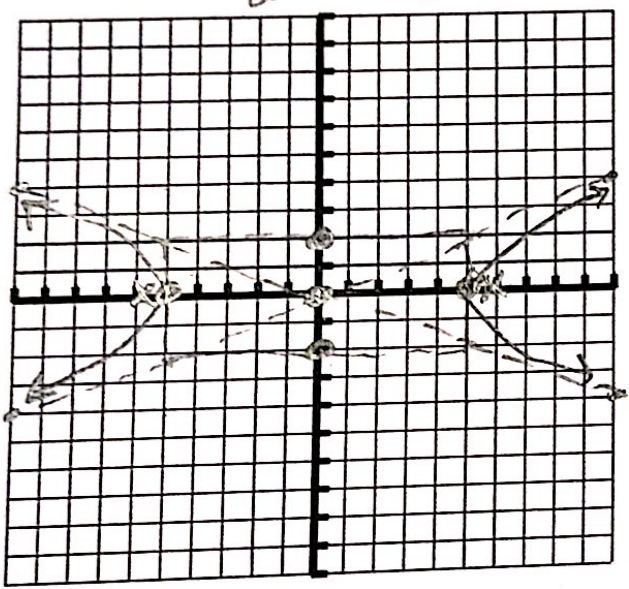
* Asymptote

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

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

Example 1: $\frac{x^2}{25} - \frac{y^2}{4} = 1$ Horizontal) (

$a = 5$
 $b = 2$
 $c^2 = a^2 + b^2$
 $c^2 = 25 + 4$
 $c^2 = 29$
 $c = \pm\sqrt{29}$
 ≈ 5.4

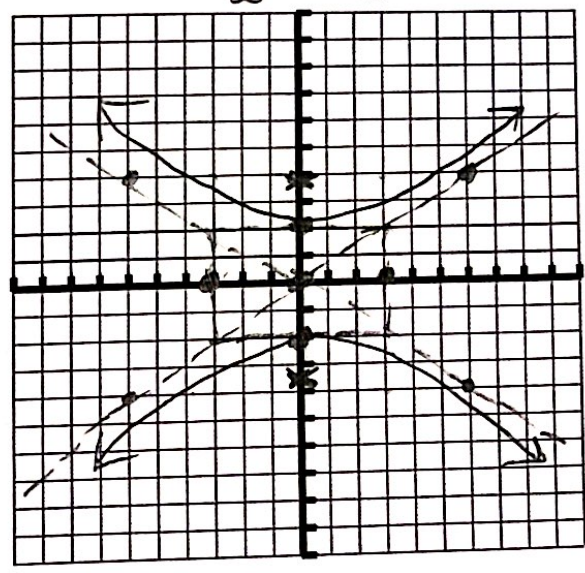


$Y = \frac{b}{a} X$

Center (0, 0)
 Vertices (5, 0) (-5, 0)
 Foci ($\sqrt{29}$, 0) ($-\sqrt{29}$, 0)
 Asymptotes = $Y = \pm \frac{2}{5} X$
 Transverse axis length = 10

Example 2: $\frac{y^2}{4} - \frac{x^2}{9} = 1$ Vertical) (

$a = 2$
 $b = 3$
 $c^2 = a^2 + b^2$
 $c^2 = 4 + 9$
 $c^2 = 13$
 $c = \pm\sqrt{13}$
 ≈ 3.6



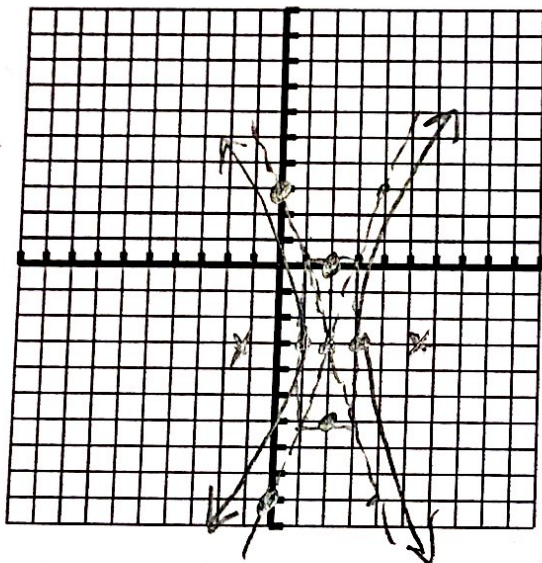
$Y = \frac{a}{b} X$

Center (0, 0)
 Vertices (0, 2) (0, -2)
 Foci (0, $\pm\sqrt{13}$)
 Asymptotes = $Y = \pm \frac{2}{3} X$
 Transverse axis length = 4

Horizontal) (

Example 3: $\frac{(x-2)^2}{a^2 1} - \frac{(y+3)^2}{b^2 9} = 1$

$a=1$
 $b=3$
 $c^2 = a^2 + b^2$
 $c^2 = 1 + 9$
 $c^2 = 10$
 $c = \pm\sqrt{10}$
 $\approx \pm 3.2$



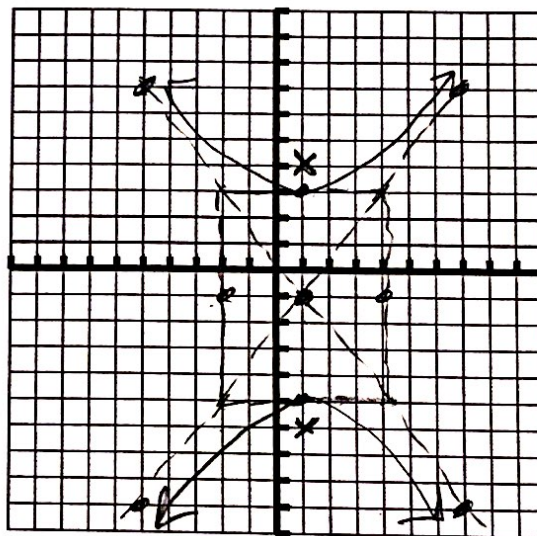
Center $(2, -3)$
Vertices $(3, -3)$ $(1, -3)$
Foci $(2 \pm \sqrt{10}, -3)$
Asymptotes = $y + 3 = \pm \frac{3}{1}(x - 2)$
Transverse axis length = 2

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

Vertical) (

Example 4: $\frac{(y+1)^2}{a^2 16} - \frac{(x-1)^2}{b^2 9} = 1$

$a=4$
 $b=3$
 $c^2 = a^2 + b^2$
 $c^2 = 16 + 9$
 $c^2 = 25$
 $c = \pm 5$



Center $(1, -1)$
Vertices $(1, 3)$ $(1, -5)$
Foci $(1, 4)$ $(1, -6)$
Asymptotes = $y + 1 = \pm \frac{4}{3}(x - 1)$
Transverse axis length = 8

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