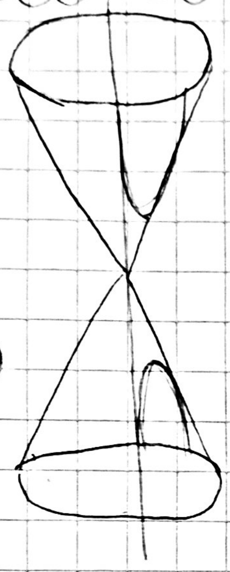
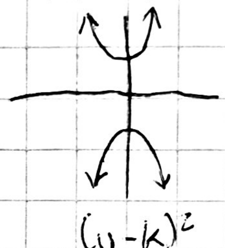
9.4 Hyperbolas



Horizontal

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

Vertical



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

a: distance from center
b: width of fundamental box
c: distance from center to focus
$c^2=a^2+b^2$

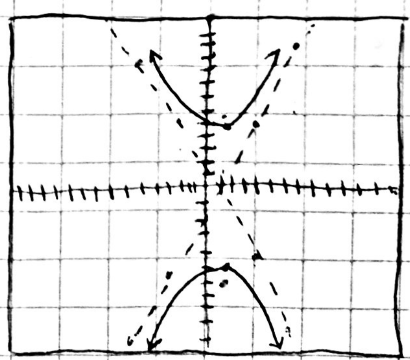
Asymptotes:

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

* The value underneath x is the denominator of the slope of the asymptotes

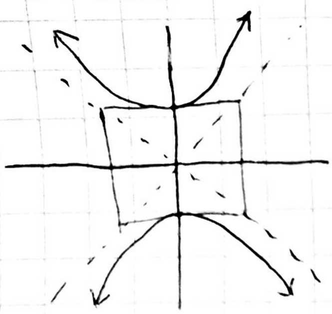
$$\frac{y^2}{25}-\frac{(x-1)^2}{9}=1$$

center: (1,0)
a: 5
c: $\sqrt{34}\approx 5.8$
foci: $(1,\sqrt{34}),(1,-\sqrt{34})$
$y=5/3$

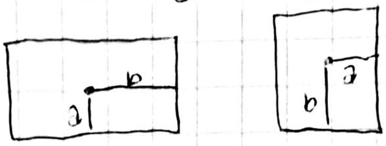


5

9.4 hyperbolas



FUNDAMENTAL BOX (slope box)



$-x^2+4y^2-2x+24y+19=0$

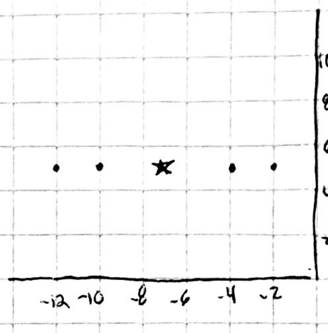
direction of opening is based on rather x or y is negative. X is negative therfore it comes second

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

If they are both positive it is an elispe

$$-x^2+4y^2-2x+24y+19=0$$
$$4y^2+24y-x^2-2x=-19$$
$$4(y^2+6y+9)-(x^2+2x+1)=16$$
$$\frac{4(y+3)^2}{16}-\frac{(x+1)^2}{16}=\frac{16}{16}$$
$$\frac{(y+3)^2}{4}-\frac{(x+1)^2}{16}=1$$

vertices: $(-4,5), (-10,5)$
foci: $(-2,5), (-12,5)$



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

$$\frac{(x+7)^2}{b^2}-\frac{(y-5)^2}{a^2}=1$$

$c^2-a^2=b^2$
$25-9=16$

$$\frac{(x+7)^2}{9}-\frac{(y-5)^2}{16}=1$$

9.4 hyperbolas

foci: $(5,9), (5,-17)$

Asymptotes: $y = 12/5\,x - 16$

$y = 12/5\,x + 8$

Vertical: $\dfrac{(y-k)^2}{a^2} - \dfrac{(x-h)^2}{b^2}$

$\dfrac{(y+4)^2}{144} - \dfrac{(x-5)^2}{25}$

Slope: $\dfrac{a}{b}$ or $\dfrac{b}{a}$

Vertical hyperbola

$\dfrac{9+(-17)}{2} = -4$

Center: $(5,-4)$

$\dfrac{(y+4)^2}{144} - \dfrac{(x-5)^2}{25} = 1$

$y \rightarrow \dfrac{12}{5}$

$x \rightarrow 5$