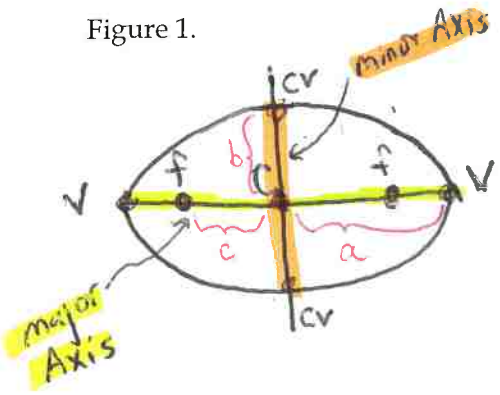
8.08 Ellipses – Day 1 Date: _____

Ellipse: A conic section where the sum of the distance from 2 fixed points (foci) is a constant.

Figure 1.



Center:

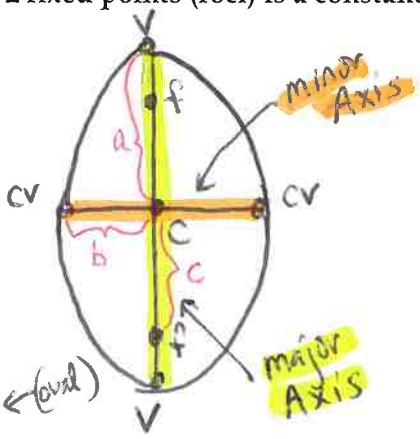
Vertices:

Co-vertices:

Foci: plural for focus foh-sie

Eccentricity:

(circle) $\rightarrow 0 < \frac{c}{a} < 1 \leftarrow$ (oval)



Horizontal Major Axis	Vertical Major Axis
$\frac{(x-h)^2}{a^2}+\frac{(y-k)^2}{b^2}=1$ *where* $a>b$	$\frac{(x-h)^2}{b^2}+\frac{(y-k)^2}{a^2}=1$ *where* $a>b$
Center: (h, k) Vertices: (h ± *a*, k) Co-vertices: (h, k ± b) Foci: (h ± c, k) Eccentricity = $\frac{c}{a}$ $a^2 - b^2 = c^2$	Center: (h, k) Vertices: (h, k ± *a*) Co-vertices: (h ± b, k) Foci: (h, k ± c) Eccentricity = $\frac{c}{a}$ $a^2 - b^2 = c^2$

Examples: Graph the ellipse. State the center, vertices, co-vertices, foci, and eccentricity.

* horizontal major Axis

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

Center: (3, 1) Vertices: (1, 1) (5, 1)

Co-Vertices: (3, 2) (3, 0)

Foci: $(3\pm\sqrt{3}, 1)$ Eccentricity= $\frac{c}{a}=\frac{\sqrt{3}}{2}$

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

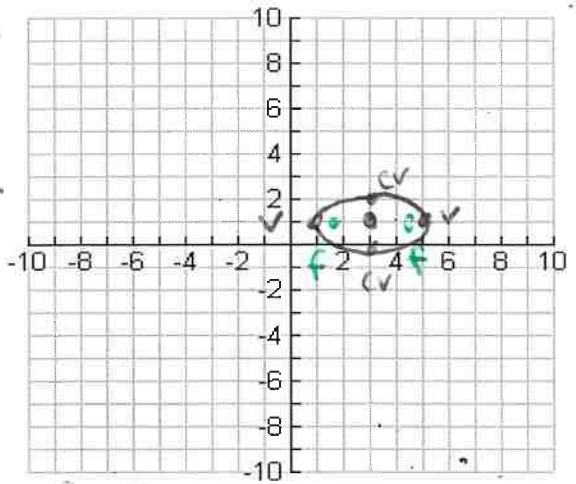
$a^2=25$ $a=5$ $b^2=9$ $b=3$

Center: (0, -2) Vertices: (0, 3) (0, -7)

Co-Vertices: (-3, -2) (3, -2)

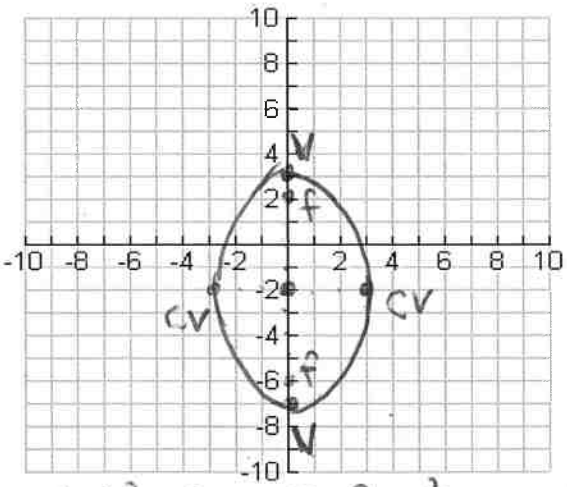
Foci: (0, -6) (0, 2) Eccentricity= $\frac{c}{a}\rightarrow\frac{4}{5}$

$a=2$ $b=1$ $c=\sqrt{3}$



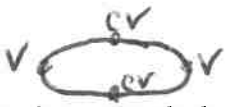
$a^2-b^2=c^2$ $4-1=c^2\rightarrow c=\sqrt{3}$

$a=5$ $b=3$ $c=4$



$a^2-b^2=c^2$ $25-9=c^2$ $c=4$

$16=c^2$



horizontal major Axis

8.08 Practice: Graph the ellipse. State the center, vertices, co-vertices, foci and eccentricity.

horizontal major Axis

1. $\frac{(x-3)^2}{81} + \frac{(y+5)^2}{25} = 1$ (a^2, b^2)

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

$c^2 = 81 - 25$

$c = \sqrt{56} = 2\sqrt{14} \approx 7.5$

$a = 9$ $b = 5$ $c = 2\sqrt{14}$

Center: $(3,-5)$ Vertices: $(-6,-5)$ $(12,-5)$

Co-Vertices: $(3,-10)$ $(3,0)$

Foci: $(3 \pm 2\sqrt{14}, -5)$ Eccentricity= $\frac{2\sqrt{14}}{9}$ $\left(\frac{c}{a}\right)$

2. $\frac{(x+2)^2}{64} + \frac{(y-6)^2}{1} = 1$ (a^2, b^2)

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

$c^2 = 64 - 1 = 63$

$c = \sqrt{63} = 3\sqrt{7} \approx 7.9$

$a = 8$ $b = 1$

Center: $(-2,6)$ Vertices: $(-10,6)$, $(6,6)$

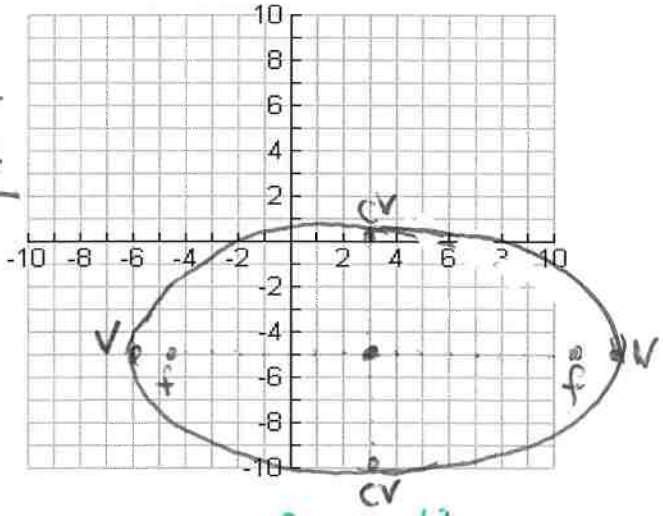
Co-Vertices: $(-2,5)$ $(-2,7)$

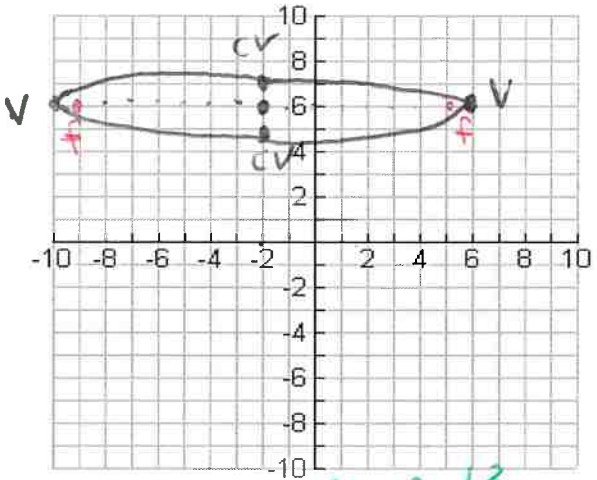
Foci: $(-2 \pm 3\sqrt{7}, 6)$ Eccentricity= $\frac{c}{a} \rightarrow \frac{3\sqrt{7}}{8}$

$a = 9$

$b = 5$

$c = 2\sqrt{14}$





$a = 8$

$b = 1$

$c = 3\sqrt{7}$

3. $\frac{x^2}{9} + \frac{y^2}{64} = 1$ (b^2, a^2)

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

$c^2 = 64 - 9 = 55$

$c = \sqrt{55} \approx 7.4$

$a = 8$ $b = 3$

Center: $(0,0)$ Vertices: $(0,-8)$ $(0,8)$

Co-Vertices: $(3,0)$ $(-3,0)$

Foci: $(0,0 \pm \sqrt{55})$ Eccentricity= $\frac{c}{a} \rightarrow \frac{\sqrt{55}}{8}$

4. $\frac{(x+2)^2}{16} + \frac{(y+3)^2}{36} = 1$ (b^2, a^2)

$c^2 = a^2 - b^2$ vertical major Axis

$c^2 = 36 - 16 = 20$

$c = \sqrt{20} \approx 4.5$

$c = 2\sqrt{5}$

$a = 6$ $b = 4$

Center: $(-2,-3)$ Vertices: $(-2,-9)$ $(-2,3)$

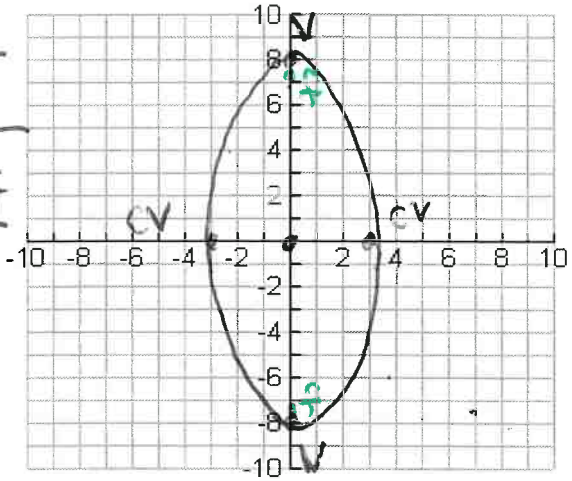
Co-Vertices: $(-6,-3)$ $(2,-3)$

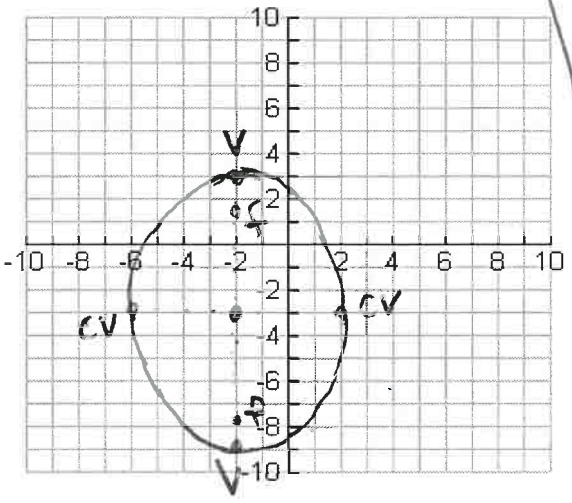
Foci: $(-2, -3 \pm 2\sqrt{5})$ Eccentricity= $\frac{c}{a} \rightarrow \frac{2\sqrt{5}}{6}$ or $\frac{\sqrt{5}}{3}$

$a = 8$

$b = 3$

$c = \sqrt{55}$





$a = 6$

$b = 4$

$c = 2\sqrt{5}$