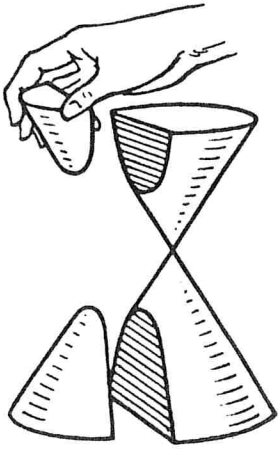


# Conic Sections: Hyperbola



Definition: set of all points whose difference of 2 distances from 2 fixed pts. is a constant.  
(foci)

Horizontal Hyperbola:

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

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

$a \rightarrow$  vertices (always 1st)

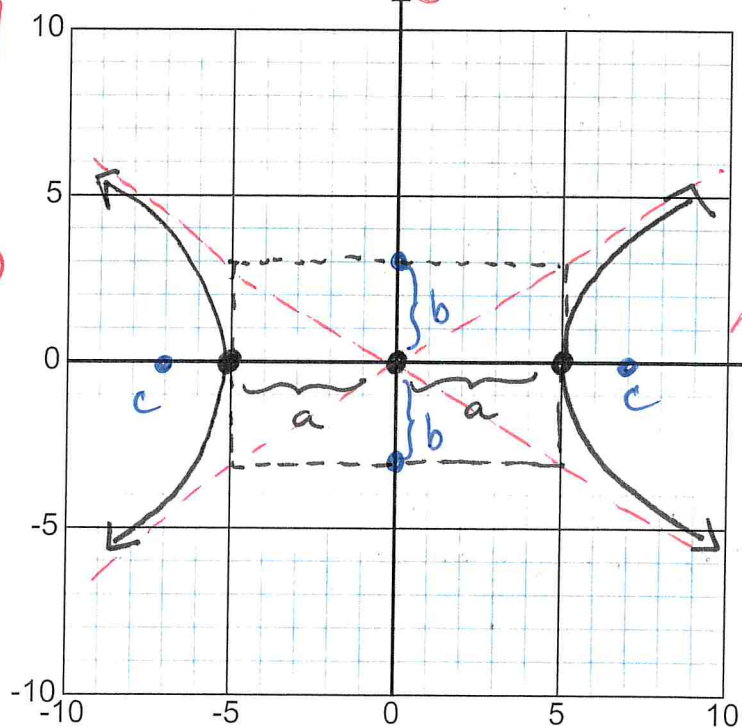
$b \rightarrow$  co-vertices

$c \rightarrow$  foci

$$(y-0) = \pm \frac{3}{5}(x-0)$$

$$y = \pm \frac{3}{5}x$$

conjugate  
(minor)



transverse  
(major)

Key parts to find in a hyperbola:

- 1) Center  $(h, k)$
- 2) Vertices  $a$  &  $b$
- 3) Foci  $c$

★ 4) Asymptotes  $(y - y_1) = m(x - x_1)$   
 $m = \pm b/a$

- 5) Eccentricity

$$e = c/a$$

Vertical Hyperbola:

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

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

★ asymptote:  $(y-y_1) = \pm \frac{a}{b}(x-x_1)$

$$m = \pm a/b$$

Ex.

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

$a = 4$   
 $b = 3$   
 $c = 5$

V:  $(7, -2)$   $(-1, -2)$

CV:  $(3, 1)$   $(3, -5)$

f:  $(8, -2)$   $(-2, -2)$

center:  $(3, -2)$

asympt:  $y+2 = \pm \frac{3}{4}(x-3)$

$e = 5/4$

Ex.  $9x^2 - y^2 - 36x - 6y + 18 = 0$

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

$a = 1$  V:  $(3, -3)$   $(1, -3)$

$b = 3$  CV:  $(2, 0)$   $(2, -6)$

$c = \sqrt{10}$  f:  $(2 \pm \sqrt{10}, -3)$

$e = \sqrt{10}$

$$\text{asympt: } y+3 = \pm 3(x-2)$$

C:  $(2, -3)$

