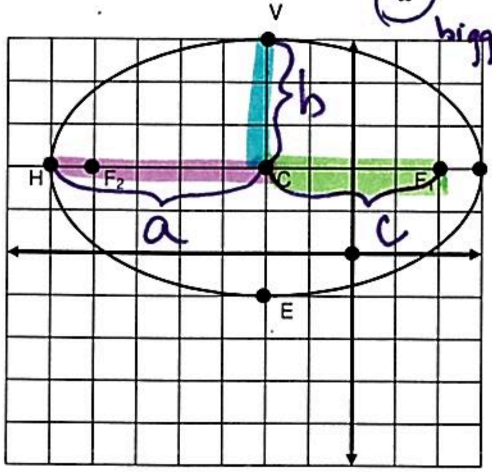
Horizontal Ellipse: $\frac{(x-h)^2}{a^2}+\frac{(y-k)^2}{b^2}=1$, where a > b > 0.

biggest denom.



Endpoints of Major Axis are called **vertices**

Endpoints of Minor Axis are called **co-**vertices

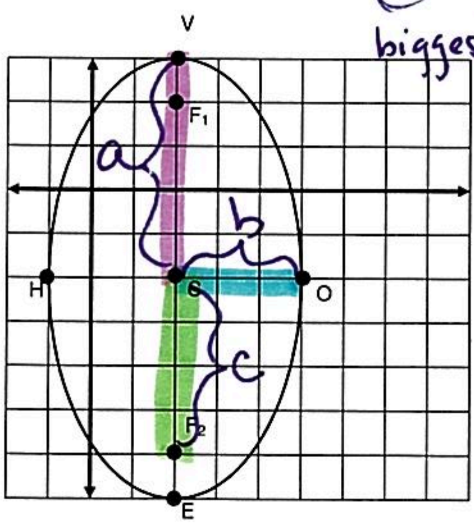
Major Axis = 2a Minor Axis = 2b

Equation to find foci: $\boxed{c^2 = a^2 - b^2}$

"Major Axis is always longer than the minor axis"

Vertical Ellipse: $\frac{(y-k)^2}{a^2}+\frac{(x-h)^2}{b^2}=1$, where a > b > 0.

biggest denom



Endpoints of Major Axis are called **vertices**

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Major Axis = 2a Minor Axis = 2b

Equation to find foci: $\boxed{c^2 = a^2 - b^2}$

"Major Axis is always longer than the minor axis"

Explain: Ellipses

1. What conic is the following equation? $2(x-2)^2+(y+3)^2=16$

looks like a circle

2. In the next unit we will want all our equations equal to 1. Change the equation above to be equal to 1.

$\frac{2(x-2)^2}{16}+\frac{(y+3)^2}{16}=\frac{16}{16} \rightarrow \frac{(x-2)^2}{8}+\frac{(y+3)^2}{16}=1$

Graph the equation $49x^2+16y^2=784$ **. Identify the vertices, co-vertices, and foci.**

Want to = 1! $\frac{49x^2+16y^2=784}{784} \rightarrow \frac{x^2}{16}+\frac{y^2}{49}=1$

a^2 under y^2

Step 1: Rewrite the equation in standard form.

Step 2: Determine the a, b, and c values. Name the center.

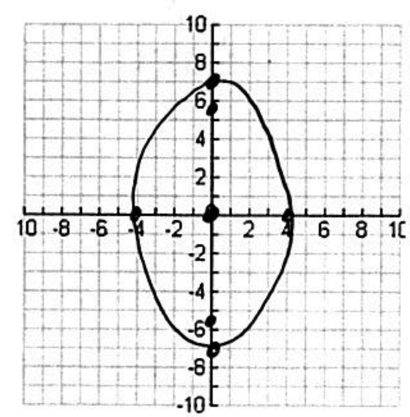
$a^2=49 \rightarrow a=7$

$b^2=16 \rightarrow b=4$

$c^2=49-16=\sqrt{33} \rightarrow c=5.744$

center (0,0)

Step 3: Graph it and determine the characteristics!



Center: (0,0)

Vertices: (0,8) & (0,-8)

Co-Vertices: (-4,0) & (4,0)

Length of Major axis: 14

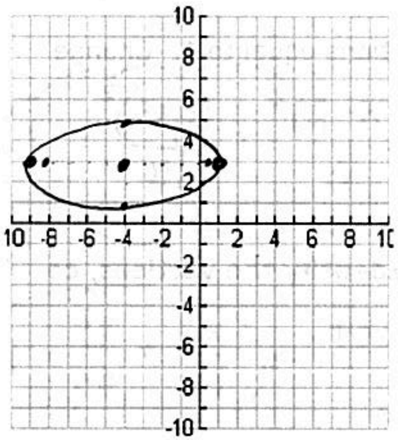
Length of Minor axis: 8

Foci: (0, 5.744) & (0, -5.744)

Example 2: Graph the equation: $\frac{(x+4)^2}{25}+\frac{(y-3)^2}{4}=1$

$a=5 \leftarrow a^2 \leftarrow 25$ $\quad 4 \rightarrow b^2 \rightarrow b=2$

Identify the vertices, co-vertices, and foci, of the ellipse.



Center: $(-4,3)$

Vertices: $(-9,3)$ & $(1,3)$

Co-Vertices: $(-4,5)$ & $(-4,1)$

Length of Major axis: 10

Length of Minor axis: 4

Foci: $(-8.6,3)$ & $(0.6,3)$

$c^2=25-4$

$\sqrt{c^2}=\sqrt{21}$ $\quad c=\sqrt{21}\approx 4.6$

Example 3: Find the standard form equation for the ellipse.

$$x^2 + 25y^2 - 8x + 100y + 91 = 0$$

$$x^2-8x+25y^2+100y=-91$$

$$\left(x^2-8x+16\right)+25\left(y^2+4y+4\right)=-91$$

$\frac{-8}{2}$, $(-4)^2$ $\qquad \frac{4}{2}$, $(2)^2$ $\qquad +16 \quad +100$

$$\frac{(x-4)^2+25(y+2)^2=25}{25}$$

$$\boxed{\frac{(x-4)^2}{25}+\frac{(y+2)^2}{1}=1}$$

Working Backwards...

Example 4: Write the equation of the ellipse that has a vertex at (2, 4), a co-vertex at (-1, 0), and a center at (2, 0)

h k

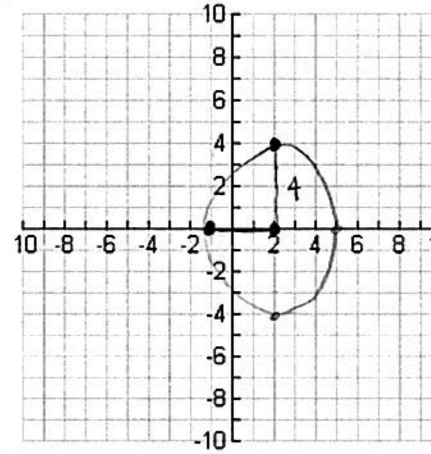
Sketch It!

a goes vertical

$a=4 \rightarrow a^2=16$

$b=3 \rightarrow b^2=9$

under y^2



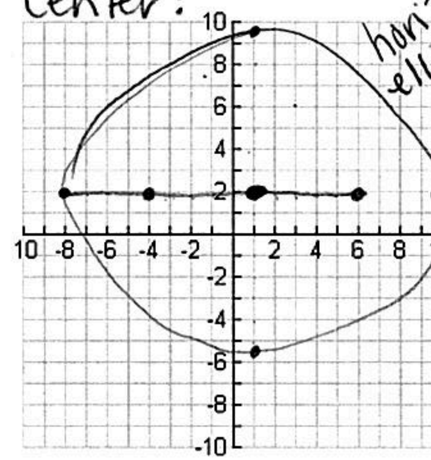
Write the equation!

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

Example 5: Write the equation of the ellipse that has the foci at (-4, 2) and (6, 2) and whose vertices are (-8, 2) and (10, 2).

Sketch It! Look in the middle of these points for center!

horiz. ellipse!



Determine where the center is.

Center $=(1,2)$

h k

$c=5$ $\quad a=9$

Determine where the co-vertices are.

$c^2=a^2-b^2$

$25=81-b^2$

$\sqrt{b^2}=\sqrt{56}$ $\quad b=\sqrt{56}\approx 7.5$

Write the equation!

$$\boxed{\frac{(x-1)^2}{81}+\frac{(y-2)^2}{56}=1}$$