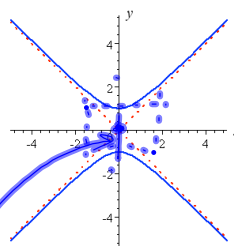


9.3 Hyperbolas Day 1



Hyperbolas: Standard Form with center (h, K)

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

transverse axis is horizontal

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

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

transverse axis is vertical

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

Vertices are "a" units from center.

Foci are "c" units from center where $c^2 = a^2 + b^2$

If center is at (0, 0), then $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ and $\frac{y^2}{a^2} - \frac{x^2}{b^2} = 1$

Find the center, vertices, foci, and asymptotes. Sketch the graph.

Ex 1) $\frac{y^2}{1} - \frac{x^2}{4} = 1$

$a^2 = 1$
 $a = 1$

center: (0, 0)

vertices: (0, 1), (0, -1)

foci: (0, $\pm\sqrt{5}$)

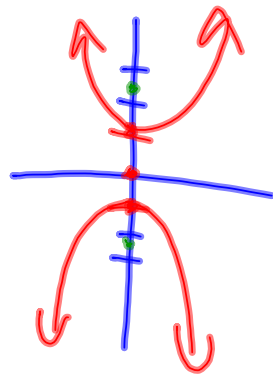
asymptotes: $y = \pm \frac{1}{2}x$

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

$$y = 0 \pm \frac{1}{2}(x-0)$$

$$y = \pm \frac{1}{2}x$$

$c^2 = a^2 + b^2$
 $c^2 = 1 + 4$
 $c^2 = 5$
 $c = \sqrt{5}$

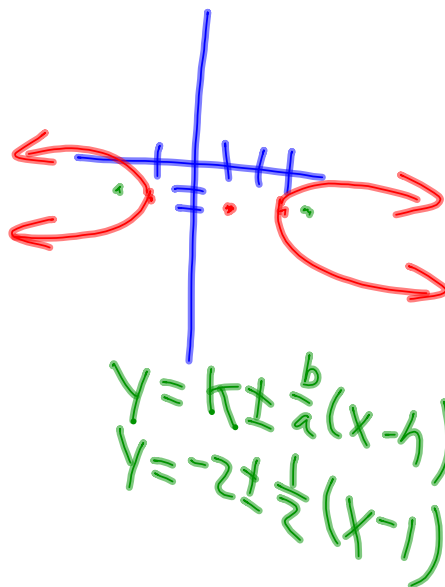


Ex 2) $\frac{(x-1)^2}{4} - \frac{(y+2)^2}{1} = 1$

center: $(1, -2)$
 vertices: $(3, -2), (-1, -2)$
 foci: $(\pm\sqrt{5}, -2)$
 asymptotes: $y = -2 \pm \frac{1}{2}(x-1)$

$a^2 = 4$
 $a = 2$
 $(1+2, -2)$
 $(1-2, -2)$

$c^2 = a^2 + b^2$
 $c^2 = 4 + 1$
 $c^2 = 5$
 $c = \sqrt{5}$



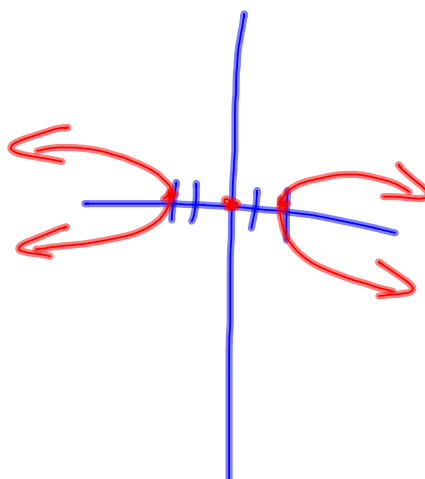
Ex 3) $\frac{9x^2}{36} - \frac{4y^2}{36} = \frac{36}{36} \Rightarrow \frac{x^2}{4} - \frac{y^2}{9} = 1$

center: $(0, 0)$
 vertices: $(2, 0), (-2, 0)$
 foci: $(\pm\sqrt{13}, 0)$
 asymptotes: $y = \pm \frac{3}{2}x$

$a^2 = 4$
 $a = 2$

$c^2 = a^2 + b^2$
 $c^2 = 4 + 9$
 $c^2 = 13$
 $c = \sqrt{13}$

$y = k \pm \frac{b}{a}(x-h)$
 $y = 0 \pm \frac{3}{2}(x-0)$
 $y = \pm \frac{3}{2}x$



Ex 4) $16y^2 - x^2 + 2x + 64y + 63 = 0$

center:

vertices:

foci:

asymptotes:

Find the standard form of the hyperbola with the center at (0, 0).

Ex 5) Vertices: $(0, \pm 2)$ and Foci: $(0, \pm 4)$

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

$$a = 2$$

$$a^2 = 4$$

$$c = 4$$

$$c^2 = 16$$

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

$$16 = 4 + b^2$$

$$12 = b^2$$

$$\frac{y^2}{4} - \frac{x^2}{12} = 1$$

