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Eq. of straight line

1. slope $= m$, Passes Throught $(0,0)$

$\rightarrow y = mx$

2. The y-intercept of Line

$\rightarrow y = mx + c$

3. Slope $= m$, Passing Though (x_1, y_1)

$\rightarrow y - y_1 = m(x - x_1)$

4. Passing Though (x_1, y_1) , (x_2, y_2)

$m = \frac{y_2 - y_1}{x_2 - x_1} \longrightarrow (y - y_1) = m(x - x_1) \rightarrow (y - y_1) = \frac{(y_2 - y_1)}{(x_2 - x_1)} (x - x_1)$

$$\frac{(y - y_1)}{(y_2 - y_1)} = \frac{(x - x_1)}{(x_2 - x_1)}$$

5. The most general eq. of St. Line

$ax + by + c = 0$ $\qquad y = \frac{-ax}{b} - \frac{c}{b}$

horizontal St. line $\rightarrow a = 0$

Vertical St. Line $\rightarrow b = 0$

Slope $= \frac{-a}{b}$

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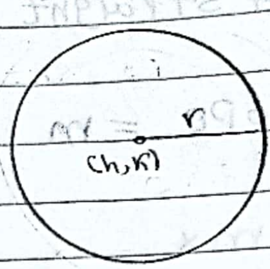
★ Circle



→ Center (h, k) , $r > 0$

→ $r = \sqrt{(x-h)^2 + (y-k)^2}$

→ The standard eq. → $(x-h)^2 + (y-k)^2 = r^2$

Center (h, k) → reverse the sign from eq.

★ To write the eq. of a circle in standard form

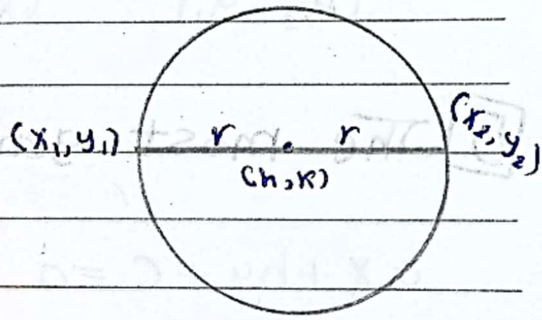
① Group the same variable together and position constant on other side

② Complete the square on both variable as needed.

③ Divide the both sides by the coefficients of squares.

Mid point → (center) / (h,k) :

$(h, k) = \left(\frac{x_1 + x_2}{2} , \frac{y_1 + y_2}{2} \right)$



Distance → diameter or radius :

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$, $r = \frac{1}{2}\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

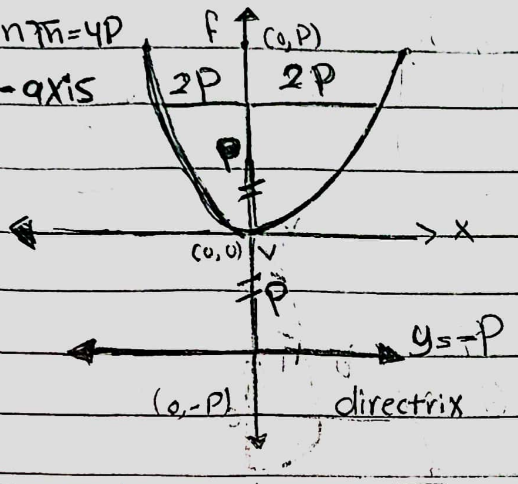
unit circle :

center = $(0,0)$ with $r = 1$

→ standard eq. = $x^2 + y^2 = 1$

Parabola: Let F Point in the Plane and D be a line not containing F, it's the set of all Points equidistant From F and D. The Point F is called focus of the parabola and D is called the directrix of Parabola

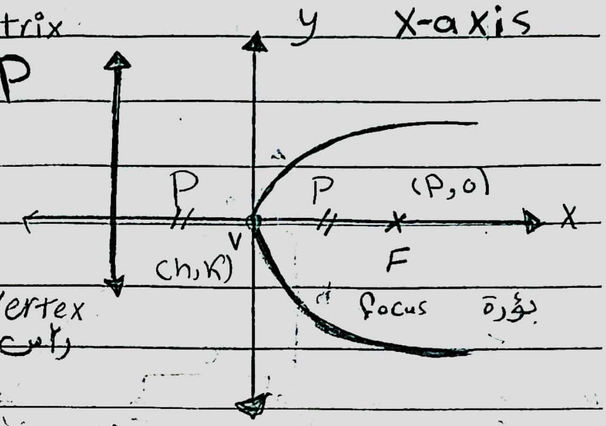
lotus rectum = $y = P$
length $= 4P$
y-axis



$$\sqrt{(x-0)^2+(y-P)^2} = \sqrt{(x-x)^2+(y+P)^2}$$

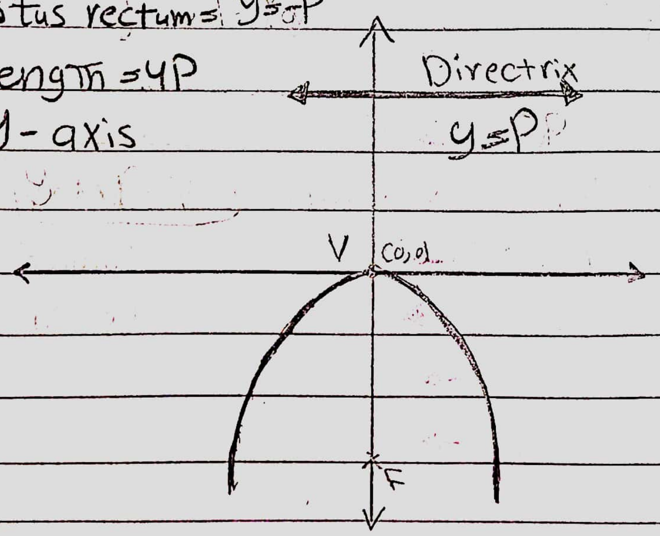
$x^2 = 4Py$, $x^2 = ny$

Lotus rectum $= x = P$
length $= 4P$
x-axis
دليل
Directrix
$x = -P$



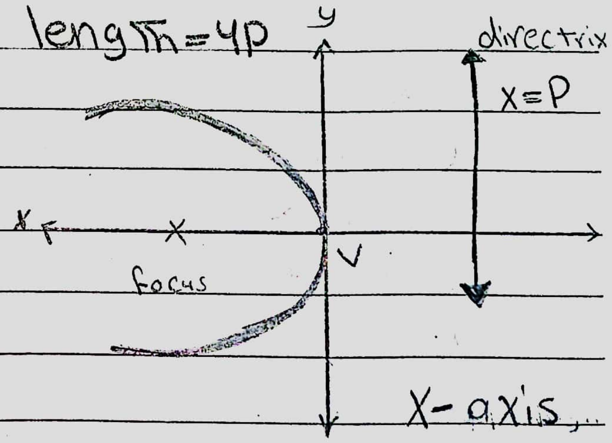
$(y-k)^2 = 4P(x-h)$, $P>0$
$y^2 = 4Px$, $y^2 = nx$

lotus rectum $= y = -P$
length $= 4P$
y-axis
Directrix
$y = P$



$(x-h)^2 = 4P(y-k)$, $P<0$
$x^2 = 4Py$, $x^2 = -ny$ $P<0$

lotus rectum $= x = -P$
length $= 4P$
directrix
$x = P$



x-axis

$y^2 = 4Px$, $y^2 = -nx$ $P<0$

$x^2 \to$ upward, downward	$+P \to$ Right , upward	$x^2 \to F(h, k+P)$
$y^2 \to$ left, Right	$-P \to$ left , downward	$y^2 \to F(h+P, k)$

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★Ellipse

→(Horizontal ellipse) $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$

$a>b$

$C^2=a^2-b^2$, $e=\frac{c}{a}$

★ Changeable X , constant y

① Vertex - Foci - center

② Major axis - minor axis

③ Endpoints of minor axis.

(Vertical ellipse) $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$

$b>a$

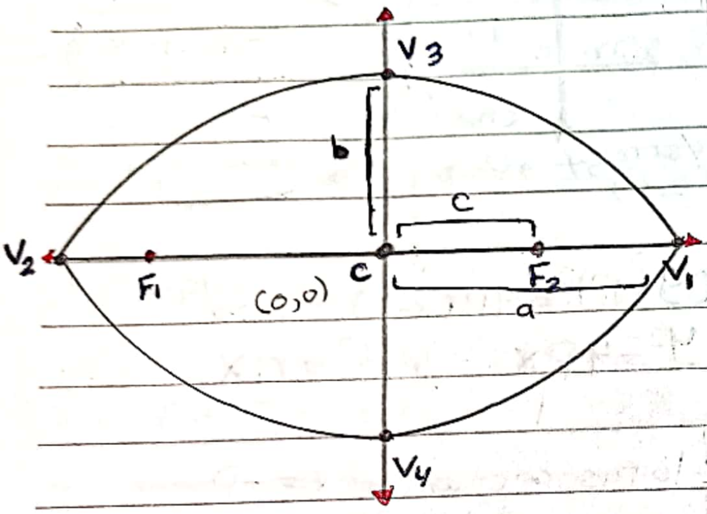
$C^2=b^2-a^2$, $e=\frac{c}{b}$

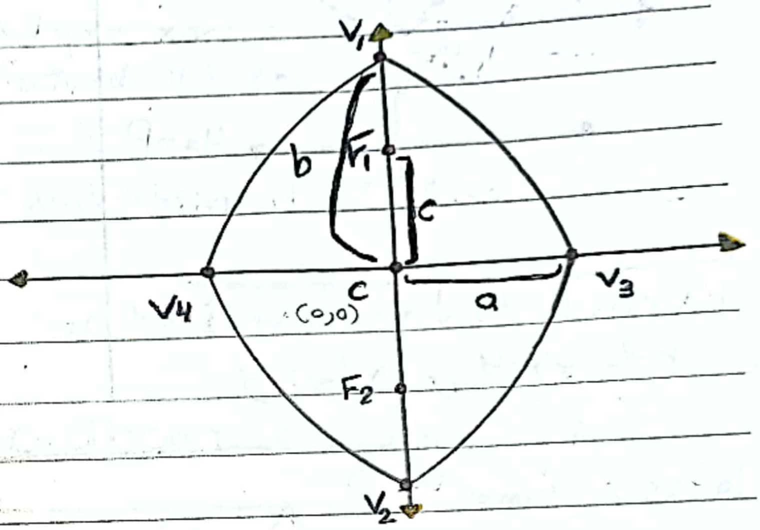
★ Changeable y , constant X

① Vertex - Foci - center

② Major axis - minor axis

③ Endpoints of minor axis





Center → From eq. (0,0)

V_1, V_2 (Major) → $(a,0)$, $(-a,0)$

V_3, V_4 (Minor) → $(0,b)$, $(0,-b)$

F_1, F_2 (Foci) → $(c,0)$, $(-c,0)$

Major → y= ___

Minor → X= ___

Center → From eq. (0,0)

V_1, V_2 → $(0,b)$, $(0,-b)$ (Major)

V_3, V_4 → $(a,0)$, $(-a,0)$ (minor)

F_1, F_2 → $(0,c)$, $(0,-c)$ (Foci)

Major → X= ___

minor → y= ___

★ Center (x_1,y_1) , vertex (x_1,z) , Focus (x_1,t)

$b=\sqrt{(x_1-x_1)^2+(y_1-z)^2}$ = ___

$C=\sqrt{(x_1-x_1)^2+(y_1-t)^2}$ → $\frac{(x-x_1)^2}{a^2}+\frac{(y-y_1)^2}{b^2}=1$ Standard eq.

$a=\sqrt{b^2-c^2}$ = ___

★ Sketch The graph of The given Parabola, find The vertex, Focus, directrix and The endpoint of The lotus rectum

① $(x-3)^2 = -16y \rightarrow x^2, -P$ (downward)

$V = (3,0)$

$4P = -16 \rightarrow P = -4$

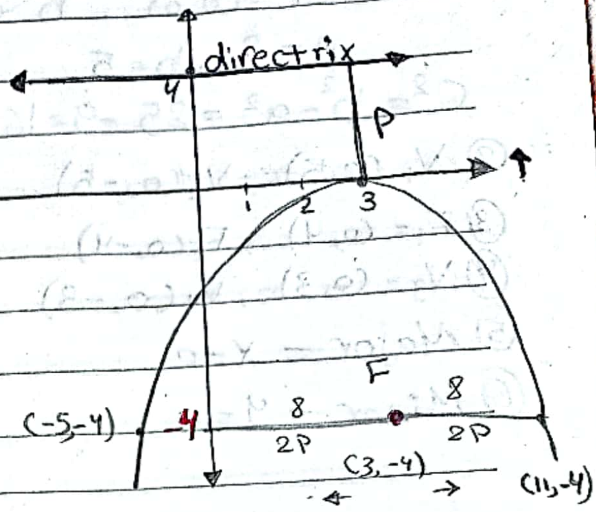
$F(h, K+P) = (3,-4)$

directrix $= y = 4$

end Points $= (-5,-4), (11,-4)$

lotus rectum (vocal diameter) $\rightarrow y = -4 \rightarrow$

length $= |4P| = 16$



② $(y-2)^2 = -12(x+3) \rightarrow y^2, -P$ (left)

$V = (-3,2)$

$4P = -12 \rightarrow P = -3$

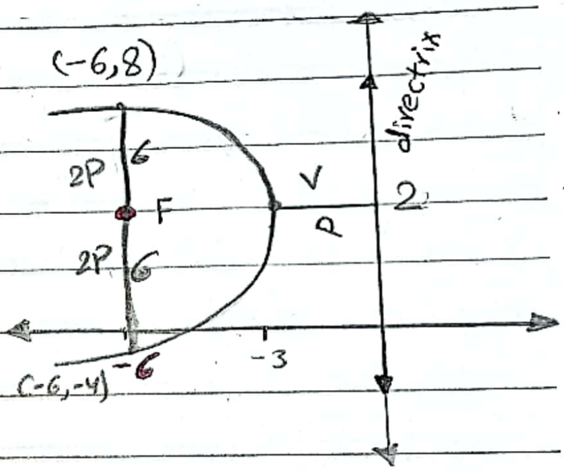
$F(h+P, K) = (-6,2)$

directrix $= x = 0$

endPoints $= (-6,8), (-6,-4)$

lotus rectum $= x = -6 \rightarrow$

length $= |4P| = 12$



★ Ellipse → Find The center, The Line which contain Major, ~~minor~~ minor, The Vertex, Foci, and The end Points of The minor axis.

① $\frac{x^2}{169} + \frac{y^2}{25} = 1$ (Horizontal)

① center $(0,0)$, $a > b$, $a = 13, b = 5$

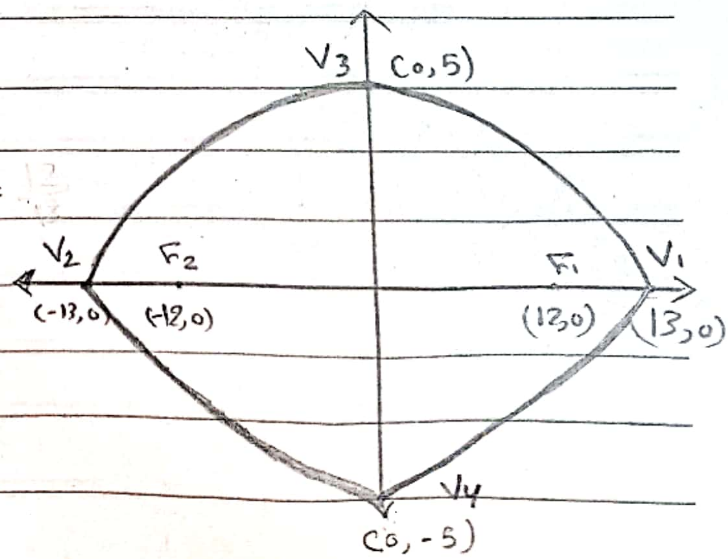
$c^2 = a^2 - b^2 = 169 - 25 = 144 \rightarrow c = 12$ ⑥ $e = \frac{c}{a} = \pm\frac{12}{13}$

② Foci $= (12,0), (-12,0)$

③ $V_1, V_2 = (13,0), (-13,0)$

④ $V_3, V_4 = (0,5), (0,-5)$

⑤ Major $= y = 0$, Minor $= x = 0$



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

[1] Center $= (0,0)$, $b > a$

$a = 3$, $b = 5$

$c^2 = b^2 - a^2 = 25 - 9 = 16 \rightarrow c = \pm 4$

② $V_1\ (0,5)$, $V_2\ (0,-5)$

③ $F_1 = (0,4)$, $F_2\ (0,-4)$

④ $V_3 = (0,3)$, $V_4\ (0,-3)$

⑦ $e = \frac{c}{b} = \pm \frac{4}{5}$

⑤ Major $= x = 0$

⑥ Minor $= y = 0$