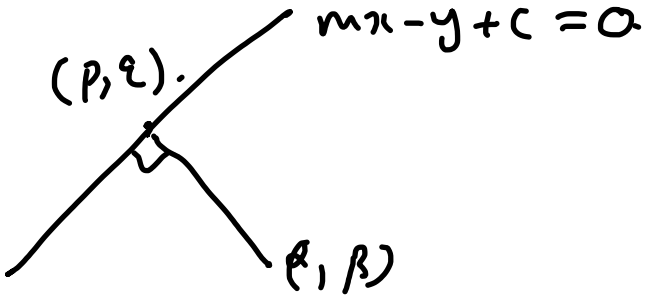
(A).



$$\frac{\beta - q}{\alpha - p} = -\frac{1}{m} \quad \text{— (1)}$$

$$\beta - q = -\frac{1}{m}(\alpha - p)$$

$$q = mp + c$$

$$mp - q + c = 0 \quad \text{— (2)}$$

$$\beta - mp - c = -\frac{1}{m}(\alpha - p)$$

$$\beta - mp - c = -\frac{\alpha}{m} + \frac{p}{m}$$

$$\beta - c + \frac{\alpha}{m} = p\left(m + \frac{1}{m}\right) = \frac{p(m^2+1)}{m}$$

$$p = \frac{m\beta - mc + \alpha}{1 + m^2} \;//$$

$$q = \frac{m^2\beta - m^2c + m\alpha + c + cm^2}{1 + m^2}$$

$$= \frac{m\alpha + m^2\beta + c}{1 + m^2} \;//.$$

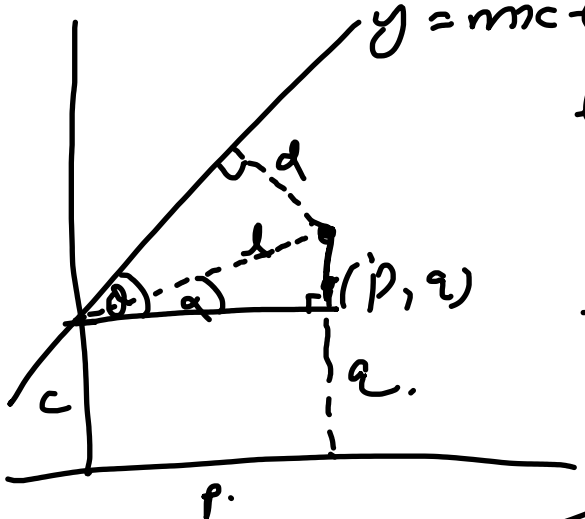
(b) $d^2 = (p-\alpha)^2 + (q-\beta)^2$

$$= \left(\frac{m\beta - mc + \alpha}{1+m^2} - \alpha\right)^2 + \left(\frac{m\alpha + m^2\beta + c}{1+m^2} - \beta\right)^2$$

$$= \left(\frac{m\beta - mc - \alpha m^2}{1+m^2}\right)^2 + \left(\frac{m\alpha + c - \beta}{1+m^2}\right)^2$$

$$\frac{m^2}{(1+m^2)^2}(p - c - \alpha m)^2 + \frac{1}{(1+m^2)^2}(\beta - c - \alpha m)^2$$

$$\frac{(\alpha m - \beta + c)^2}{(1+m^2)^2}(m^2+1) = \frac{(\alpha m - \beta + c)^2}{m^2+1}$$

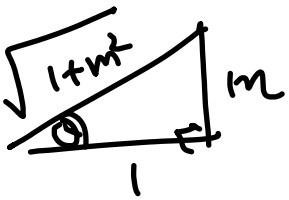


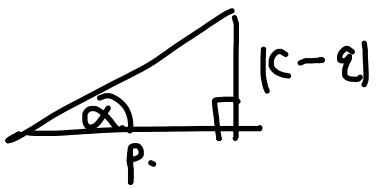
$l\cos\alpha = p.$

$l\sin(\theta - \alpha) = d.$

$$\frac{d}{p} = \frac{\sin(\theta-\alpha)}{\cos\alpha}$$

$$= \frac{\sin\theta\cos\alpha - \cos\theta\sin\alpha}{\cos\alpha}$$





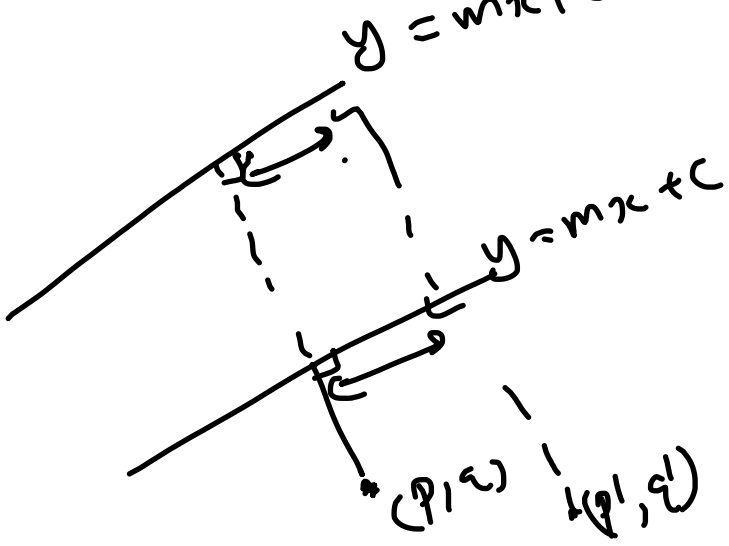
$$\frac{d}{p} = \sin\theta - \cos\theta\tan\alpha.$$

$$\frac{d}{p} = \frac{m}{\sqrt{1+m^2}} - \frac{1}{\sqrt{m^2+1}}\cdot\frac{|c-q|}{p}$$

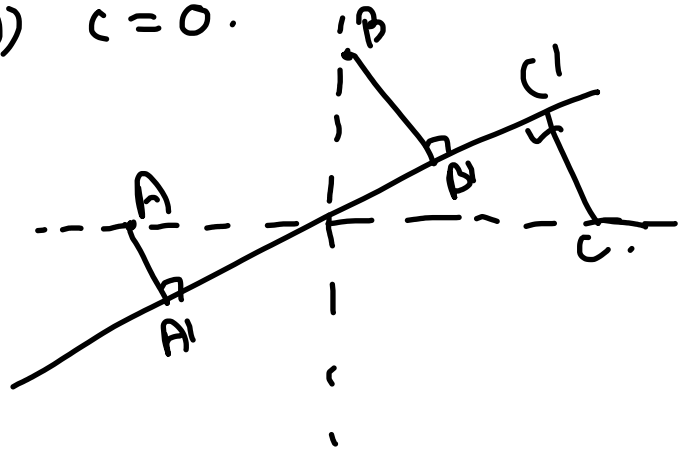
$$\therefore d = \frac{pm - |c-q|}{\sqrt{1+m^2}} = \frac{pm - (q-c)}{\sqrt{1+m^2}}$$

$$d = \frac{pm - q + c}{\sqrt{1+m^2}} \qquad d = \frac{|\alpha m - \beta + c|}{\sqrt{1+m^2}}$$

(C)



(D) $c = 0$.



$$A = \begin{pmatrix} -1 \\ 0 \end{pmatrix}$$

$$B = \begin{pmatrix} 0 \\ 1 \end{pmatrix}$$

$$C = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$$

$$\bar{x} = \begin{pmatrix} 0 \\ 1/3 \end{pmatrix}$$

$$A - \bar{x} = \begin{pmatrix} -1 \\ -1/3 \end{pmatrix} \begin{pmatrix} -1 & -\frac{1}{3} \end{pmatrix} = \begin{pmatrix} 1 & 1/3 \\ \frac{1}{3} & \frac{1}{9} \end{pmatrix}$$

$$B - \bar{x} = \begin{pmatrix} 0 \\ 2/3 \end{pmatrix} \begin{pmatrix} 0 & 2/3 \end{pmatrix} = \begin{pmatrix} 0 & 0 \\ 0 & 4/9 \end{pmatrix}$$

$$C - \bar{x} = \begin{pmatrix} +1 \\ -1/3 \end{pmatrix} \begin{pmatrix} 1 & -1/3 \end{pmatrix} = \begin{pmatrix} 1 & \frac{-1}{3} \\ \frac{-1}{3} & \frac{1}{9} \end{pmatrix}$$

$$S = \begin{pmatrix} 2 & 0 \\ 0 & 2/3 \end{pmatrix}$$

$$(S - 2I) = \begin{pmatrix} 0 & 0 \\ 0 & -\frac{4}{3} \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$$

$$-\frac{4}{3}x_2 = 0 \qquad x_2 = 0$$

$$u_1 = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$$