# SEC 8.2 ELLIPSE

1. ELLIPSE: THE SET OF ALL POINTS IN A PLANE WHERE THE SUM OF THE DISTANCE FROM TWO FIXED POINTS IS CONSTANT.

2. FOCI: (PLURAL FOR TWO FOCUS) THE TWO FIXED POINTS

3. MAJOR AXIS: THE LONGEST AXIS. $(2a)$

4. MINOR AXIS: THE SHORTER AXIS $(2b)$

5. VERTICES: THE ENDPOINTS OF THE MAJOR AXIS.

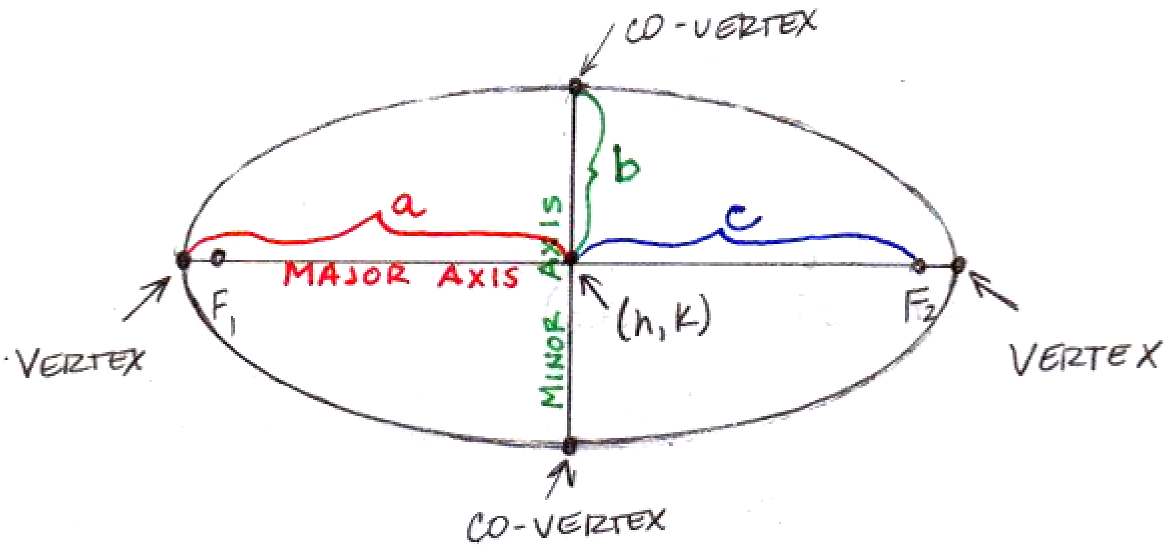
6. CO-VERTICES: THE ENDPOINTS OF THE MINOR AXIS.

7. FORMULA FOR FINDING $c$ IS $c^2 = a^2 - b^2$

8. AREA FOR AN ELLIPSE : $ab\pi$

9. ECCENTRICITY: $\frac{c}{a} \approx$ eccentricity

# HORIZONTAL ELLIPSE




$F_1$ & $F_2$ ARE THE FOCI

LENGTH OF MAJOR AXIS : $2a$

LENGTH OF MINOR AXIS : $2b$

EQUATION FOR FOCI : $c^2 = a^2 - b^2$

10. STANDARD EQUATION FOR AN ELLIPSE WHOSE CENTER IS AT THE ORIGIN.

| HORIZONTAL ELLIPSE | VERTICAL ELLIPSE |
|---|---|
| $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ | $\frac{x^2}{b^2} + \frac{y^2}{a^2} = 1$ |
| $a > b > 0$ | $a > b > 0$ |
| LENGTH OF MAJOR AXIS: $2a$ | $\longrightarrow$ |
| LENGTH OF MINOR AXIS: $2b$ | $\longrightarrow$ |
| VERTICES: $(\pm a, 0)$ | VERTICES: $(0, \pm a)$ |
| CO-VERTICE: $(0, \pm b)$ | CO-VERTICES: $(\pm b, 0)$ |
| FOCI: $(\pm c, 0)$ | FOCI: $(0, \pm c)$ |
| CENTER: $(0,0)$ | CENTER $(0,0)$ |
| ECC: $\frac{c}{a}$ | ECC: $\frac{c}{a}$ |

11. STANDARD EQUATION FOR AN ELLIPSE WHERE CENTER IS $(h,k)$ (NOT ON THE ORIGIN)

| HORIZONTAL ELLIPSE | VERTICAL ELLIPSE |
|---|---|
| $\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1$ | $\frac{(x-h)^2}{b^2} + \frac{(y-k)^2}{a^2} = 1$ |
| VERTICES $(h \pm a, k)$ | VERTICES $(h, k \pm a)$ |
| CO-VERTICES $(h, k \pm b)$ | CO-VERTICES $(h \pm b, k)$ |
| FOCI $(h \pm c, k)$ | FOCI $(h, k \pm c)$ |

#3 $\dfrac{(x-5)^2}{36}+\dfrac{(y+2)^2}{25}=1$

$a=6$

$b=5$

$c=\sqrt{11}$

DIRECTION: HORIZONTAL

CENTER: $(\overset{h}{5},\overset{k}{-2})$

VERTICES $(11,-2)$ $(-1,-2)$

CO-VERTICES: $(5,3)$ $(5,-7)$

FOCI: $(5\pm\sqrt{11},-2)$

ECC: $\dfrac{\sqrt{11}}{6}\approx .55$

AREA: $30\pi$

12. CONVERT FROM GENERAL FORM TO STANDARD FORM

#12

$9x^2+25y^2+18x+50y-191=0$

$9x^2+18x+25y^2+50y=191$

$9(x^2+\underset{2}{2x}+1)+25(y^2+\underset{2}{2y}+1)=191+9+25$

$\dfrac{\cancel{9}(x+1)^2}{2\cancel{2}5\ 25}+\dfrac{\cancel{2}5(y+1)^2}{2\cancel{2}5\ 9}=\dfrac{225}{225}$

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

# 7. $\dfrac{{}^{12100}(x+2)^2}{\cancel{100}} + \dfrac{{}^{\cancel{12}100}(y+9)^2}{\cancel{121}} = 1^{12100}$

LCD: 12100

$$121(x+2)^2 + 100(y+9)^2 = 12{,}100$$

$$121(x^2+4x+4) + 100(y^2+18y+81) = 12{,}100$$

$$121x^2+484x+484+100y^2+1800y+8100-12{,}100=0$$

$$\boxed{121x^2+100y^2+484x+1800y-3516=0}$$

# 16.

$$49x^2+36y^2-392x-216y-656=0$$

$$49x^2-392x+36y^2-216y=656$$

$$49(x^2-\underset{/2}{8}x+\underline{16})+36(y^2-\underset{/2}{6}y+\underline{9})=656+\underline{784}+\underline{324}$$

$$\frac{49(x-4)^2}{1764}+\frac{36(y-3)^2}{1764}=\frac{1764}{1764}$$

$$\frac{(x-4)^2}{36}+\frac{(y-3)^2}{49}=1$$

$a=7$
$b=6$
$c=\sqrt{13}$

CENTER $(4,3)$
VERTICAL ELLIPSE
VERTICES $(4,-4)$ $(4,10)$
CO-VERTICES $(10,3)$ $(-2,3)$
FOCI $(4,\ 3\pm\sqrt{13})$
AREA $42\pi$
ECC $\frac{\sqrt{13}}{7}$