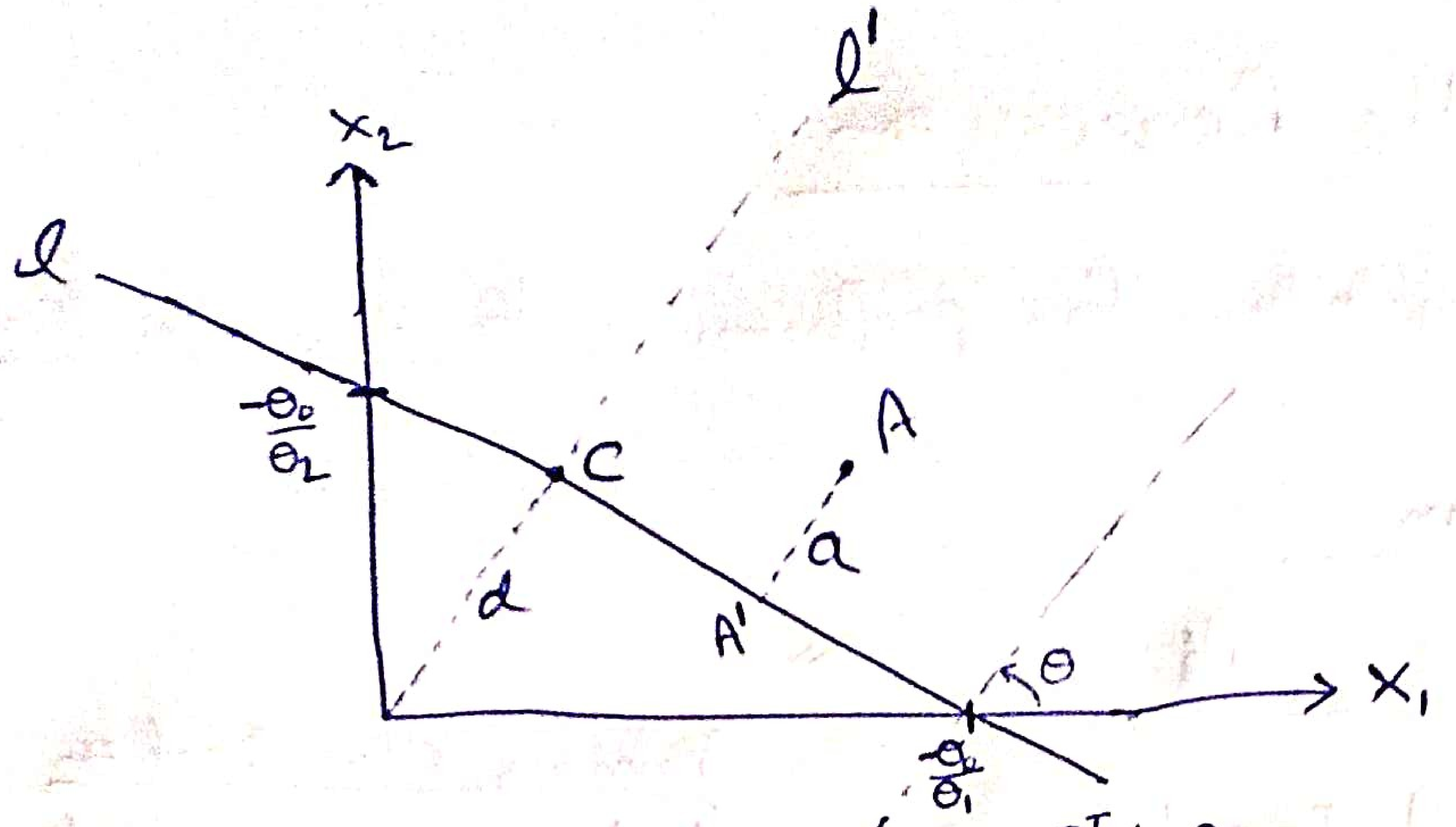

$\theta^T X = 0$

or

$\boxed{\theta_0 + \theta_1 x_1 + \theta_2 x_2 = 0}$ — (1)

$m = \frac{dx_2}{dx_1}$ $\qquad 0 + \theta_1 + \theta_2 \frac{dx_2}{dx_1} = 0$

$m = \frac{dx_2}{dx_1} = \tan(90+\theta)$ $\qquad \frac{dx_2}{dx_1} = \frac{-\theta_1}{\theta_2}$

$m' = \tan(\theta)$ $\qquad \tan(90+\theta) = \frac{-1}{\tan\theta} = \frac{-\theta_1}{\theta_2}$

$m' = \frac{\theta_2}{\theta_1}$ $\qquad \tan\theta = \frac{\theta_2}{\theta_1}$

⇒ Eq of line l':

{Point (θ_1, θ_2) lies on l'}

$x_2 = m' x_1$

$\theta_1 x_2 = \theta_2 x_1 \Rightarrow \boxed{\theta_2 x_1 - \theta_1 x_2 = 0}$ — (2)

⇒ Solving Eq (1) & (2) Simultaneously will give:

$$C = \left(\frac{-\theta_0 \theta_1}{\theta_1^2 + \theta_2^2}, \frac{-\theta_0 \theta_2}{\theta_1^2 + \theta_2^2} \right)$$

$$d = \sqrt{c_1^2 + c_2^2} = \sqrt{\frac{\theta_0^2(\theta_1^2 + \theta_2^2)}{(\theta_1^2 + \theta_2^2)^2}} = \sqrt{\frac{\theta_0^2}{(\theta_1^2 + \theta_2^2)}} = \frac{\pm\theta_0}{\sqrt{\theta_1^2 + \theta_2^2}}$$

$$d = \frac{|\theta_0|}{\sqrt{\theta_1^2 + \theta_2^2}}$$

⇒ Unit vector normal to line l:

$$\hat{l}_\perp = \begin{bmatrix} \dfrac{-\frac{\theta_0}{|\theta_0|} * \theta_1}{\sqrt{\theta_1^2+\theta_2^2}} \\ \\ \dfrac{-\frac{\theta_0}{|\theta_0|} * \theta_2}{\sqrt{\theta_1^2+\theta_2^2}} \end{bmatrix} = \begin{bmatrix} \dfrac{\mp\theta_1}{\sqrt{\theta_1^2+\theta_2^2}} \\ \\ \dfrac{\mp\theta_2}{\sqrt{\theta_1^2+\theta_2^2}} \end{bmatrix}$$

$$A = A' + a\, l_\perp$$

$$(\theta_0 + \theta_1 A_1 + \theta_2 A_2) = (\theta_0 + \theta_1 A_1' + \theta_2 A_A') + a(\theta_1 \hat{l}_{\perp 1} + \theta_2 \hat{l}_{\perp 2})$$

$$\theta^T A = 0 + \left(a * \mp\sqrt{\theta_1^2+\theta_2^2}\right)$$

as A' lies of the line l

$$\boxed{\theta^T A = \mp a\sqrt{\theta_1^2+\theta_2^2}}$$

$\boxed{\theta^T A > 0 \text{ for +ve Side iff } \theta_0 < 0}$