

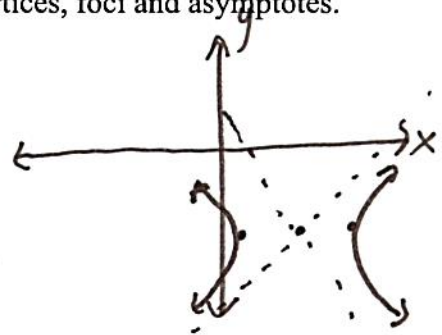
# Homework 03-05

## Classwork:

Sketch the graph of each hyperbola. Plot and label the center, vertices, foci and asymptotes. State the length of the transverse axis.

1.  $(x-4)^2 - 9(y+5)^2 = 9$

$$\frac{(x-4)^2}{9} - (y+5)^2 = 1$$



HTA

center: (4, -5)

$a = 3 \Rightarrow$

$b = 1$

$c^2 = 9 + 1 = 10 \Rightarrow c = \sqrt{10}$

vertices: (1, -5), (7, -5)

foci:  $(4 \pm \sqrt{10}, -5)$

asymptotes:  $y + 5 = \pm \frac{1}{3}(x - 4)$

transverse axis length: 6

2.  $4x^2 - 9y^2 = 36$

$$\frac{x^2}{9} - \frac{y^2}{4} = 1$$

HTA

c: (0, 0)

$a = 3 \Rightarrow$

$b = 2$

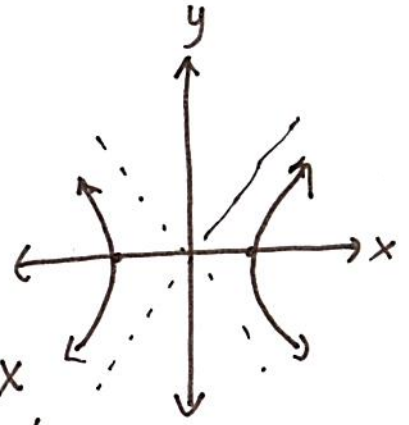
$c^2 = 9 + 4 = 13 \Rightarrow c = \sqrt{13}$

vertices:  $(\pm 3, 0)$

foci:  $(\pm \sqrt{13}, 0)$

asymptotes:  $y = \pm \frac{2}{3}x$

transverse axis length: 6



3.  $9(y+2)^2 - 4(x-1)^2 = 36$

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

VTA

center: (1, -2)

$a = 2 \updownarrow$

$b = 3$

$c^2 = 4 + 9 = 13$

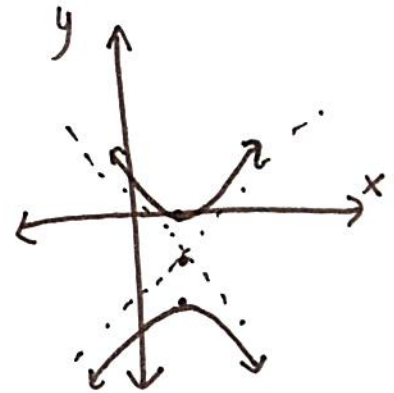
$c = \sqrt{13} \updownarrow$

vertices: (1, -4), (1, 0)

foci:  $(1, -2 \pm \sqrt{13})$

asymptotes:  $y + 2 = \pm \frac{2}{3}(x - 1)$

transverse axis length: 4

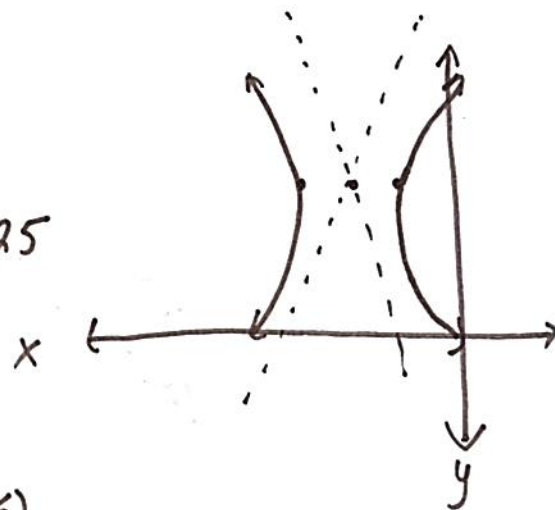


4.  $9x^2 + 36x - y^2 + 10y + 2 = 0$

$$9(x^2 + 4x + 4) - (y^2 - 10y + 25) = -2 + 36 - 25$$

$$9(x+2)^2 - (y-5)^2 = 9$$

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



HTA

center:  $(-2, 5)$

$a = 1 \Rightarrow$

$b = 3$

$$c^2 = 1 + 9$$

$$c = \sqrt{10} \Rightarrow$$

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

foci:  $(-2 \pm \sqrt{10}, 5)$

asymptotes:  $y - 5 = \pm 3(x + 2)$

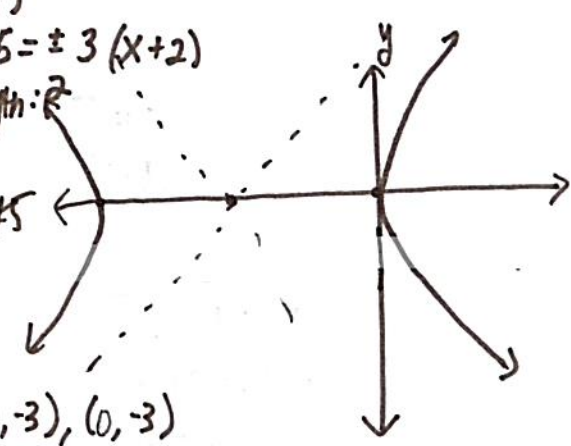
transverse axis length:  $2$

5.  $4x^2 - 5y^2 + 40x - 30y - 45 = 0$

$$4(x^2 + 10x + 25) - 5(y^2 + 6y + 9) = 45 + 100 - 45$$

$$4(x+5)^2 - 5(y+3)^2 = 100$$

$$\frac{(x+5)^2}{25} - \frac{(y+3)^2}{20} = 1$$



HTA

C:  $(-5, -3)$

$a = 5 \Rightarrow$

$b = \sqrt{20}$

$$c^2 = 45$$

$$c = \sqrt{45} \text{ or } 3\sqrt{5} \Rightarrow$$

vertices:  $(-10, -3), (0, -3)$

foci:  $(-5 \pm \sqrt{45}, -3)$

asymptotes:  $y + 3 = \pm \frac{\sqrt{20}}{5}(x + 5)$

transverse axis length:  $10$

6.  $x^2 - 4y^2 - 2x + 16y = 20$

$$x^2 - 2x + 1 - 4(y^2 - 4y + 4) = 20 + 1 - 16$$

$$(x-1)^2 - 4(y-2)^2 = 5$$

$$\frac{(x-1)^2}{5} - \frac{(y-2)^2}{\frac{5}{4}} = 1$$

C:  $(1, 2)$

HTA

$$a = \sqrt{5} \Rightarrow$$

$$b = \frac{\sqrt{5}}{2} \Rightarrow$$

$$c^2 = 5 + \left(\frac{5}{4}\right)$$

$$c^2 = \frac{25}{4} \Rightarrow$$

$$c = \frac{5}{2} \Rightarrow$$

vertices:  $(1 \pm \sqrt{5}, 2)$

foci:  $(1 \pm \frac{5}{2}, 2)$

$(\frac{7}{2}, 2)$

$(-\frac{3}{2}, 2)$

Write, in standard form, the equation of the hyperbola, having the given properties.

7. Center  $(0, 0)$ ; foci  $(\pm 6, 0)$ ; vertices  $(\pm 4, 0)$

HTA

$$c = 6$$

$$a = 4$$

$$\frac{x^2}{16} - \frac{y^2}{20} = 1$$

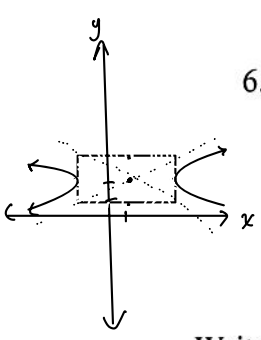
$$c^2 = a^2 + b^2$$

$$36 = 16 + b^2$$

$$20 = b^2$$

asymptotes:

$$y - 2 = \pm \frac{\sqrt{5}}{2}(x - 1)$$



$$a=1$$

$$c=4$$

VTA

8. Center (0, 0); foci (0, ±4); vertices (0, ±1)

$$y^2 - \frac{x^2}{15} = 1$$

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

$$4^2 = 1^2 + b^2$$

$$16 = 1 + b^2$$

$$15 = b^2$$

9. Center (3, -1); foci (-2, -1) and (8, -1); vertices (0, -1) and (6, -1) HTA

$$c=5$$

$$a=3$$

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

$$5^2 = 3^2 + b^2$$

$$16 = b^2$$

$$4 = b$$

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

10. Asymptotes  $y = \pm \frac{5}{12}x$ ; foci (±13, 0) HTA

center: (0, 0)

$$c=13$$

$$\frac{x^2}{144} - \frac{y^2}{25} = 1$$

11. Asymptotes  $y = \pm \frac{8}{15}x$ ; foci (0, ±17) VTA

center: (0, 0)

$$c=17$$

$$a=8$$

$$b=15$$

$$\frac{y^2}{64} - \frac{x^2}{225} = 1$$

$$(15) -10y - y^2 = -4x^2 - 72x - 199$$

$$4x^2 + 72x - y^2 - 10y = -199$$

$$4(x^2 + 18x + 81) - (y^2 + 10y + 25) = -199 + 324 - 25$$
$$4(x+9)^2 - (y+5)^2 = 100$$

$$\frac{(x+9)^2}{25} - \frac{(y+5)^2}{100} = 1$$

Center:  $(-9, -5)$

HFA

$$a = 5 \Rightarrow$$

$$b = 10$$

$$c^2 = 125$$

$$c = \sqrt{125} \text{ or } 5\sqrt{5}$$

center:  $(-9, -5)$

vertices:  $(-14, -5), (-4, -5)$

foci:  $(-9 \pm \sqrt{125}, -5)$   
or

$$(-9 \pm 5\sqrt{5}, -5)$$

asymptotes:  $y + 5 = \pm 2(x + 9)$   
opens left and right

$$\textcircled{16} \quad -y^2 + 12y - 19 = 18x - x^2$$

$$\begin{aligned} x^2 - 18x - y^2 + 12y &= 19 \\ x^2 - 18x + 81 - (y^2 - 12y + 36) &= 19 \end{aligned}$$

$$\begin{aligned} (x-9)^2 - (y-6)^2 &= 19 + 81 - 36 \\ (x-9)^2 - (y-6)^2 &= 64 \end{aligned}$$

$$\frac{(x-9)^2}{64} - \frac{(y-6)^2}{64} = 1$$

$$\begin{aligned} a &= 8 \Rightarrow \text{HTA} \\ b &= 8 \end{aligned}$$

$$c^2 = 128$$

$$c = \sqrt{128} \text{ or } 8\sqrt{2} \Rightarrow$$

center:  $(9, 6)$

vertices:  $(1, 6), (17, 6)$

foci:  $(9 \pm 8\sqrt{2}, 6)$

asymptotes:  $y - 6 = \pm 1(x - 9)$

opens left and right