Hyperbola Exploration:

Solve the following equations for y and graph.

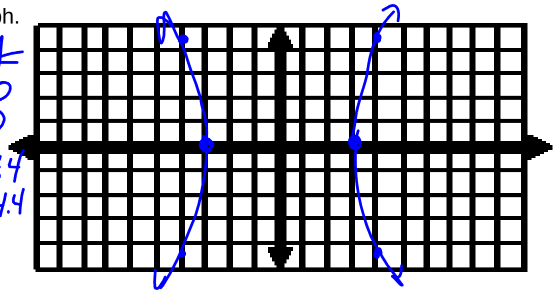
1. $\boxed{\dfrac{x^2}{9} - \dfrac{y^2}{25} = 1}$

$-25\left(-\dfrac{y^2}{25} = 1 - \dfrac{x^2}{9}\right)$

$y^2 = -25\left(1 - \dfrac{x^2}{9}\right)$

$y = \pm\sqrt{-25\left(1 - \dfrac{x^2}{9}\right)}$

x	y
3	0
-3	0
4	±4.4
-4	±4.4



2. $\boxed{\dfrac{y^2}{16} - \dfrac{x^2}{36} = 1}$

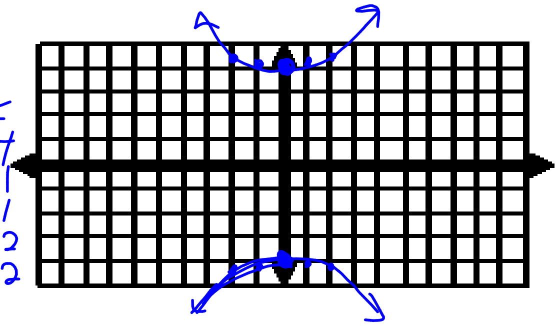
$+\dfrac{x^2}{36} \quad + \dfrac{x^2}{36}$

$16\left(\dfrac{y^2}{16} = 1 + \dfrac{x^2}{36}\right)$

$y^2 = 16\left(1 + \dfrac{x^2}{36}\right)$

$y = \pm\sqrt{16\left(1 + \dfrac{x^2}{36}\right)}$

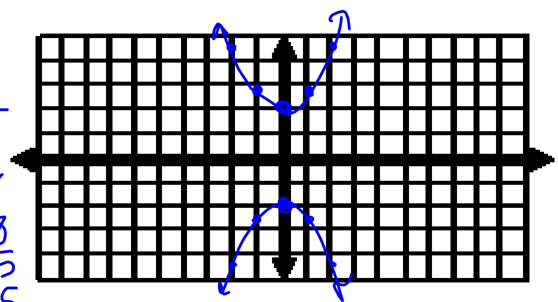
x	y
0	±4
1	±4.1
-1	±4.1
2	±4.2
-2	±4.2



3. $\boxed{\dfrac{y^2}{4} - \dfrac{x^2}{1} = 1}$

$y = \pm\sqrt{4(1+x^2)}$

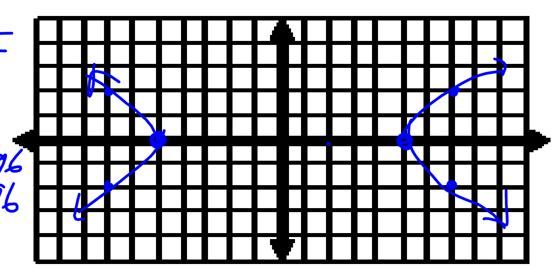
x	y
0	±2
1	±2.8
-1	±2.8
2	±4.5
-2	±4.5



4. $\boxed{\dfrac{x^2}{25} - \dfrac{y^2}{4} = 1}$

$y = \pm\sqrt{-4\left(1 - \dfrac{x^2}{25}\right)}$

x	y
5	0
-5	0
7	±1.96
-7	±1.96



What do the graphs have in common?

How does the hyperbola equation differ from the ellipse equation?
minus

How do you know if the hyperbola will open up/down or right/left? $x^2 - y^2$
$y^2 - x^2$

How do you know how far out on the axis to start the hyperbola?

$\sqrt{}$ of 1st denominator of 1st variable the standard form is: $\boxed{\dfrac{(x-h)^2}{a^2}-\dfrac{(y-k)^2}{b^2}=1 \quad or \quad \dfrac{(y-k)^2}{a^2}-\dfrac{(x-h)^2}{b^2}=1}$

Centered at (h,k)

Rewrite the equation into standard form and graph. State the Vertices, and co-vertices of the hyperbola.
Vertices are on the actual graph, the co-vertices are used only to help graph the hyperbola.

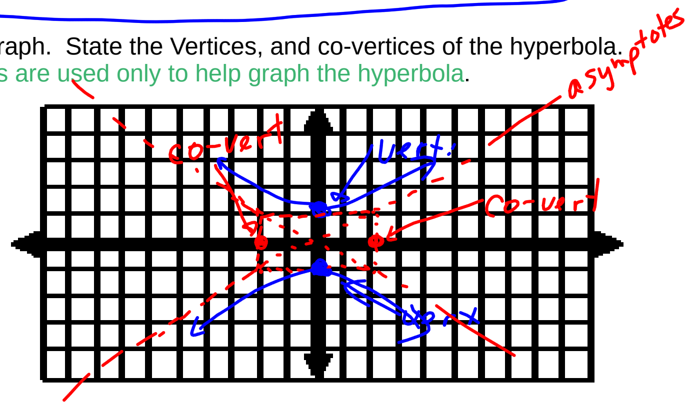
1. $100y^2 - 25x^2 = 100$

$\underline{}$ 100

$\boxed{\dfrac{y^2}{1} - \dfrac{x^2}{4} = 1}$

Vertices (0,1), (0,−1)

co-vert (−2,0) (2,0)



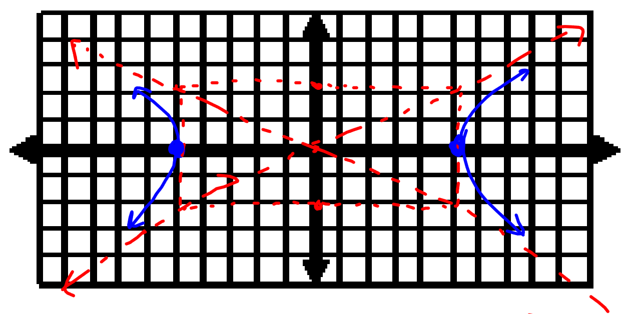
2. $x^2 - 5y^2 = 25$

center (0,0)

$\dfrac{x^2}{25} - \dfrac{y^2}{5} = 1$

vertices: (−5,0)(5,0)

co-verts: $(0,\sqrt{5})$, $(0,-\sqrt{5})$

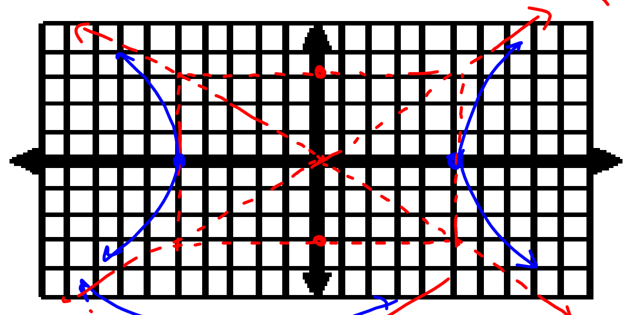


3. $\dfrac{9x^2}{225} - \dfrac{25y^2}{225} = \dfrac{225}{225}$

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

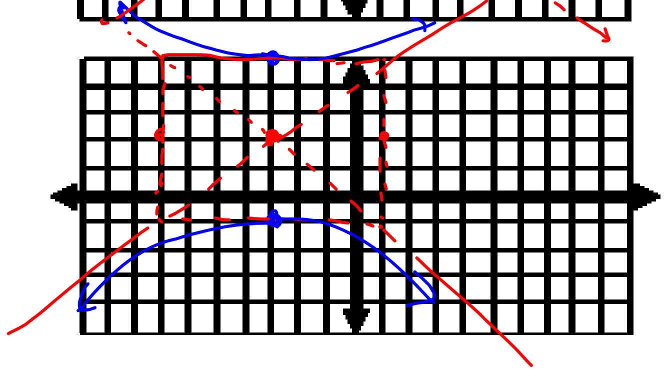
vertices: (5,0), (−5,0)

co-verts: (0,3), (0,−3)



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

hint: first find the center, then graph



Center: (−3, 2)

Vertices: (−3, 5) (−3, 1) 1st one!

Co-vertices (1, 2) (−7, 2)

Put in standard form [redacted]

$Ex.1\quad y^2-6x-2y-x^2-17=0$

$\qquad\qquad\qquad\qquad\quad +17\ +17$

$y^2-2y\quad -x^2-6x\ = 17$

$y^2-2y+\underline{1}\ -1(x^2+6x+\underline{9}) = 17+\underline{1}+\underline{-9}$

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

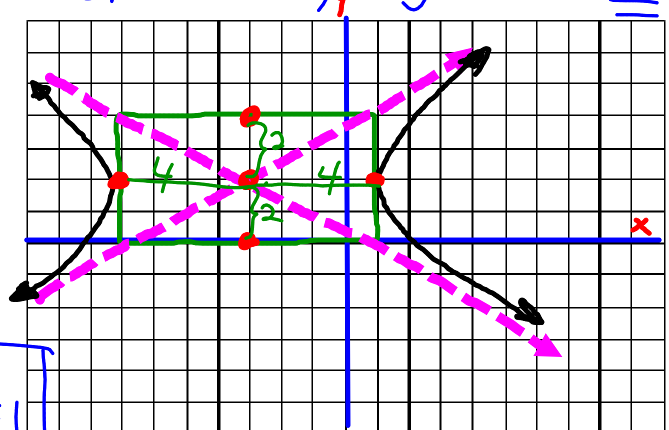
(must = 1 so ÷ by 9)

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

Example 2 Write the equation of the hyperbola graphed.

center $(-3, 2)$

opens left/right so $\underline{\underline{x}}$ first.



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

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

simplify...

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