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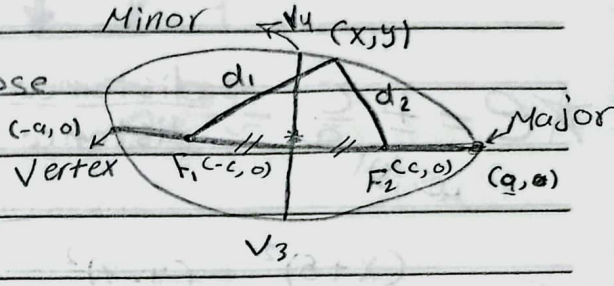
lecture 4

Ellipse ⇒ القطع الناقص

Definition : given time distinct points F_1 and F_2 in the plane and a fixed distance (d), an ellipse is the set of all points (x,y) in the plane such that the sum of each of the distance from f_1 and F_2 to (x,y) is (d). The points f_1 and f_2 are called the foci of the ellipse

بؤرتين



$d_1 + d_2 = d$ for all (x,y) on the ellipse

* The center of ellipse :

↳ is the midpoint of line segment connecting the two foci

* The major axis of the ellipse :

↳ is the line segment connecting two oppsite ends of the ellipse which aslo contains the center and the foci

* Minor axis :

↳ is the line segment connecting two oppsite ends of the ellipse which contain the center but is perpendicular to the major axis

⇒ Standard eq. of the ellipse

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

center V_1, V_2 ← a^2 ; center, V_3 or V_4 ← b^2

(h,k) → center

* $a > b$ → horizontal
* $a < b$ → vertical

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

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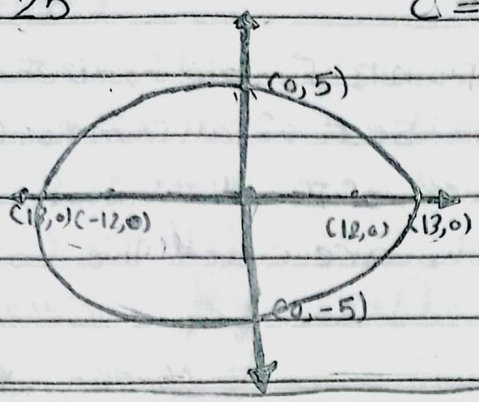
Ex. $\frac{x^2}{169} + \frac{y^2}{25} = 1$ center (0,0) , $a > b$

$c^2 = a^2 - b^2 = 169 - 25 = 144 = (12)^2$

$c = \pm 12$, $a = 13$, $b = 5$



Minor ← $x = 0$, $y = 0$ ← Major

$e = \pm \frac{c}{a} = \pm \frac{12}{13}$

$\star e = \pm \frac{c}{a} = \frac{\text{distance From center to focus}}{\text{distance From the center to vertex}}$

الأكبر

Ex: $\frac{(x+5)^2}{16} + \frac{(y-4)^2}{1} = 1$ center (-5,4) $a > b$

$a = 4$, $b = 1$ $\rightarrow c^2 = a^2 - b^2$

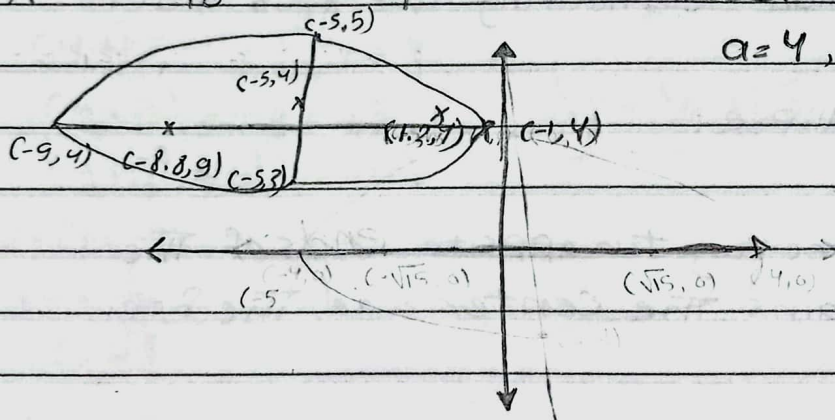
$= 16 - 1 = 15$

$c = \pm\sqrt{15}$

$y = 4$ (Major)

$x = -5$ (Minor)

$e = \sqrt{15}/4$



Ex :

$\frac{(x-3)^2}{25} + \frac{(y-1)^2}{9} = 1$ center (3,1) $a > b$

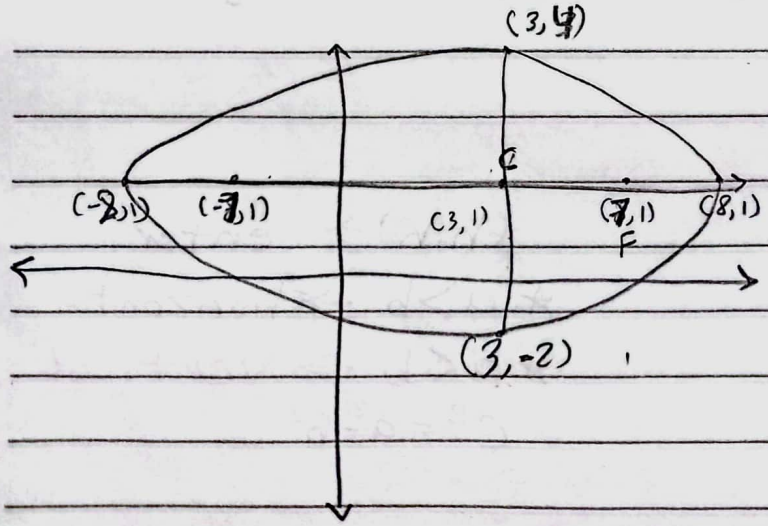
$a = 5$, $b = 3$ $c^2 = 25 - 9 = 16$

$c = \pm 4$

$e = \frac{4}{5}$

$y = 1$

$x = 3$



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Ex: $x^2-2x+2y^2-12y+3=0$

$(x-1)^2-1+2(y-3)^2-18=-3$

$(x-1)^2+2(y-3)^2=18-3+1=16$

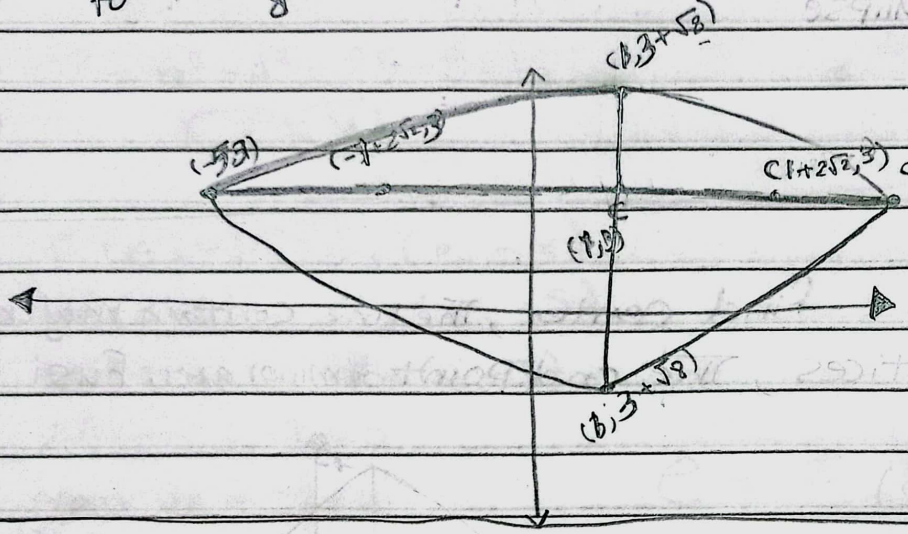
$\frac{(x-1)^2}{16}+\frac{(y-3)^2}{8}=1$

center $(1,3)$ $a>b$

$a=\pm 4$ $b=\pm\sqrt{8}$

$c^2=(4)^2-(8)=16-8=18$

$c=2\sqrt{2}$



$y=3$

$x=1$

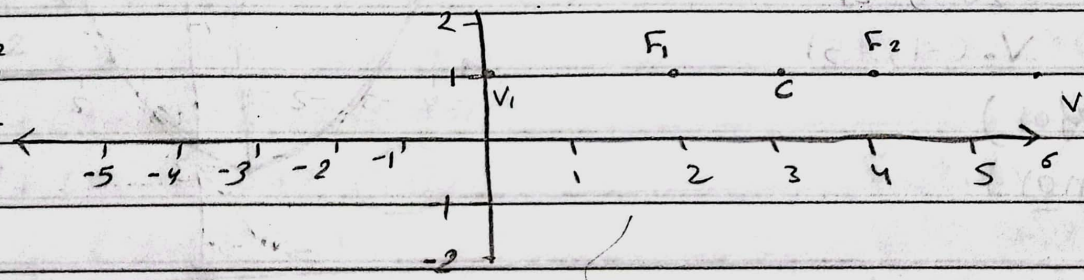
$e=\frac{2\sqrt{2}}{4}$

*Find the equation of the ellipse with foci (2,1), (4,1) and vertex (0,1)

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

$1^2=3^2-b^2$

$b=\sqrt{8}$



$\frac{(x-3)^2}{9}+\frac{(y-1)^2}{8}=1$