

Precalculus  
Hyperbolas Day 1

Name DiMarco

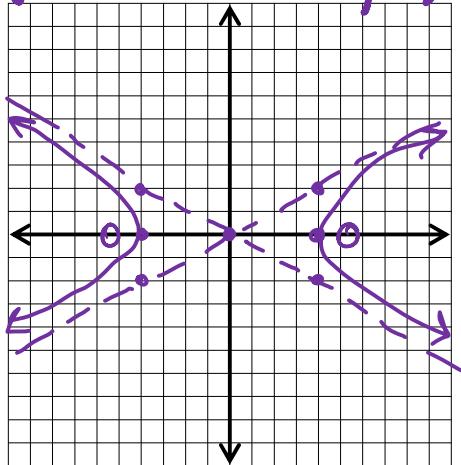
For questions 1 - 6, find the coordinates of the center, the lengths of the semi-transverse (a), and semi-conjugate (b) axes, the coordinates of the foci, and the slopes of the asymptotes, then sketch an accurate graph of the hyperbola.

1)  $\frac{x^2}{16} - \frac{y^2}{4} = 1$  opens hor. center  $(0,0)$   
 $a=4$   
 $b=2$

slope of asy:  $\pm \frac{1}{2}$

$$c^2 = a^2 + b^2 \\ = 16 + 4 \\ c = \sqrt{20}$$

foci  $(\pm \sqrt{20}, 0)$

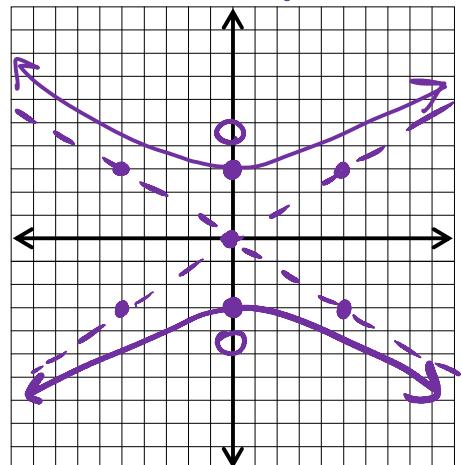


2)  $\frac{y^2}{9} - \frac{x^2}{25} = 1$  opens vert. center  $(0,0)$   
 $a=3$   
 $b=5$

slope of asy:  $\pm \frac{5}{3}$

$$c = \sqrt{34}$$

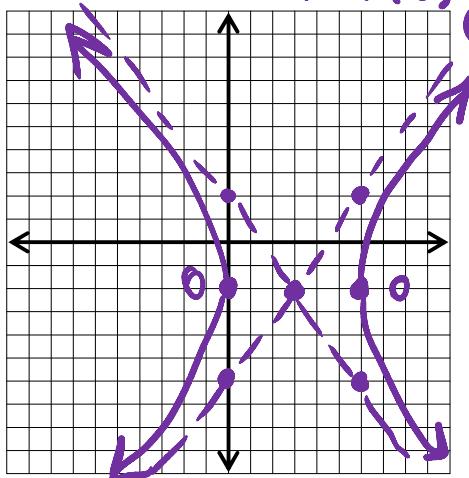
foci  $(0, \pm \sqrt{34})$



3)  $\frac{(x-3)^2}{9} - \frac{(y+2)^2}{16} = 1$  center  $(3, -2)$   
opens hor.

$$a=3 \\ b=4$$

slope of asy:  $\pm \frac{4}{3}$   $c = \sqrt{25} = 5$   
foci  $(8, -2)$   $(-2, -2)$



4)  $\frac{4(y+3)^2}{64} - \frac{(x+1)^2}{64} = 1$

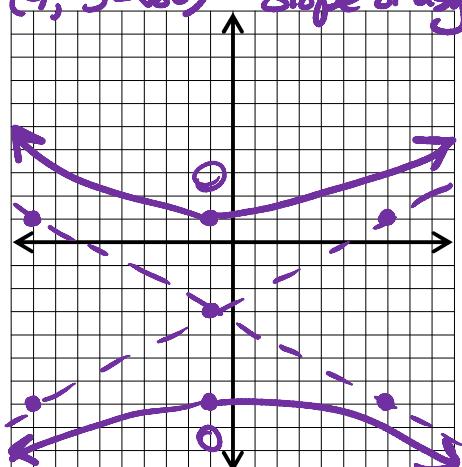
$$\frac{(y+3)^2}{16} - \frac{(x+1)^2}{64} = 1$$

opens vert.  
center  $(-1, -3)$

$$a=4 \\ b=8$$

$c = \sqrt{80}$   
foci  $(-1, -3 \pm \sqrt{80})$

slope of asy:  $\pm \frac{1}{2}$



$$5) \frac{25x^2}{225} - \frac{9y^2}{225} = \frac{225}{225}$$

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

$$c = \sqrt{34}$$

$$\text{foci } (\pm\sqrt{34}, 0)$$

center  $(0, 0)$

opens hor.

$$a = 3$$

$$b = 5$$

$$\text{slope asy: } \pm \frac{5}{3}$$

$$6) \frac{4(y-2)^2}{16} - \frac{(x+3)^2}{16} = \frac{16}{16}$$

$$\frac{(y-2)^2}{4} - \frac{(x+3)^2}{16} = 1$$

$$c = \sqrt{20}$$

$$\text{foci } (-3, 2 \pm \sqrt{20})$$

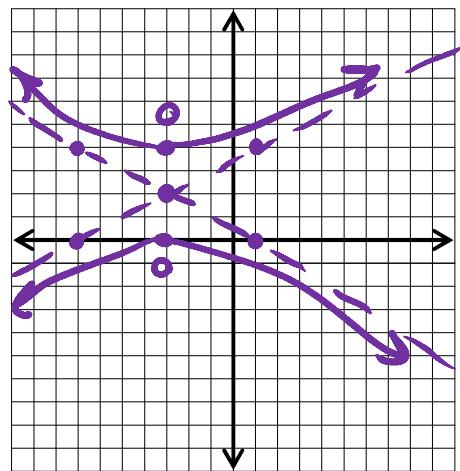
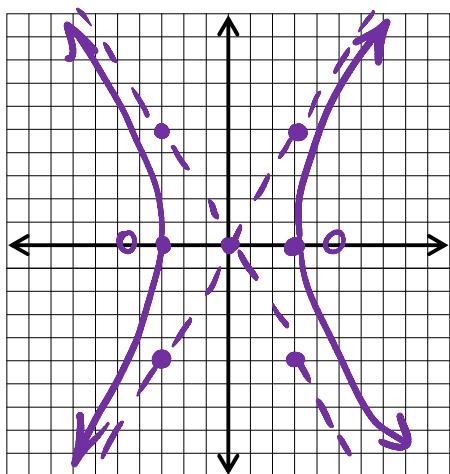
center  $(-3, 2)$

opens vert

$$a = 2$$

$$b = 4$$

$$\text{slope asy: } \pm \frac{1}{2}$$



Recall that:  $1 + \tan^2 t = \sec^2 t$  therefore  $1 = \sec^2 t - \tan^2 t$

7) Put into general form:  $x = 3 \sec t; y = 7 \tan t$

$$\frac{x}{3} = \sec t$$

$$\frac{y}{7} = \tan t$$

Square + Subtract!

$$\left(\frac{x}{3}\right)^2 - \left(\frac{y}{7}\right)^2 = \sec^2 t - \tan^2 t$$

$$\boxed{\frac{x^2}{9} - \frac{y^2}{49} = 1}$$

8) Put into general form:  $x = -2 + 3 \tan t; y = 4 + 7 \sec t$

$$\frac{x+2}{3} = \tan t \quad \frac{y-4}{7} = \sec t$$

$$\left(\frac{y-4}{7}\right)^2 - \left(\frac{x+2}{3}\right)^2 = \sec^2 t - \tan^2 t$$

$$\boxed{\frac{(y-4)^2}{49} - \frac{(x+2)^2}{9} = 1}$$