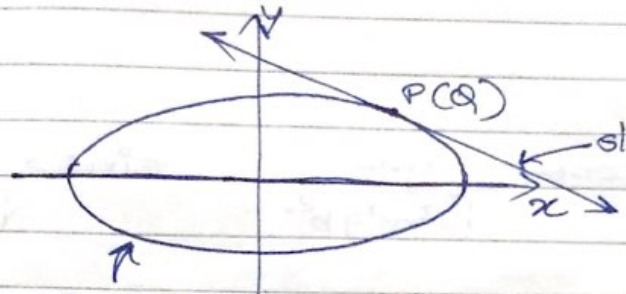
ii.



slope $= -\frac{b}{a}\cot\theta$

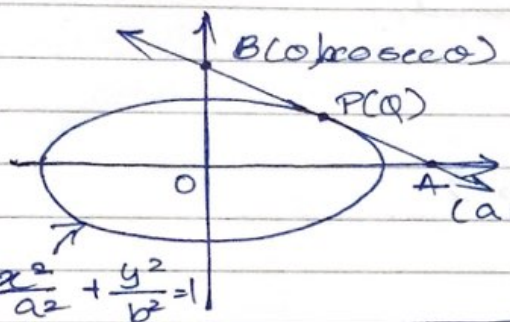
$\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$

$P(\theta) \equiv (a\cos\theta, b\sin\theta)$

$$\frac{x}{a}\cos\theta + \frac{y}{b}\sin\theta = 1$$

$\Rightarrow$ slope $= -\frac{b}{a}\cot\theta$

iii.



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

$A > a$

$a^2\tan^2\theta + b^2\cot^2\theta \geq 2\sqrt{a^2b^2\tan^2\theta\cdot\cot^2\theta}$

$A \geq 2ab$ (min.)

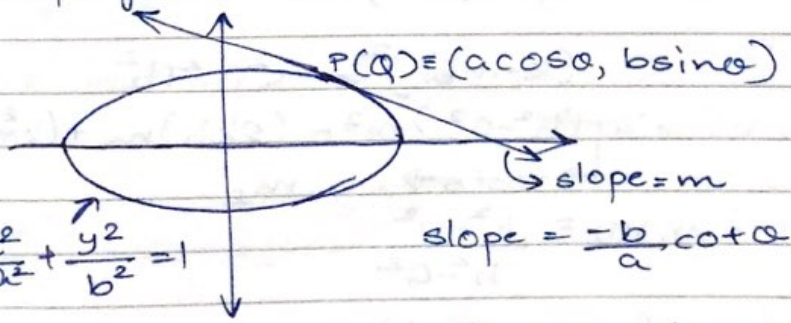
$AB = \sqrt{a^2\sec^2\theta + b^2\operatorname{cosec}^2\theta}$

$= \sqrt{a^2+b^2+a^2\tan^2\theta+b^2\cot^2\theta}$

$\min = 2ab$

$AB_{min} = |a+b|$

Slope form



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

slope $= -\frac{b}{a}\cot\theta$

$\Rightarrow m = -\frac{b}{a}\cot\theta$

$\Rightarrow \boxed{\tan\theta = \frac{-b}{am}}$

Page No.:
Date:
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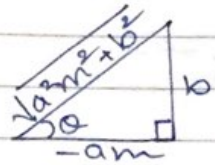
Based on P(Q)

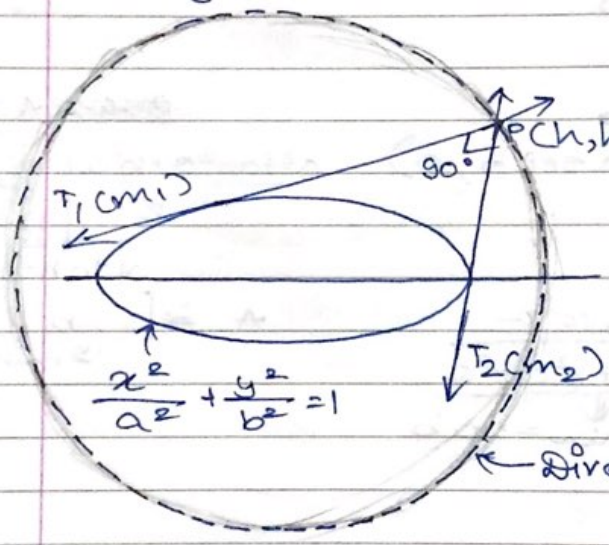


$$\cos\theta = \frac{-am}{\sqrt{a^2m^2+b^2}} \qquad \sin\theta = \frac{b}{\sqrt{a^2m^2+b^2}}$$

Eqⁿ Tangent $\Rightarrow$ $y - \frac{b^2}{\sqrt{a^2m^2+b^2}} = m\left[x \pm \frac{a^2m}{\sqrt{a^2m^2+b^2}}\right]$

$$y = mx \pm \frac{b^2+a^2m^2}{\sqrt{a^2m^2+b^2}}$$

$$\Rightarrow \boxed{y = mx \pm \sqrt{a^2m^2+b^2}}$$



Eqⁿ of tangent $\rightarrow$ $y = mx \pm \sqrt{a^2m^2+b^2}$

$\hookrightarrow$ P(h,k), $(\ )^2$

$$\therefore (k-mh)^2 = a^2m^2+b^2$$

$$\therefore (h^2-a^2)m^2 - (2kh)m + (k^2-b^2) = 0$$

$\hookrightarrow$ roots $\rightarrow m_1, m_2$

$$m_1 m_2 = \frac{k^2-b^2}{h^2-a^2}$$

but $T_1 \perp T_2$ $(m_1 m_2 = -1)$

$$a^2-h^2 = k^2-b^2$$

$$h^2+k^2 = a^2+b^2$$

locus $\Rightarrow \boxed{x^2+y^2 = a^2+b^2}$

ICE - 2

① $y = \sqrt{2}x + c$

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

$\Rightarrow a = 2$ & $b = 1$

$\Rightarrow \frac{x^2}{4} + \frac{(\sqrt{2}x + c)^2}{1} = 1$

$\Rightarrow \frac{x^2}{4} + 2x^2 + c^2 + 2\sqrt{2}cx = 1$

$\Rightarrow x^2 + 8x^2 + 4c^2 + 8\sqrt{2}cx = 4$

$\Rightarrow 9x^2 + 4c^2 + 8\sqrt{2}cx = 4$

$\Rightarrow 9x^2 + 8\sqrt{2}cx + 4c^2 - 4 = 0$

② $\frac{x^2}{8} + \frac{y^2}{18}$

$P(2, 3)$

$\frac{xx_1}{a^2} + \frac{yy_1}{b^2} = 1$

$\Rightarrow \frac{2x}{8} + \frac{3y}{18} = 1$

$\Rightarrow \{36x + 24y = 144$

$\Rightarrow \boxed{3x + 2y = 12}$

③ $\frac{x^2}{4} + \frac{y^2}{6} = 1$

$(x^2 + y^2) = 4 + 6$

$\Rightarrow \boxed{x^2 + y^2 = 10}$

④ $3x + 4y = \sqrt{7}$

$3x^2 + 4y^2 = 1$

$m = \frac{-4}{3}$

$\frac{x^2}{4} + \frac{y^2}{3} = 1$

$\Rightarrow \cot\theta = 1 \rightarrow \theta = 45^\circ$

$\Rightarrow$

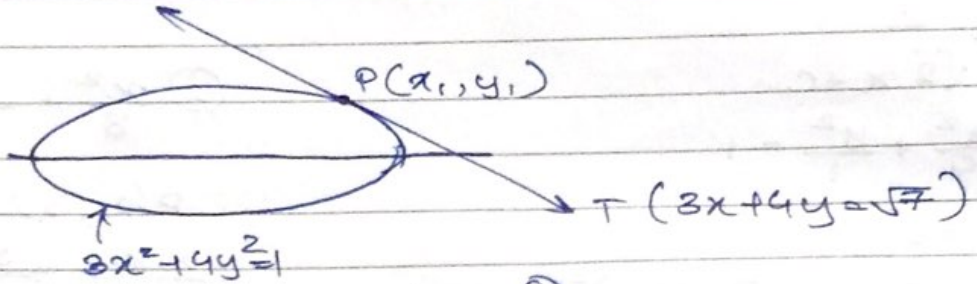
$(3x + 4y)^2 - 24xy = 1$

$\Rightarrow 7 - 24xy = 1$

$\Rightarrow 24xy = 6$

$\Rightarrow xy = \frac{1}{4}$

④



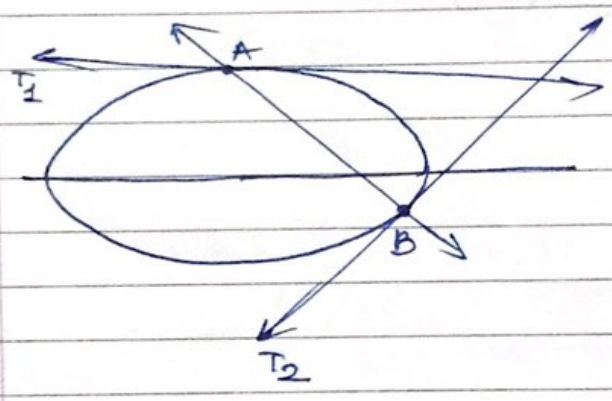
$\Rightarrow 3xx_1 + 4yy_1 = 1$ —— ①

$\frac{3x}{\sqrt{7}} + \frac{4y}{\sqrt{7}} = 1$ —— ②

$\Rightarrow x_1 = \frac{1}{\sqrt{7}}$ & $y_1 = \frac{1}{\sqrt{7}}$

⇒ Option A

⑤



$\frac{x^2}{10} + \frac{y^2}{5} = 1$