DAY 43

MCA CET 2025

MATHS

Basics

Circle

Parabola

ELLIPSE

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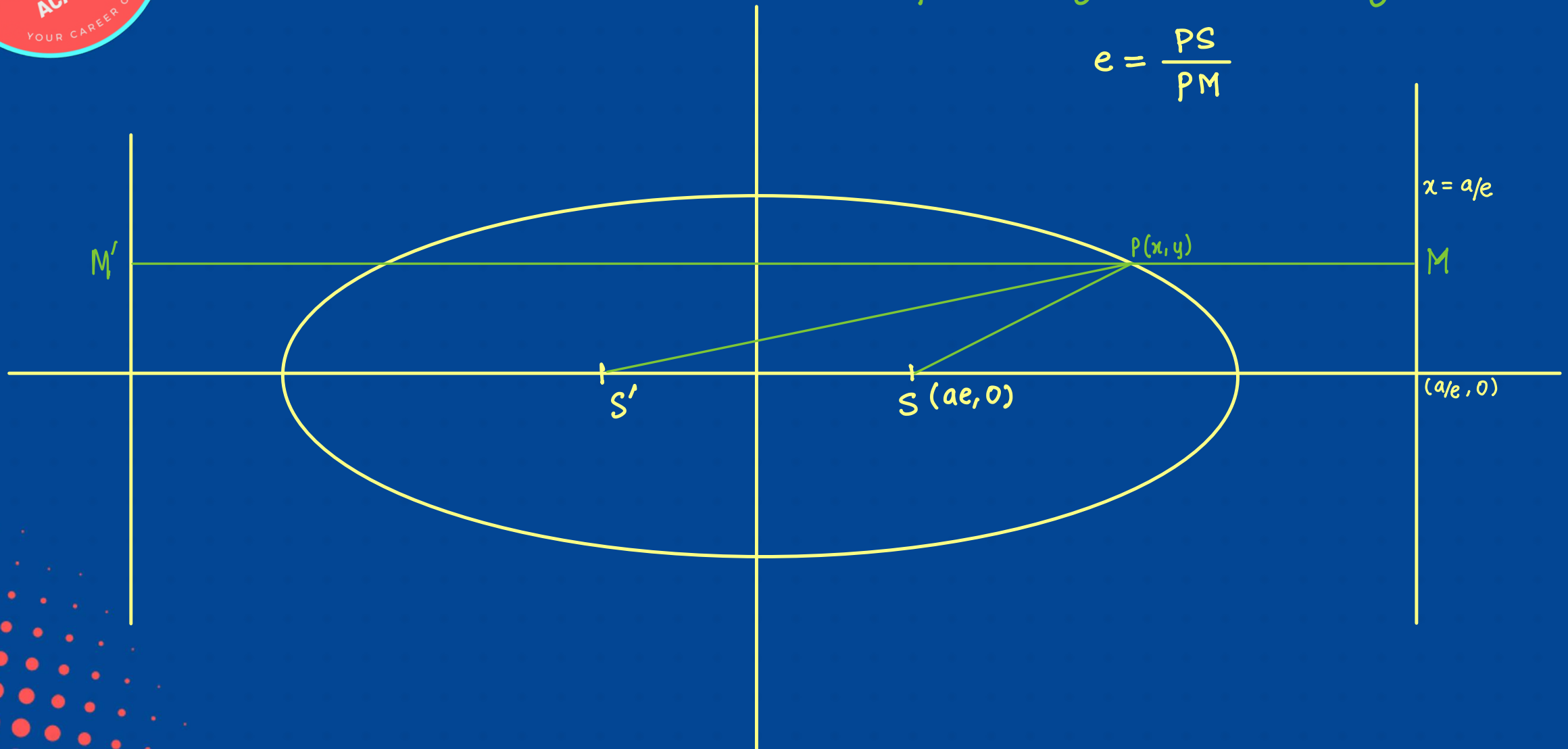
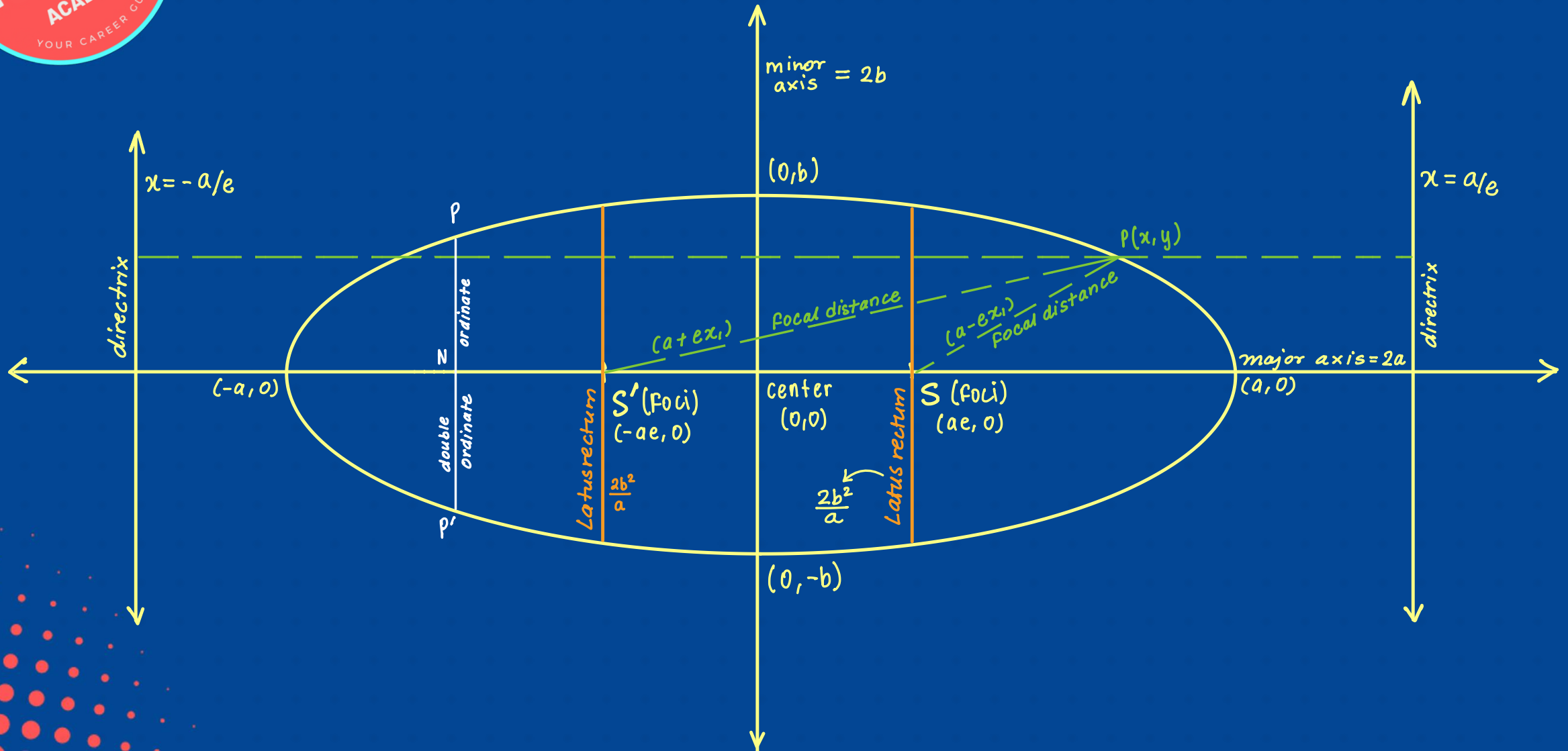
Ellipse

Locus of a point which moves in the plane such that the ratio of its distance from a fixed point (focus) to its distance from a fixed straight line is always constant.

$$e = \frac{PS}{PM}$$



Understanding parts of ellipse



Horizontal ellipse if $|a| > |b|$

Understanding parts of ellipse

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

⇑ standard eqn. of ellipse

Focus : $(\pm ae, 0)$

length of Major axis : $2a$

length of minor axis : $2b$

eqn. of directrix : $x = \pm a/e$

Length of latus rectum : $\frac{2b^2}{a}$

Endpoints of LR : $(\pm ae, \pm \frac{b^2}{a})$

Distance between foci : $2ae$

Distance between directrix : $2a/e$

Focal radii : $PS' = a + ex_1$ $\quad PS = a - ex_1$

$$PS + PS' = 2a$$

Relation b/n a, b, e

$$b^2 = a^2(1 - e^2)$$

Vertical ellipse if $|a| < |b|$

Understanding parts of ellipse

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

⇑

standard eqn. of ellipse

Focus : $(0, \pm be)$

length of Major axis : $2b$

length of minor axis : $2a$

eqn. of directrix : $x = \pm b/e$

Length of latus rectum : $\frac{2a^2}{b}$

Endpoints of LR : $\left(\pm\frac{a^2}{b}, \pm be\right)$

Distance between foci : $2be$

Distance between directrix : $2b/e$

Focal radii : $PS' = b + ey_1$, $PS = b - ey_1$

$$PS + PS' = 2b$$

Relation b/n a, b, e

$$a^2 = b^2(1 - e^2)$$

General Equation of an Ellipse

$$ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$$

represents ellipse

if $abc + 2fgh - af^2 - bg^2 - ch^2 \neq 0$

$ab - h^2 > 0$

$e < 0$

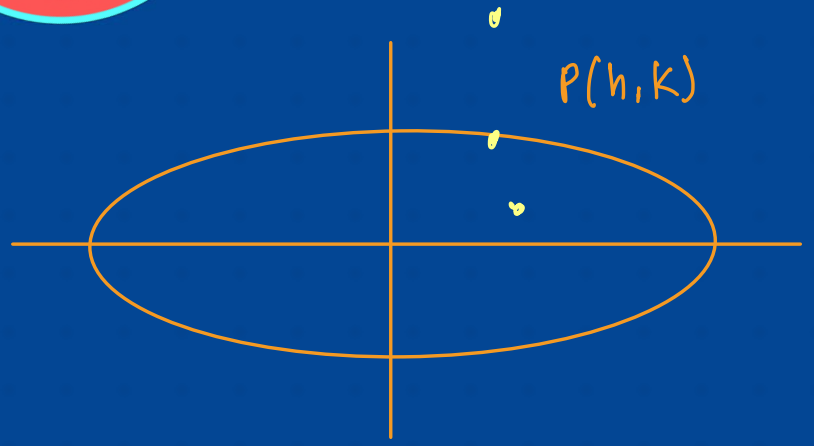
Parametric Equation of Ellipse

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

Parametric form: $x = a\cos\theta$

$y = b\sin\theta$

Position of a point w.r.t. Ellipse



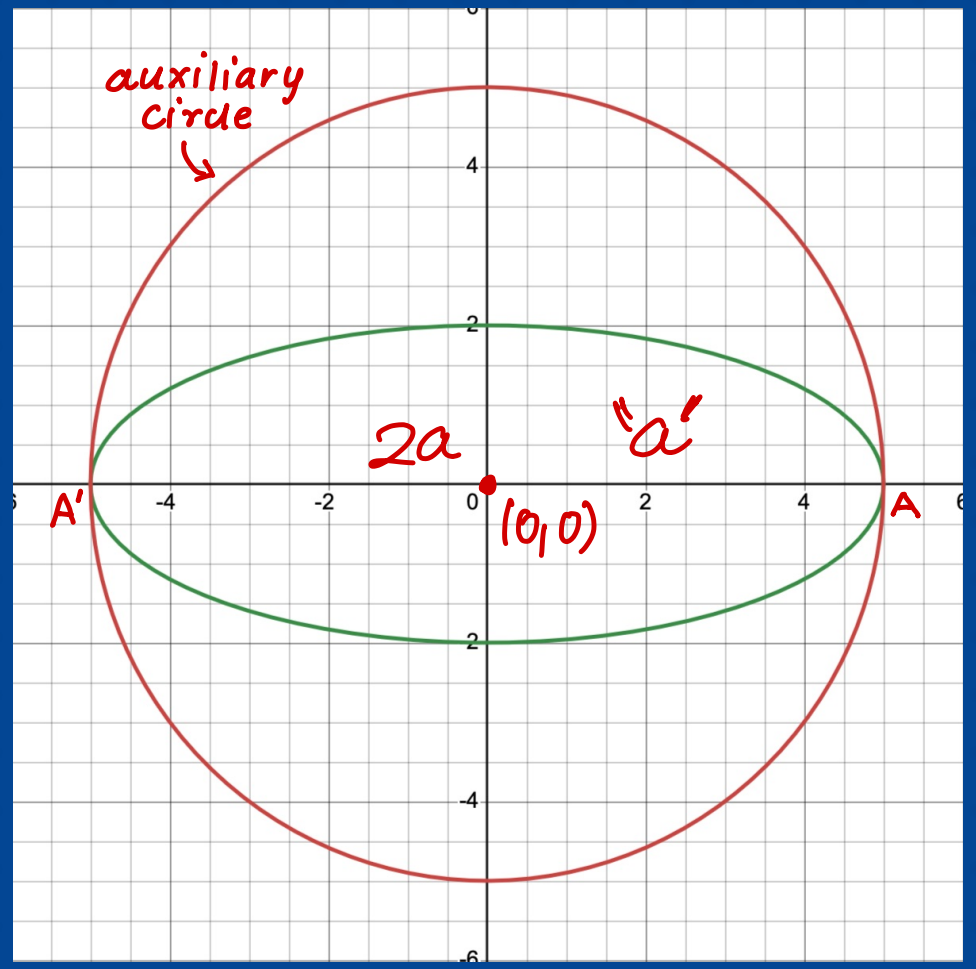
$$\frac{x^2}{a^2} + \frac{y^2}{b^2} - 1 = 0$$

Position of point $P(h,k)$

$$\frac{h^2}{a^2} + \frac{k^2}{b} - 1 \begin{cases} > 0 & \text{outside} \\ = 0 & \text{on ellipse} \\ < 0 & \text{inside} \end{cases}$$

Auxiliary Circle

A circle described by major axis AA' as diameter is called as Auxiliary Circle



equation of auxiliary circle.

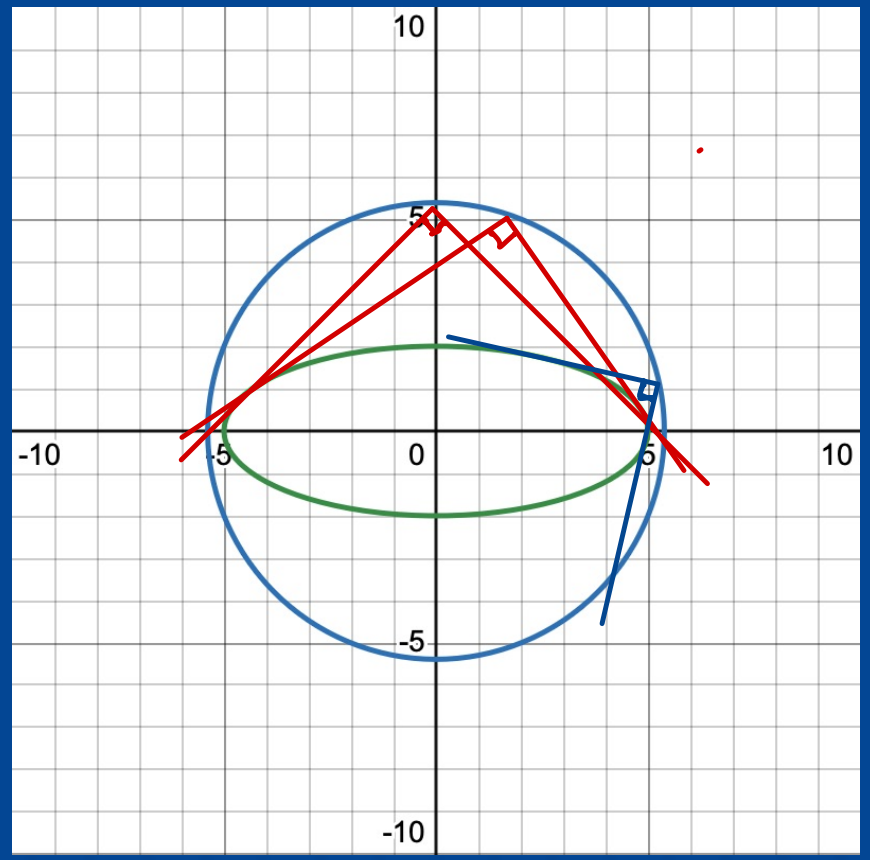
$$x^2 + y^2 = a^2$$

Director Circle

The locus of point of intersection of tangents $\perp^r$ to $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

Eqn. of director circle

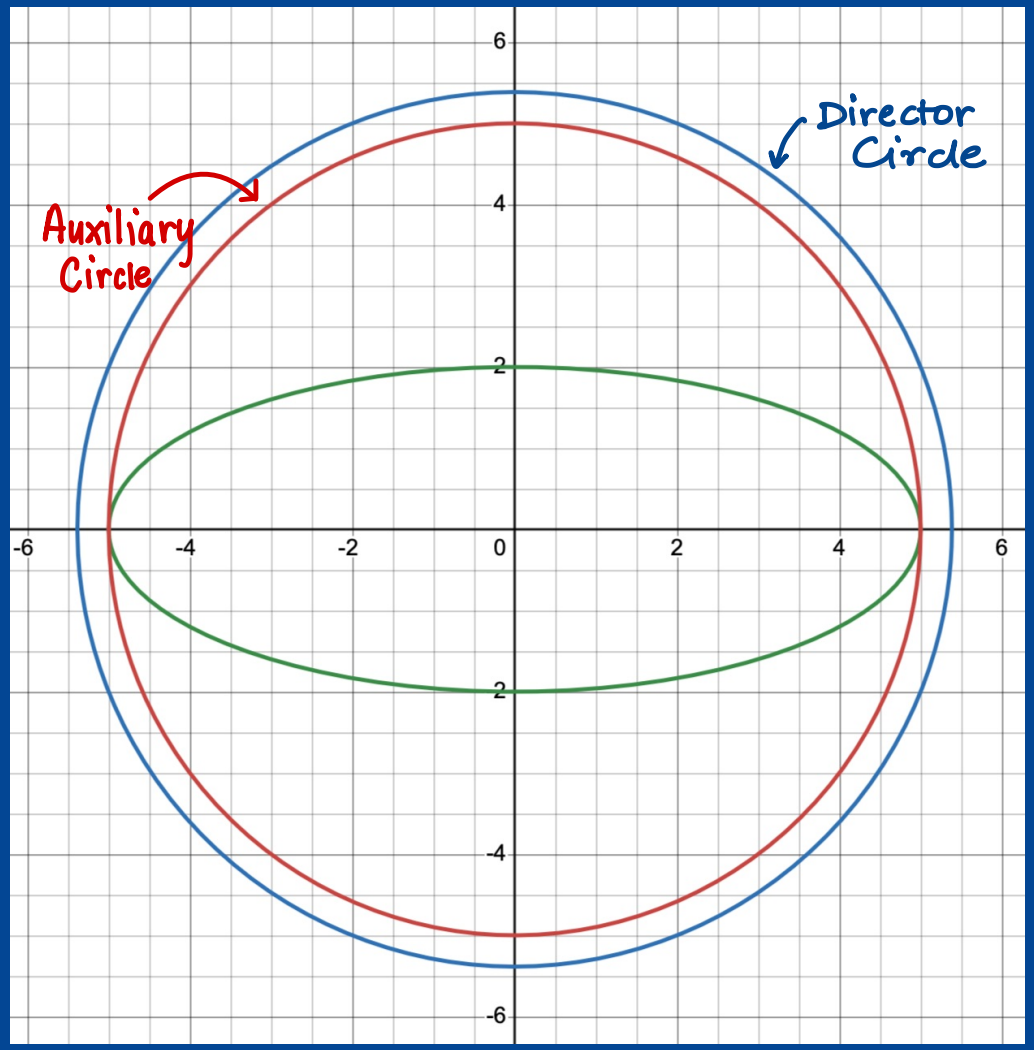
$$x^2 + y^2 = a^2 + b^2$$



Difference b/n Auxiliary and Director Circle.

Aux: $x^2+y^2=a^2$

Dir. C.: $x^2+y^2=a^2+b^2$



The eccentricity of the ellipse $25x^2 + 16y^2 = 400$ is

(a) 3/5

(b) 1/3

(c) 2/5

(d) 1/5

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

$$\frac{25x^2}{400} + \frac{16y^2}{400} = \frac{400}{400}$$

$$\frac{1}{16} \qquad \frac{1}{25} \qquad 1$$

$a < b$

$$a^2 = b^2(1 - e^2)$$

$$\frac{16}{25} = 1 - e^2$$

$$e^2 = 1 - \frac{16}{25} = \frac{25-16}{25} = \frac{9}{25} = e^2$$

$$\frac{x^2}{(4)^2} + \frac{y^2}{(5)^2} = 1$$

$a = 4$

$b = 5$

$$\Rightarrow e = \frac{3}{5}$$

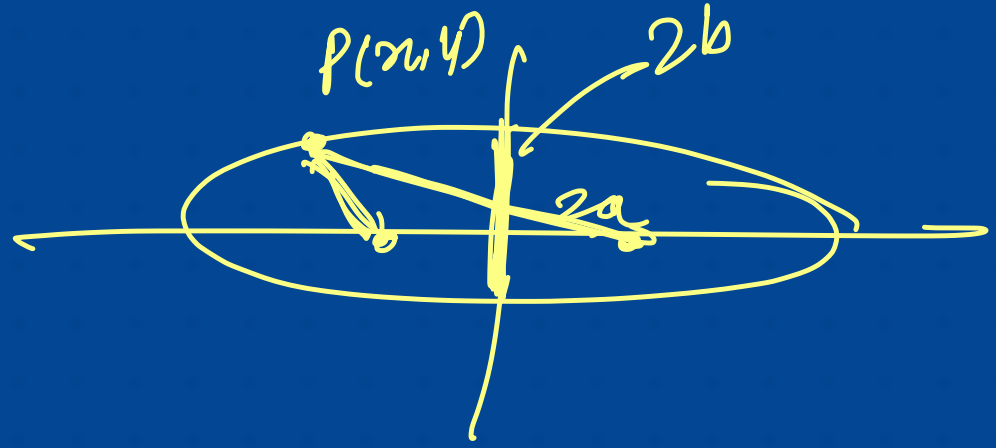
The sum of focal distance of any point on the ellipse with major and minor axes as 2a and 2b respectively, is equal to

(a) 2a

(b) $\frac{2a}{b}$

(c) $\frac{2b}{a}$

(d) $\frac{b^2}{a}$



In an ellipse $9x^2 + 5y^2 = 45$, the distance between the foci is

(a) $4\sqrt{5}$

(b) $3\sqrt{5}$

(c) 3

(d) 4

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

$\frac{9x^2}{45} + \frac{5y^2}{45} = 1$

$\frac{x^2}{5} + \frac{y^2}{9} = 1$

$\frac{x^2}{(\sqrt{5})^2} + \frac{y^2}{(3)^2} = 1$

$\sqrt{5} \quad 3$

$\sqrt{5} \quad \sqrt{9}$

$\sqrt{5} < \sqrt{9}$

$a < b$

$2be$

$a^2 = b^2(1-e^2)$

$5 = 1 - e^2$

$\frac{5}{9}$

$e^2 = 1 - \frac{5}{9}$

$e^2 = \frac{4}{9} \Rightarrow e = \frac{2}{3}$

$2 \times \beta \times \frac{2}{\beta}$

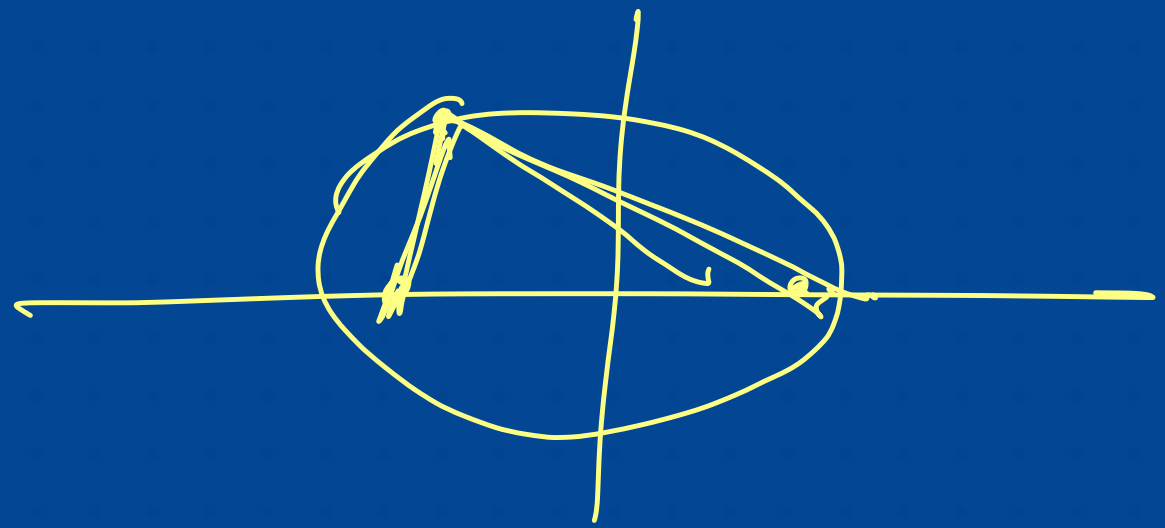
The locus of a point which moves such that, the difference of its distances from two fixed points is always a constant is

(a) a straight line

(b) a circle

(c) an ellipse

(d) a hyperbola



If (4, 0) and (- 4, 0) are the foci of an ellipse and the semi-minor axis is 3, then the ellipse passes through which one of the following points?

(a) (2, 0)

(b) (0,5)

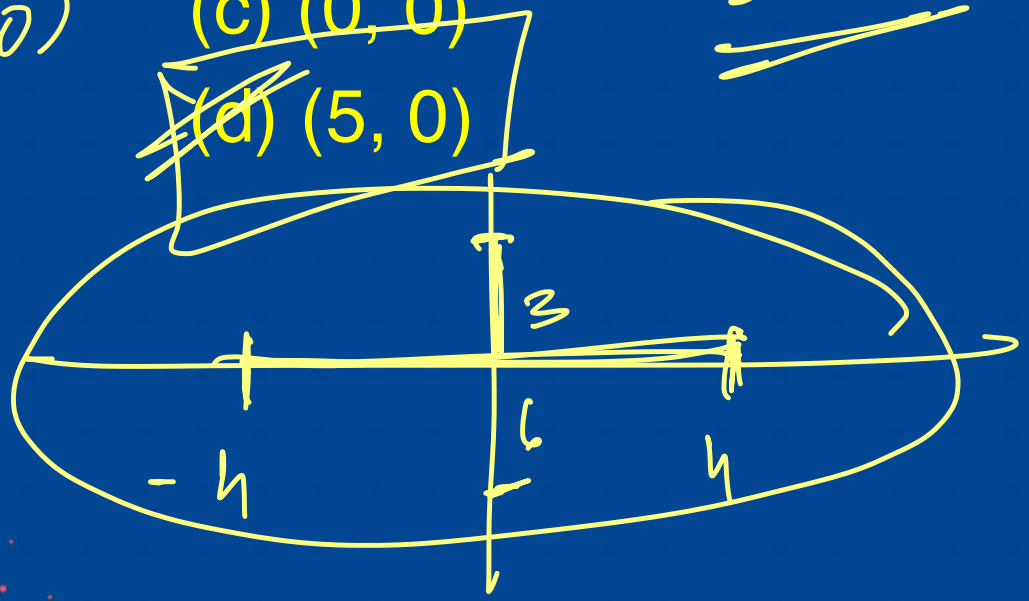
(c) (0, 0)

(d) (5, 0)

$(\pm a, 0)$

$(\pm 5, 0)$

$b = 3$



$(\pm ae, 0) = (\pm 4, 0)$

$b^2 = a^2(1 - e^2)$

$b^2 = a^2 - a^2e^2$

$9 = a^2 - 16$

$a^2 = 9 + 16$

$a^2 = 25$

$a = 5$

The latusractum of the ellipse $9x^2 + 16y^2 = 144$ is

(a) 4

(b) 11/4

(c) 7/2

(d) 9/2

$$\frac{9x^2}{144} + \frac{16y^2}{144} = 0$$

$$\frac{2b^2}{a} = \frac{2\times 9}{\sqrt{2}}$$

$16 \quad 9$

$(4)^2 \quad (3)^2$

$a > b.$

$\frac{9}{2}$

$b > a$

The eccentricity of the ellipse $25x^2 + 16y^2 - 150x - 175 = 0$ is

(a) 2/5

(b) 2/3

(c) 4/5

(d) 3/5

$a^2 = b^2(1-e^2)$

$\frac{16}{25} = 1 - e^2$

$e^2 = 1 - \frac{16}{25}$

$e^2 = \frac{9}{25}$

$25x^2 - 150x - 175 + 16y^2 = 0$

$(5x)^2 - 2 \times 5 \times 15 \times x + 15^2 - 15^2 - 175 + 16y^2 = 0$

$25x^2 - 150x + 15^2 - 15^2 - 175 + 16y^2 = 0$

$25(x^2 - 6x + 9) - 225 - 175 + 16y^2 = 0$

$\frac{25(x-3)^2}{400} + \frac{16y^2}{400} = 1$

$\frac{(x-3)^2}{16} + \frac{y^2}{25} = 1$

$(4)^2 \quad (5)^2$

Which one of the following points lies outside the ellipse $(x^2/a^2) + (y^2/b^2)=1$?

(a) (a, 0)

(b) (0, b)

(c) (-a, 0)

(d) (a, b)

$$\frac{a^2}{a^2} + \frac{b^2}{b^2} - 1 = 0$$

$$1 + 1 - 1 = 0$$

$$1 > 0$$

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} - 1 = 0$$

$$\frac{a^2}{a^2} + \frac{0}{b^2} - 1 = 0 \times$$

$$\frac{0}{a^2} + \frac{b^2}{b^2} - 1 = 0 \times$$

$$\frac{a^2}{a^2} + \frac{0}{b^2} - 1 = 0 \times$$

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