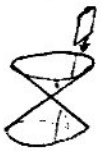
10.4: HYPERBOLAS

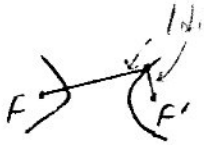
have 2 branches)(



Manip.

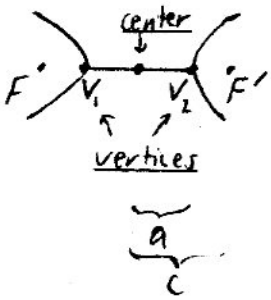
(A) Locus Def'n

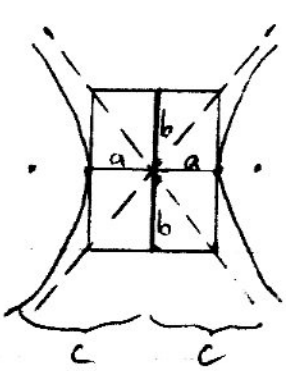
In an ellipse... 2 foci



(B) Terminology

Some of you are





Transverse axis = $2a$
Conjugate axis = $2b$

$c^2 = a^2 + b^2$
Notice: $c > a$

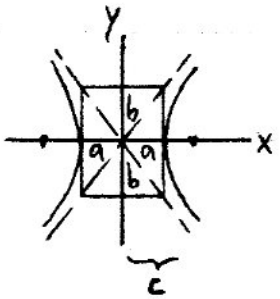
Scarface — 1st you draw the box...

Draw: ① Box
② Asymptotes
③ Hyperbola

(C) If Center is (0,0)

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

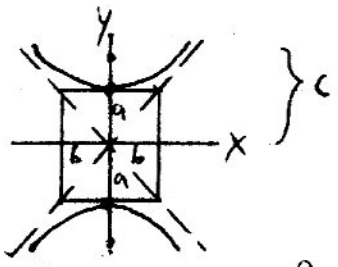
a^2 on left (not necessarily $> b^2$)



rise/run

Asyms: $y = \pm \frac{b}{a}x$ (slopes)

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



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

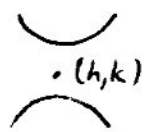
(D) If Center is (h,k)

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

)(h,k)(

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

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



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

(E) Eccentricity

$e = \frac{c}{a}$

Is $c > a$ or $c < a$?

$c > a$, so $e > 1$

>·<

$\frac{a}{c}$

$e = 2$

·)(·

$e = 10$

Ex (#14)

Graph $y^2 - 4x^2 - 12y - 16x + 16 = 0$
Find center, vertices, foci, and asymptotes.

Group terms

$$(y^2 - 12y) + \underbrace{(-4x^2 - 16x)}_{\text{factor out } (-4)} = -16$$

$$(y^2 - 12y \underbrace{+36}_{\text{CTS}}) - 4(x^2 + 4x \underbrace{+4}_{\text{CTS}}) = -16 \underbrace{+36 - 4(4)}_{\text{Be fair!}}$$

Factor!

$$(y-6)^2 - 4(x+2)^2 = 4$$

Need a "1"
÷ thru by 4

$$\frac{(y-6)^2}{4} - \frac{(x+2)^2}{1} = 1$$

Center: $(\overset{x}{-2}, \overset{y}{6})$
h, k

"y stuff" on left, so $a^2 = 4$

$a^2 = 4$ $\quad$ $b^2 = 1$

$a = \pm\sqrt{4} = 2$ $\quad$ $b = \pm\sqrt{1} = 1$

Find c

$$c^2 = a^2 + b^2$$
$$= 4 + 1$$
$$= 5$$

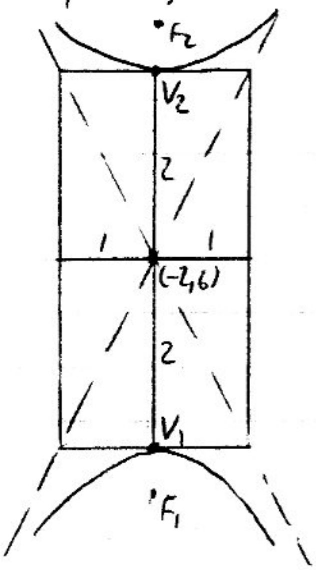
$$c = \sqrt{5}$$

Asyms

$$y - k = \pm \frac{a}{b}(x - h)$$
$$y - 6 = \pm \frac{2}{1}(x - (-2))$$
$$\boxed{y - 6 = \pm 2(x+2)}$$

Graph Setup

$a = 2,\ b = 1,\ c = \sqrt{5} \approx 2.2$



V_1: $(-2, 6-2)$ $\boxed{(-2, 4)}$

V_2: $(-2, 6+2)$ $\boxed{(-2, 8)}$

F_1: $\boxed{(-2, 6-\sqrt{5})}$
F_2: $\boxed{(-2, 6+\sqrt{5})}$

LORAN
Intersect hyps ⇒ pinpoint
Telescopes (HW look at

⑥ Applics.
Radar
Property: |diff| = const.

receives signal earlier; where would source be?
Reflecting property