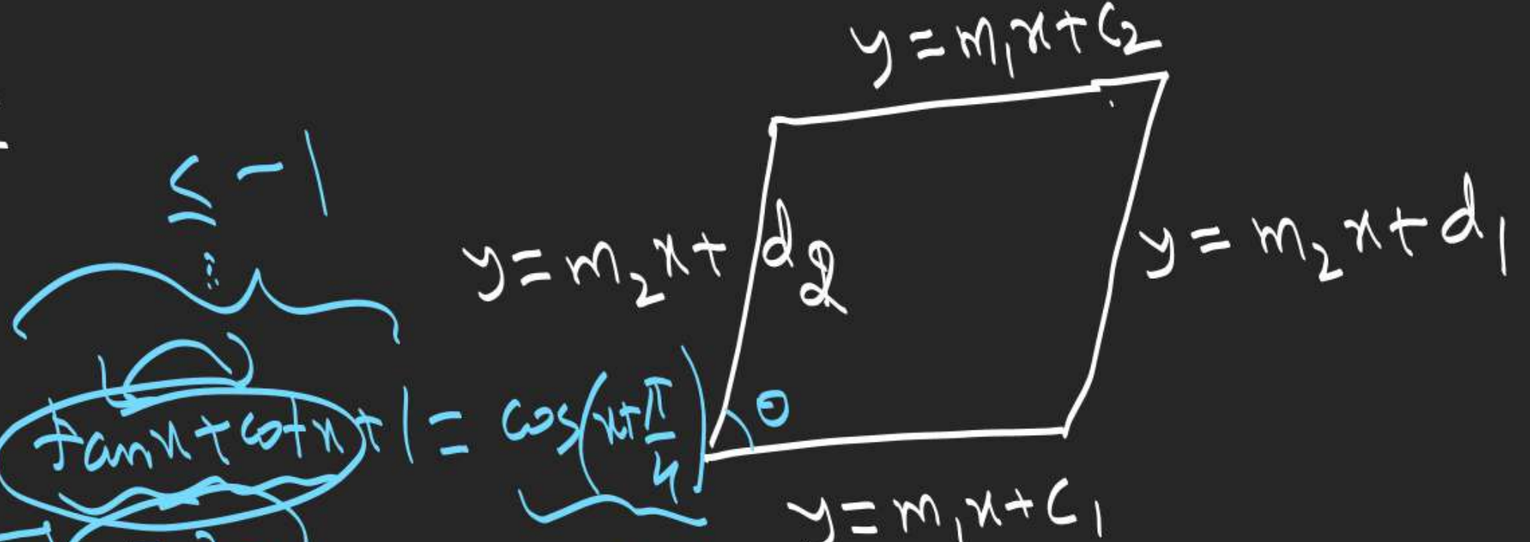
Nishant Jindal

1.



$|\tan x + \cot x| = \left|\cos\left(x + \frac{\pi}{4}\right)\right|$

$\tan x + \cot x \le -1$ or ≥ 2 ; $\cos\left(x + \frac{\pi}{4}\right) \ge -1$

$\tan x = -1$

P.T. area of llgm is $\left|\frac{(c_1 - c_2)(d_1 - d_2)}{(m_1 - m_2)}\right|$

$$\frac{|c_1 - c_2|}{\sqrt{1+m_1^2}} \cdot \frac{|d_1 - d_2|}{\sqrt{1+m_2^2}} \cdot \sqrt{1 + \frac{(1+m_1m_2)^2}{(m_1-m_2)^2}} = \frac{|(c_1 - c_2)(d_1 - d_2)|}{\sqrt{1+m_1^2}\sqrt{1+m_2^2}} \cdot \sqrt{\frac{m_1^2 + m_2^2 + 1 + m_1^2m_2^2}{(m_1-m_2)^2}}$$

$$= \left|\frac{(c_1 - c_2)(d_1 - d_2)}{(m_1 - m_2)}\right|$$

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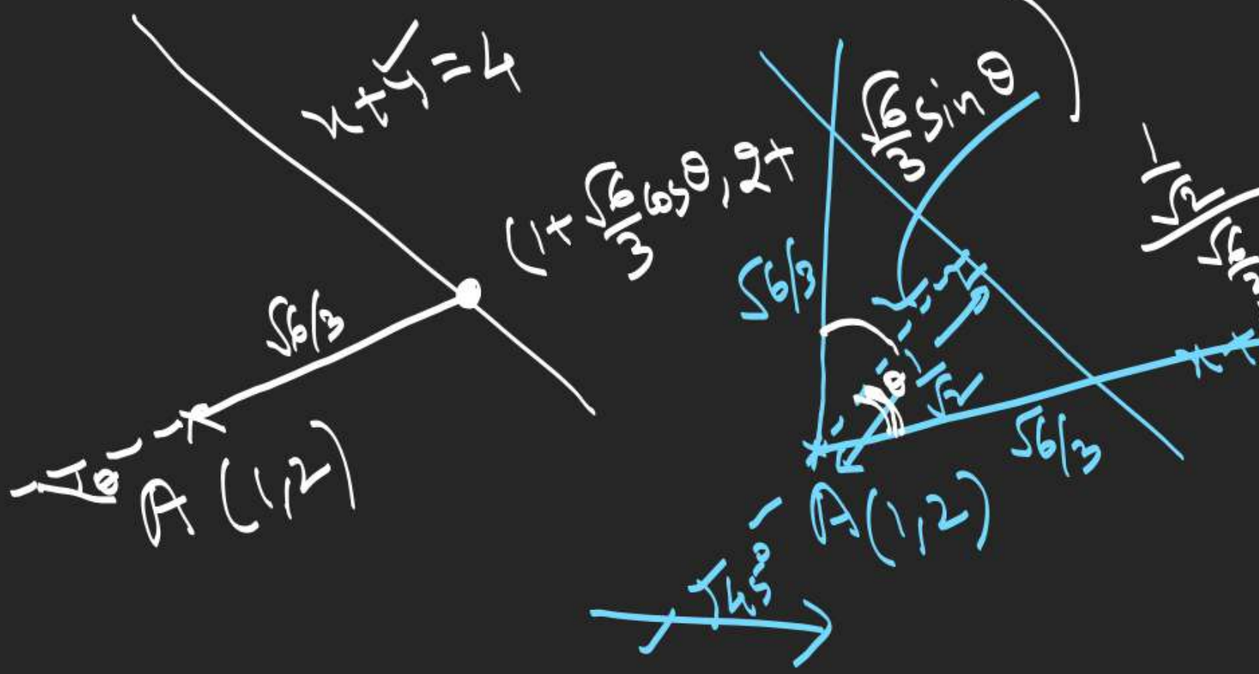
2. In what direction a line thru the point A(1,2) must be drawn so that its intersection

$$3+\frac{\sqrt{6}}{3}(\cos\theta+\sin\theta)=4 \Rightarrow \frac{3}{\sqrt{6}}=\sqrt{2}\sin(\theta+45^\circ) \Rightarrow \frac{\sqrt{3}}{2}=\sin(\theta+45^\circ)$$

$$\theta+45^\circ = 60^\circ, 120^\circ$$



$$\frac{\frac{1}{\sqrt{2}}}{\sqrt{6}/3}=\cos\theta=\frac{3}{\sqrt{12}}=\frac{\sqrt{3}}{2}$$

$$\theta=30^\circ$$

$45^\circ-30^\circ$, $45^\circ+30^\circ$

$15^\circ, 75^\circ$

$\therefore$

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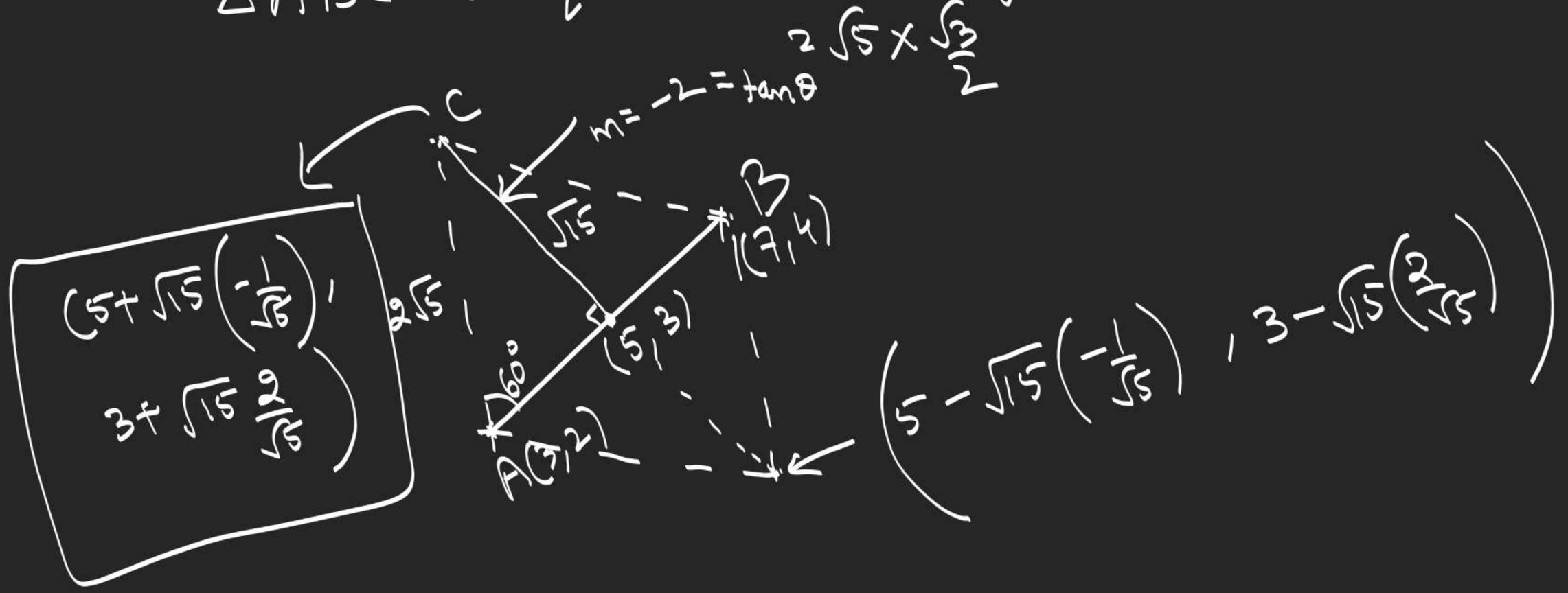
3. Let $A=(3,2)$ and $B=(7,4)$, find C so that ΔABC is equilateral triangle.



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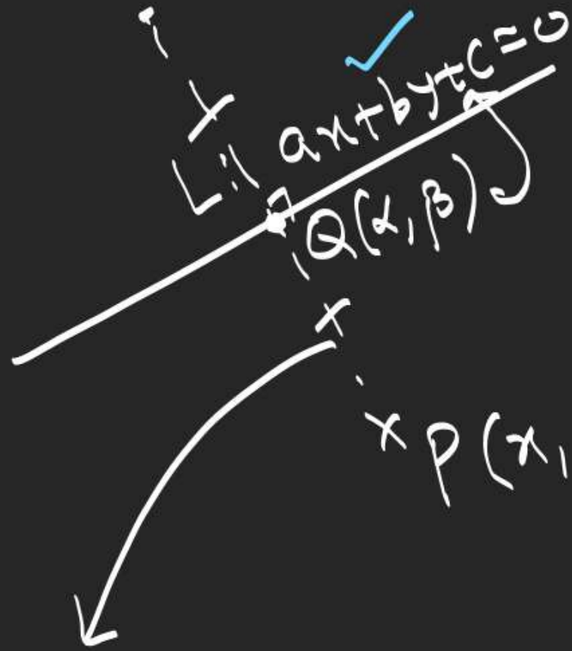

① Foot of $\perp$ from P on L

② Image of P from 'L'.

$a\alpha+b\beta+c=0$

$bx-ay = bx_1-ay_1$

Put (α,β) $\quad b\alpha-a\beta = bx_1-ay_1$

$$\frac{x-x_1}{a} = \frac{y-y_1}{b} = -\left(\frac{ax_1+by_1+c}{a^2+b^2}\right)$$

$$\frac{a\alpha-ax_1}{a^2} = \frac{b\beta-y_1b}{b^2} = \frac{a\alpha+b\beta-ax_1-by_1}{a^2+b^2}$$

$$\frac{\alpha-x_1}{a} = \frac{\beta-y_1}{b} = \frac{-ax_1-by_1-c}{a^2+b^2}$$

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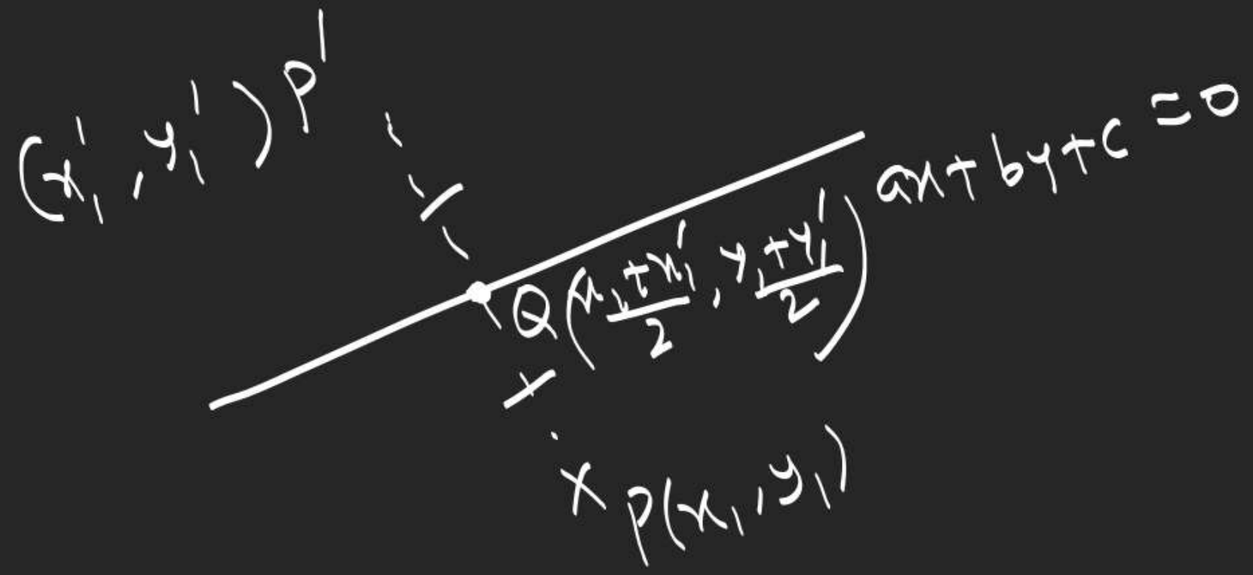

$$\frac{\frac{x_1+x_1'}{2}-x_1}{a} = \frac{\frac{y_1+y_1'}{2}-y_1}{b} = -\left(\frac{ax_1+by_1+c}{a^2+b^2}\right)$$

$$\frac{x_1'-x_1}{a} = \frac{y_1'-y_1}{b} = -2\left(\frac{ax_1+by_1+c}{a^2+b^2}\right)$$

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Concurrency of 3 lines

Intersection point

$$\frac{x}{b_1c_2-b_2c_1}=\frac{y}{c_1a_2-a_1c_2}=\frac{1}{a_1b_2-a_2b_1}$$

$$\begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}=0$$

$a_3x+b_3y+c_3=0$

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

$$a_3(b_1c_2-b_2c_1)+b_3(c_1a_2-a_1c_2)+c_3=0$$

$$a_3\frac{(b_1c_2-b_2c_1)}{a_1b_2-a_2b_1}+b_3\frac{(c_1a_2-a_1c_2)}{a_1b_2-a_2b_1}+c_3=0$$

$$a_3(b_1c_2-b_2c_1)+b_3(c_1a_2-a_1c_2)+c_3(a_1b_2-a_2b_1)=0.$$

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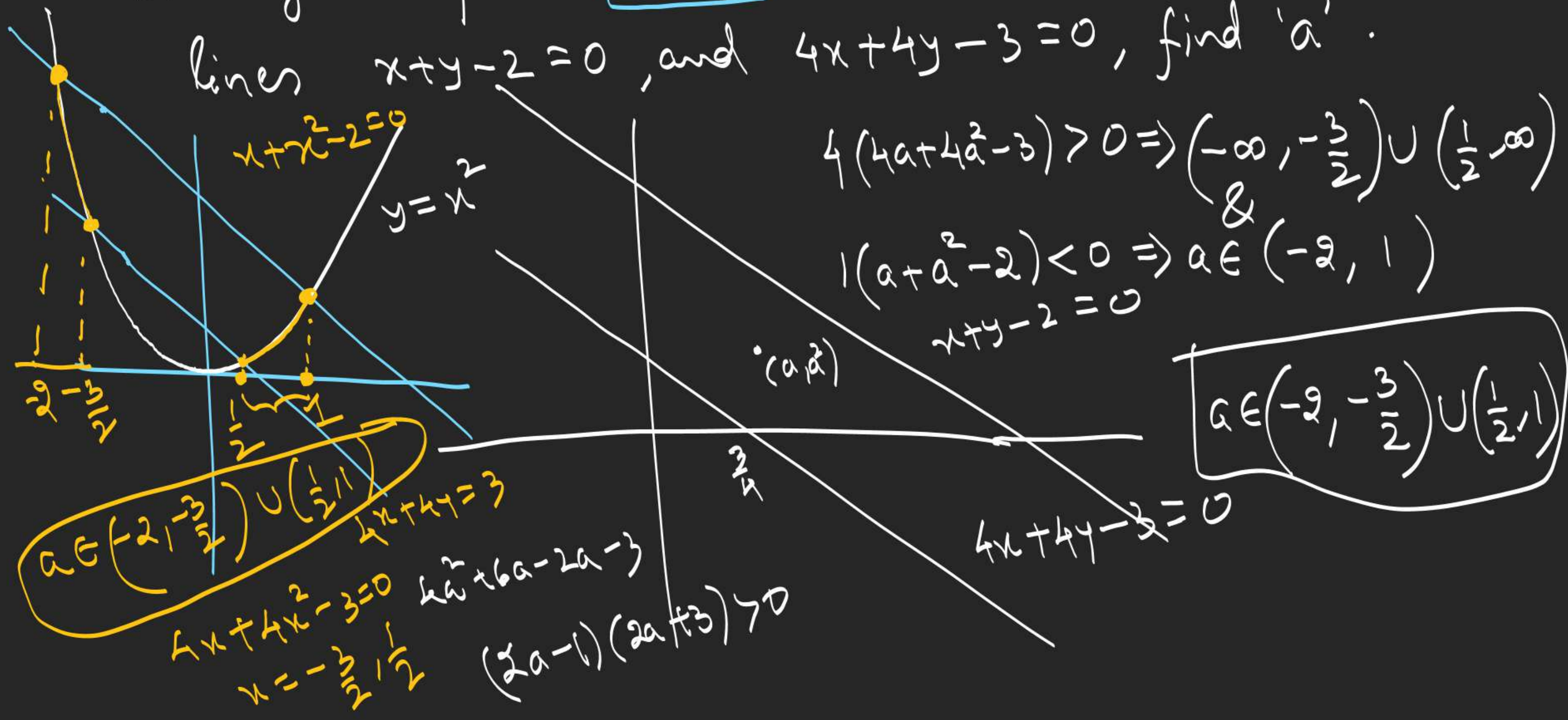
5: If the point (a, a^2) lies between the lines $x+y-2=0$, and $4x+4y-3=0$, find 'a'.



$4(4a+4a^2-3)>0 \Rightarrow (-\infty, -\frac{3}{2}) \cup (\frac{1}{2}, \infty)$

&

$1(a+a^2-2)<0 \Rightarrow a \in (-2, 1)$

$$a \in \left(-2, -\frac{3}{2}\right) \cup \left(\frac{1}{2}, 1\right)$$