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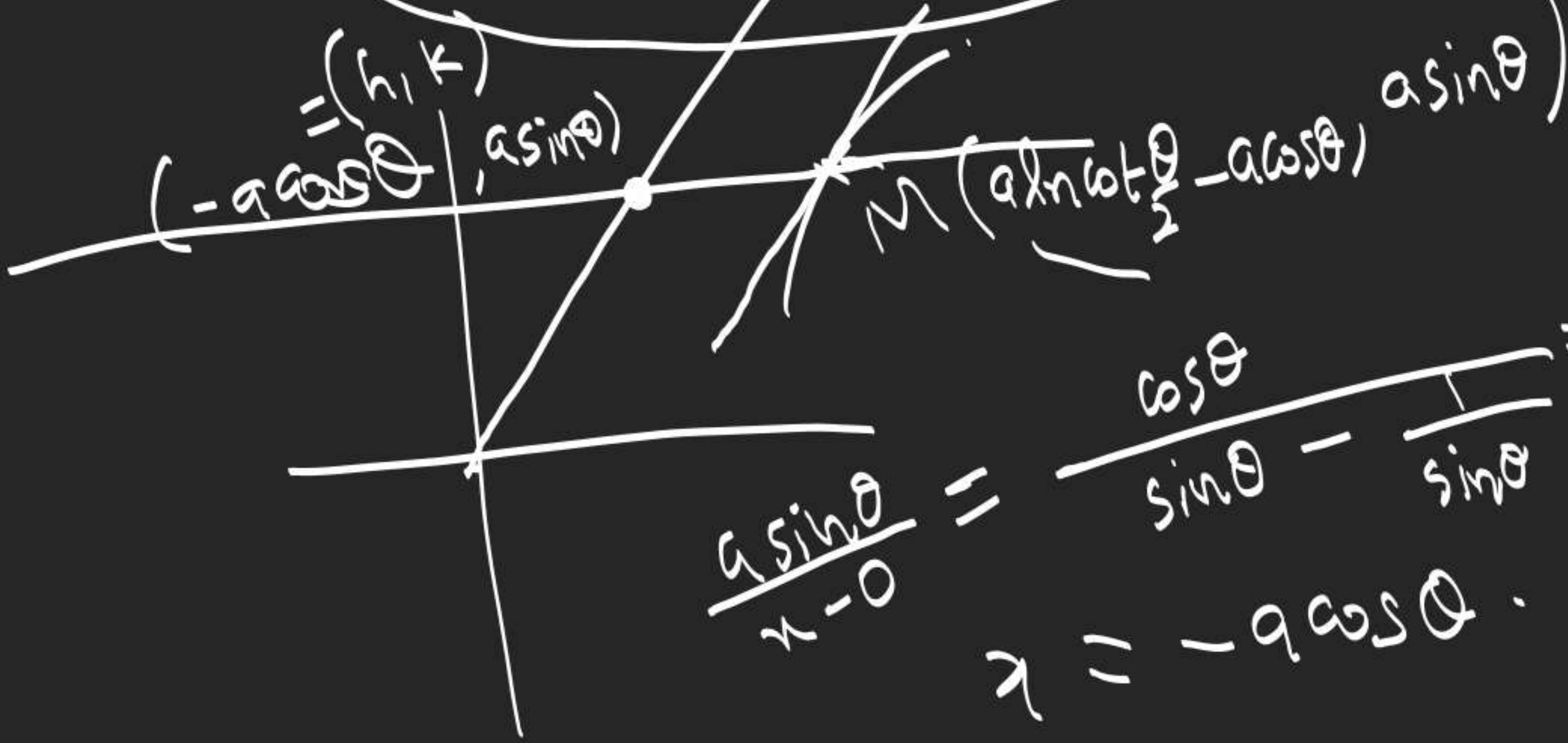
$$2yy' - 6x^2 - 4y' = 0$$

$$y' = \frac{3x_1^2}{y_1 - 2}$$

$$\frac{y_1 - 2}{x_1 - 1} = \frac{3x_1^2}{y_1 - 2}$$

$$(y_1 - 2)^2 = 3x_1^2(x_1 - 1) = 2x_1^3 - 4$$

$$(y_1 - 2)^2 = 2x_1^3 - 4$$



$$\frac{a\sin\theta}{x - 0} = \frac{\cos\theta}{\sin\theta - \frac{1}{\sin\theta}} = \frac{-\sin\theta}{\cos\theta}$$

$$x = -a\cos\theta.$$

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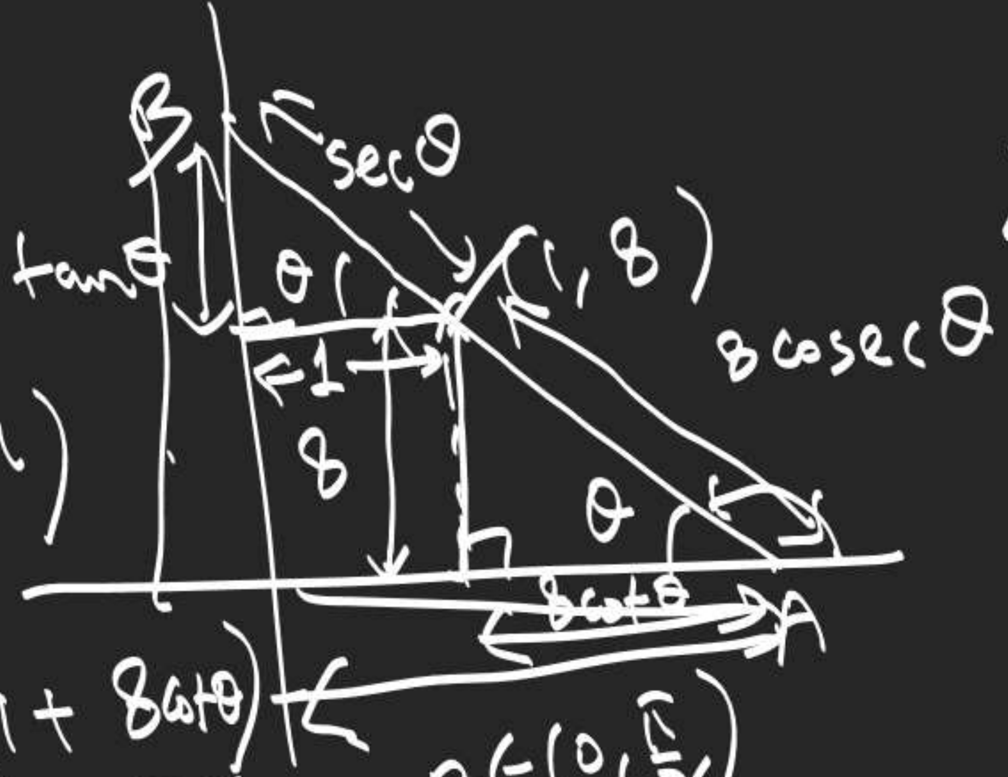

$y-8=-8(x-1)$

$\Delta=\frac{1}{2}(8+\tan\theta)(1+8\cot\theta)$ $\quad \theta\in\left(0,\frac{\pi}{2}\right)$

$\geq\frac{1}{2}\left[16+(\tan\theta+64\cot\theta)\right]\geq 16$

$y-8=-2(x-1)$

$L=AB=8\operatorname{cosec}\theta+\sec\theta$.

$L'(\theta)=-\frac{8\cos\theta}{\sin^2\theta}+\frac{\sin\theta}{\cos^2\theta}$

$=\frac{\sin^3\theta-8\cos^3\theta}{\sin^2\theta\cos^2\theta}$

$\cos^3\theta(\tan^3\theta-8)$

$-\quad +$

$\tan^{-1}2$

$\boxed{\text{min}}$

111

$8+\tan\theta+1+8\cot\theta$

$\geq 9+4\sqrt{2}$

$y-8=-2\sqrt{2}(x-1)$

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Cauchy's Inequality

$$\left(a_1^2+a_2^2+a_3^2+\cdots+a_n^2\right)\left(b_1^2+b_2^2+b_3^2+\cdots+b_n^2\right)\geq\left(a_1b_1+a_2b_2+\cdots+a_nb_n\right)^2$$

Equality holds if $\dfrac{a_1}{b_1}=\dfrac{a_2}{b_2}=\dfrac{a_3}{b_3}=\cdots=\dfrac{a_n}{b_n}$.

$$\left(a_1+xb_1\right)^2+\left(a_2+xb_2\right)^2+\cdots+\left(a_n+xb_n\right)^2\geq 0$$

$$\left(b_1^2+b_2^2+\cdots b_n^2\right)x^2+2\left(a_1b_1+a_2b_2+\cdots+a_nb_n\right)x+\left(a_1^2+a_2^2+\cdots+a_n^2\right)\geq 0 \quad \forall x\in R.$$

$$D\leq 0 \Rightarrow \left(\sum a_1b_1\right)^2-\left(\sum a_1^2\right)\left(\sum b_1^2\right)\leq 0$$

$D=0$

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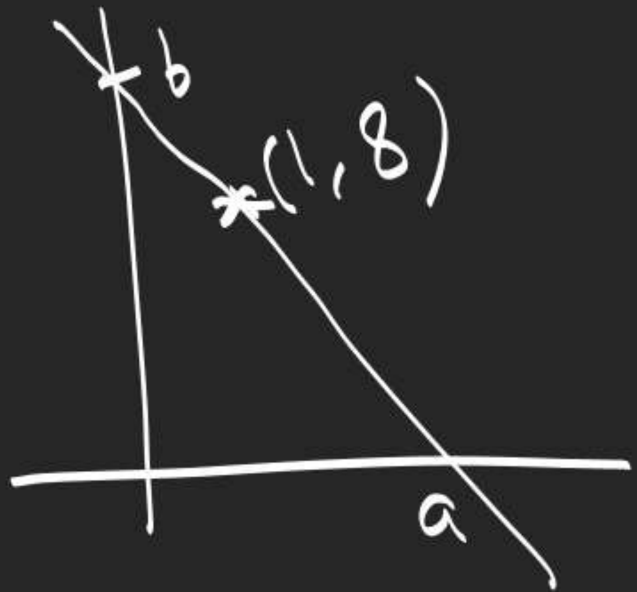

$\frac{x}{a}+\frac{y}{b}=1$ ✓ $m=-\frac{b}{a}$

$$\boxed{\frac{1}{a}+\frac{8}{b}=1}$$

$(a+b)_{min} = ?$

$$(a+b)\left(\frac{1}{a}+\frac{8}{b}\right) \geq \left(1+2\sqrt{2}\right)^2$$

$$a+b \geq (1+2\sqrt{2})^2 \Rightarrow \frac{b}{a}=2\sqrt{2} \checkmark$$

$$a=\frac{b}{2\sqrt{2}}$$

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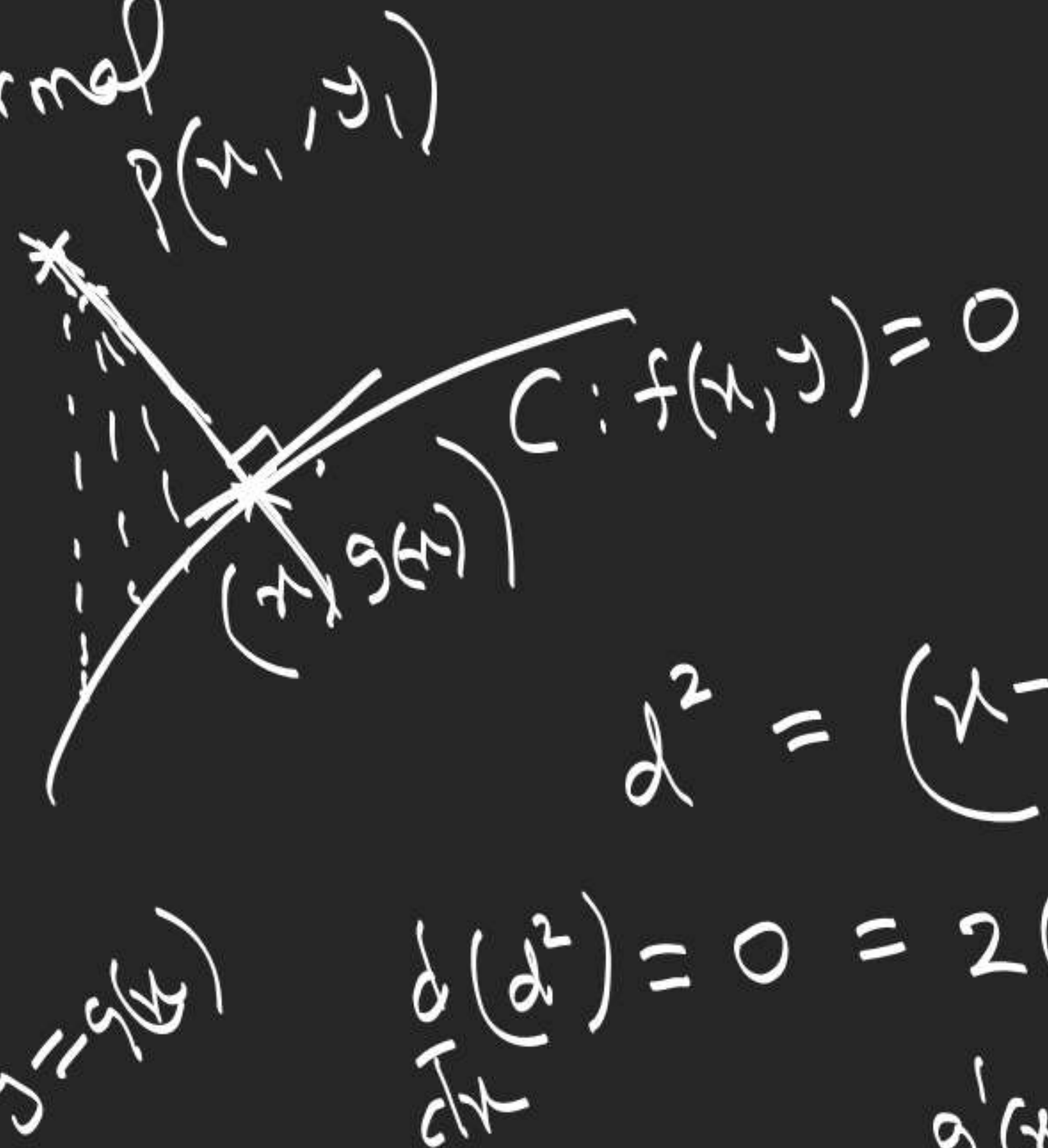
Max / Min distance of a point from a curve

occur along normal from P to C.



$$d^2 = (x - x_1)^2 + (g(x) - y_1)^2$$

$$\frac{d}{dx}(d^2) = 0 = 2(x - x_1) + 2(g(x) - y_1)\, g'(x)$$

$$g'(x) = -\frac{x - x_1}{g(x) - y_1}$$

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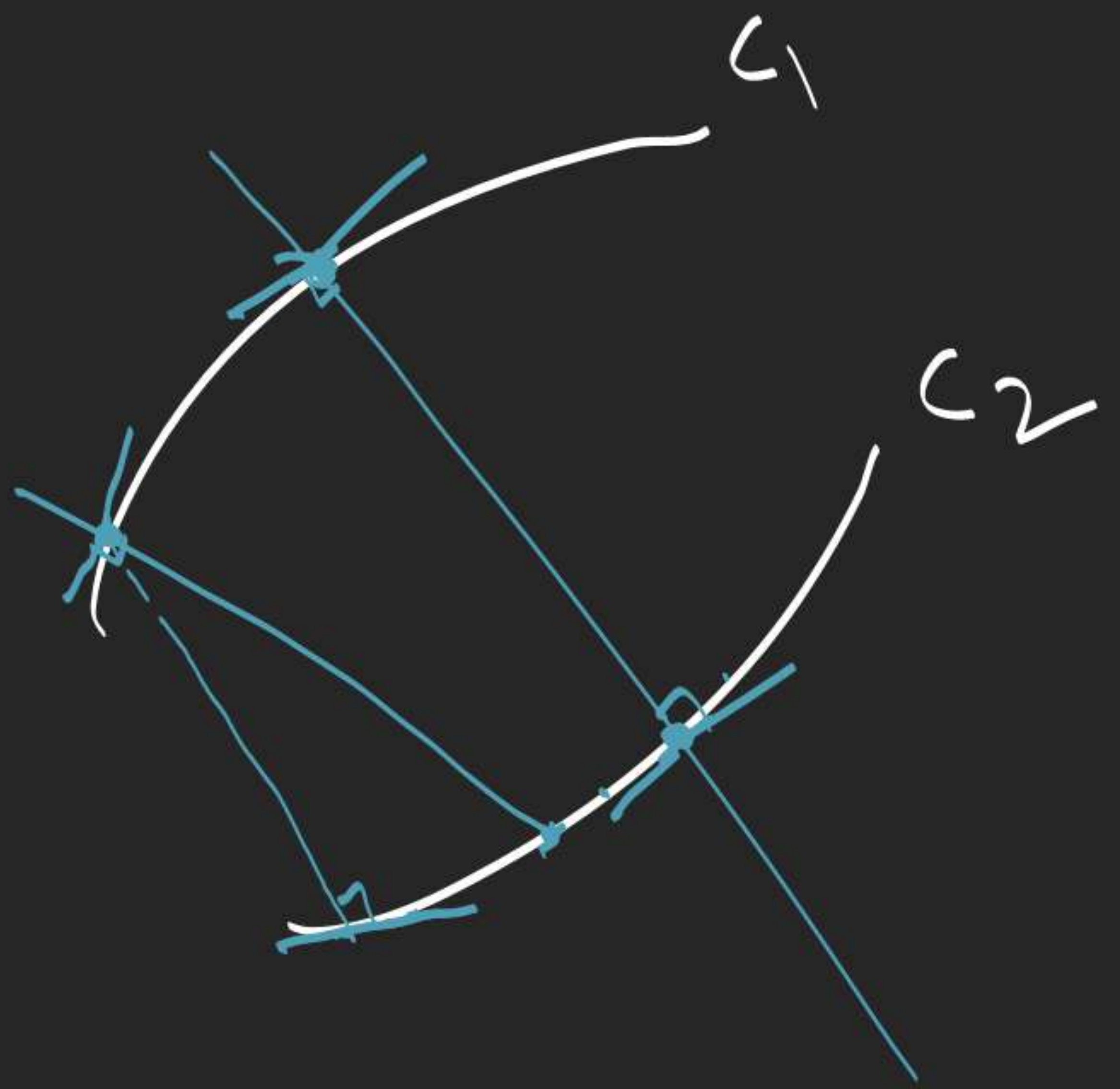
Max/Min distance between two Curves

↓ occur along common normal to curves



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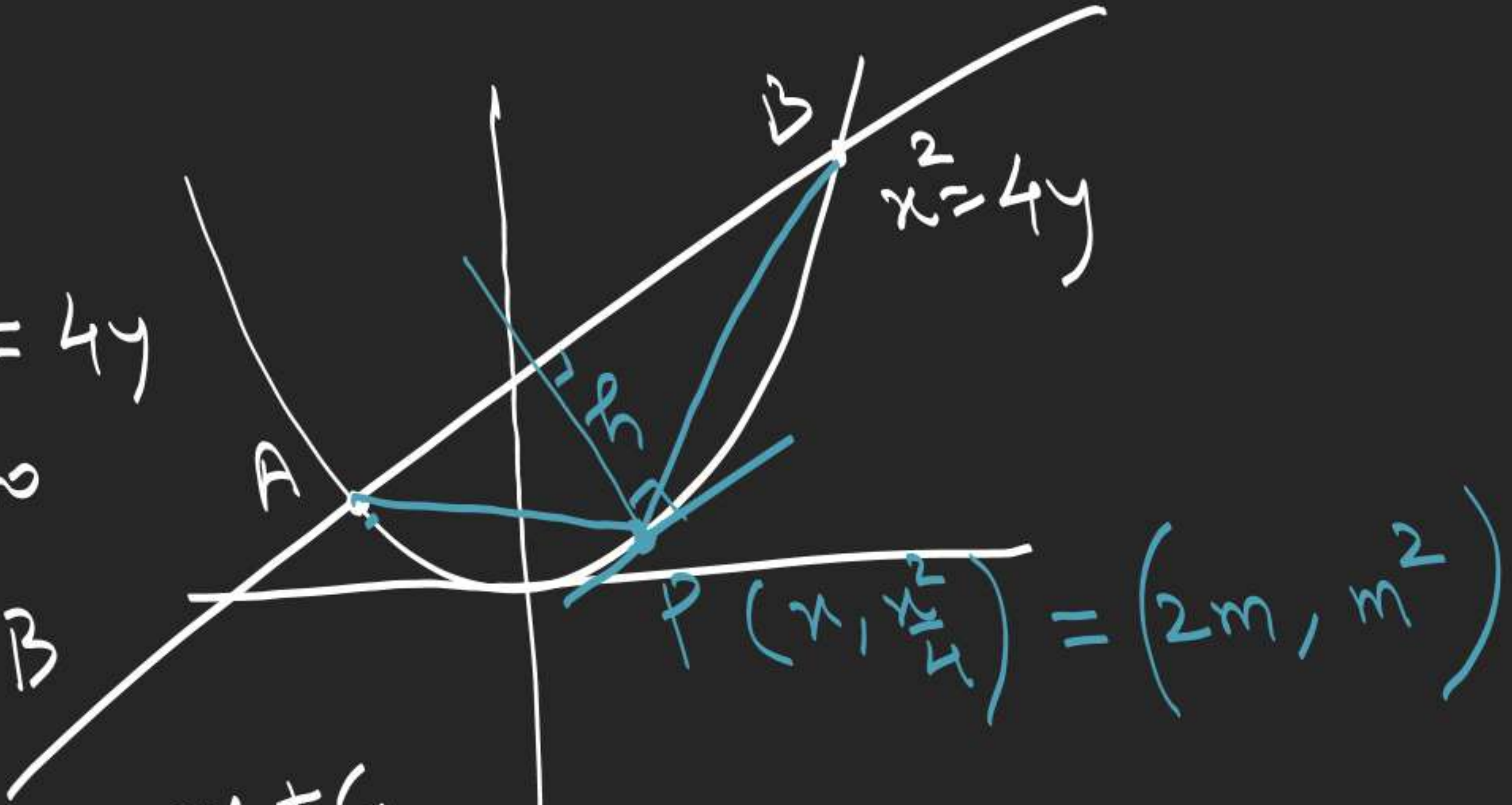
1.



Find P on $x^2=4y$ between A, B so that area of ΔAPB is maximum

$y=mx+c$

$y-mx-c$

$\frac{x}{2}=m$

$x=2m$

$1\left(\frac{x^2}{4}-mx-c\right)<0$

$(2m, -$

$$h = \frac{\left|\frac{x^2}{4}-mx-c\right|}{\sqrt{1+m^2}}$$

$$= \frac{1}{\sqrt{1+m^2}}\left(mx+c-\frac{x^2}{4}\right)$$

$ax+by+c=0$

(x_1, y_1) lies above, $b(ax_1+by_1+c)>0$

below, <0

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Q. Four points A, B, C, D, with $A = (-2, 3)$, $B = (-1, 1)$, $D = (2, 7)$ lie in order on parabola $y = ax^2 + bx + c$. Find 'C' for which area of quadrilateral ABCD is the greatest.

Ex- II (T/N)
Ex- IV (T/N)