in 2D space

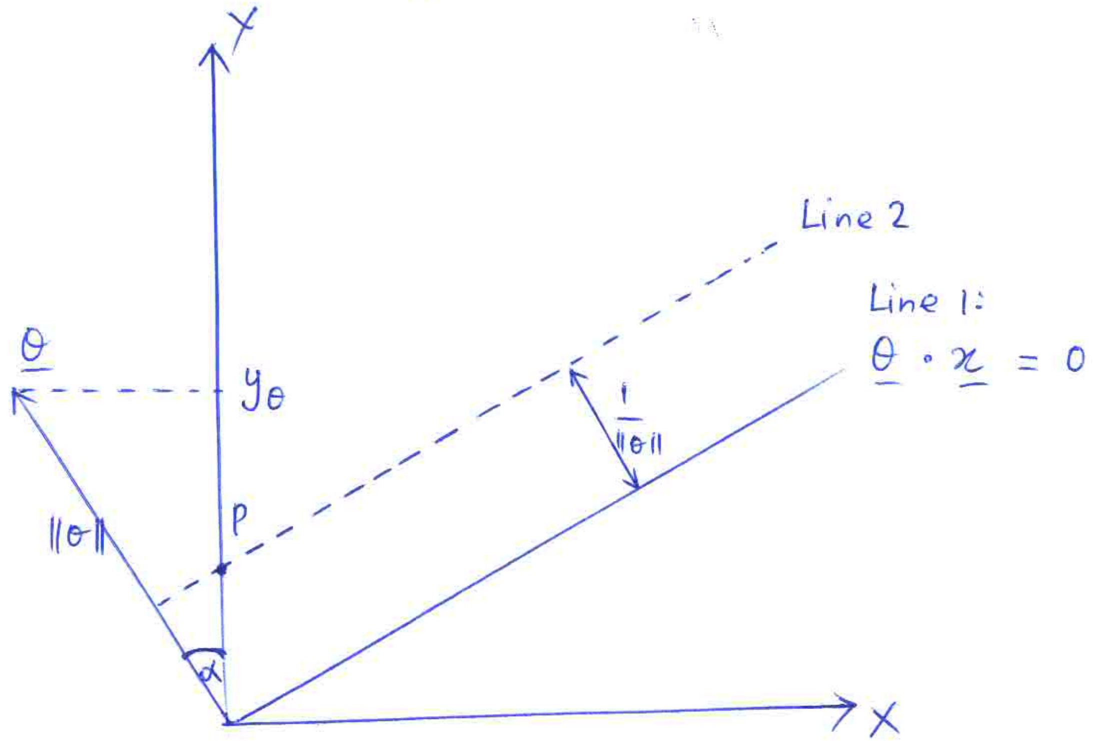
Let $\underline{x} \equiv (x, y)$

$\underline{\theta} = (\theta_x, \theta_y)$

$y = mx + c$

$y y_\theta + x x_\theta = 1$

$\underline{\theta} \cdot \underline{x} = 1$ #



Line equation of Line 1 is

$\underline{\theta} \cdot \underline{x} = 0$

$x_\theta \cdot x + y_\theta \cdot y = 0$

$y_\theta \cdot y = -x_\theta \cdot x + 0$

$y = -\frac{x_\theta}{y_\theta} \cdot x + 0$

slop of ~~line~~ line 1 : $m = -\frac{x_\theta}{y_\theta}$

m is also the slop for Line 2

(because they are parallel.)

$\cos\alpha = \frac{y_\theta}{\|\theta\|}$ (for the big triangle)

$\cos\alpha = \frac{1/\|\theta\|}{P}$ (for the small triangle)

Thus, $\frac{y_\theta}{\|\theta\|} = \frac{\frac{1}{\|\theta\|}}{P}$

$y_\theta P = 1$

$P = \frac{1}{y_\theta}$

Line equation of Line 2 is

$y = mx + P$

$y = -\frac{x_\theta}{y_\theta} x + \frac{1}{y_\theta}$

$y = \frac{-x_\theta x + 1}{y_\theta}$