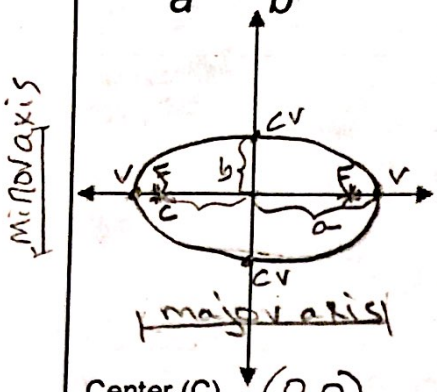
Graphing Ellipses Notes

Horizontal Ellipse

$$\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$$

a is the largest #
a > b

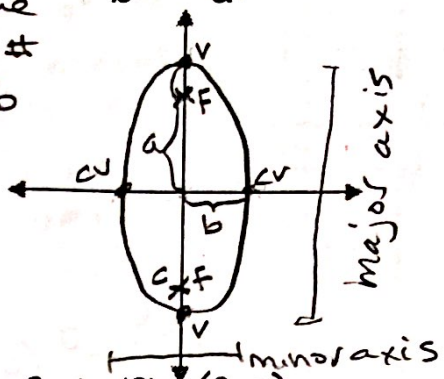


Center (C) (0,0)
Vertices (V) (a,0) (-a,0)
Co-vertices (CV) (0,b) (0,-b)
Foci (F) (c,0) (-c,0)
major axis length = 2a
minor axis length = 2b

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

Vertical Ellipse

$$\frac{x^2}{b^2}+\frac{y^2}{a^2}=1$$



Center (C) (0,0)
Vertices (V) (0,a) (0,-a)
Co-vertices (CV) (b,0) (-b,0)
Foci (F) (0,c) (0,-c)
major axis length = 2a
minor axis length = 2b

Ellipses - Translated/Shifted Ellipses

Horizontal Ellipse

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

Vertical Ellipse

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

center (h, k)

a^2 : (larger #) major axis 2a

a = length from center to vertice

b^2 : (smaller #) minor axis 2b

b = length from center to co-vertice

Foci : $a^2-b^2=c^2$ where c = length from center of ellipse to focus point.

Graphing Ellipses Notes

Example 1:

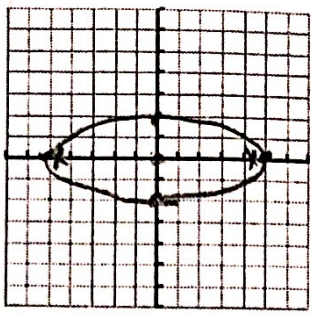
$\frac{x^2}{25}+\frac{y^2}{4}=1$

a^2 b^2

Horizontal Ellipse

$a=5$

$b=2$



C (0,0)

V (5,0) (-5,0) $(\pm 5, 0)$

CV (0,2) (0,-2) $(0, \pm 2)$

F $(\sqrt{21}, 0)$ $(-\sqrt{21}, 0)$ $(\pm\sqrt{21}, 0)$

2a major length = 10

2b minor length = 4

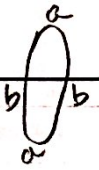
$a^2-b^2=c^2$

$25-4=c^2$

$21=c^2$

$c=\pm\sqrt{21} \approx 4.6$

Example 2:



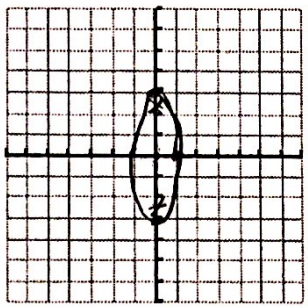
$\frac{x^2}{1}+\frac{y^2}{9}=1$

b^2 a^2

Vertical Ellipse

$a=3$

$b=1$



C (0,0)

V (0,3) (0,-3) $(0, \pm 3)$

CV (1,0) (-1,0) $(\pm 1, 0)$

F $(0, 2\sqrt{2})$ $(0, -2\sqrt{2})$ $(0, \pm 2\sqrt{2})$

major length = 6

minor length = 2

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

$9-1=c^2$

$8=c^2$

$\pm\sqrt{8}=c$

$\pm 2\sqrt{2}=c$ $2\sqrt{2} \approx 2.3$

Example 3:

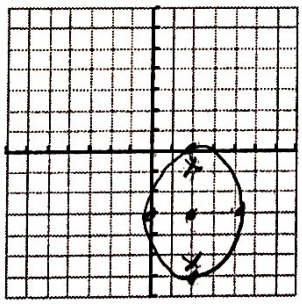
$\frac{(x-2)^2}{4}+\frac{(y+3)^2}{9}=1$

b^2 a^2

Vertical Ellipse

$a=3$

$b=2$



C (2,-3)

V (2,0) (2,-6)

CV (4,-3) (0,-3)

F $(2, -3 \pm \sqrt{5})$

major length = 6

minor length = 4

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

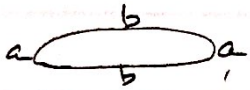
$9-4=c^2$

$5=c^2$

$\pm\sqrt{5}=c$

$\sqrt{5} \approx 2.2$

Example 4:



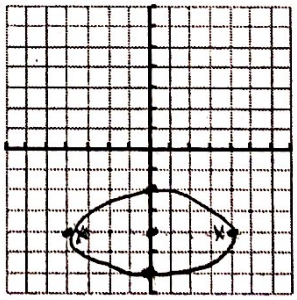
$\frac{x^2}{16}+\frac{(y+4)^2}{4}=1$

a^2 b^2

Horizontal Ellipse

$a=4$

$b=2$



C (0,-4)

V (4,-4) (-4,-4)

CV (0,-2) (0,-6)

F $(0 \pm 2\sqrt{3}, -4) = (\pm 2\sqrt{3}, -4)$

major length = 8

minor length = 4

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

$16-4=c^2$

$12=c^2$

$c=\pm\sqrt{12}=\pm 2\sqrt{3} \approx 3.5$

4 3