(Q). Find θ and P if ($\sqrt{3}$ 1)x = -2 is equivalent to (cosθ sinθ)x = P ?

Given, ($\sqrt{3}$ 1)x = -2 is equivalent to (cosθ sinθ)x = P

The given equation of line is,

$$n^T\ x = c \tag{1}$$

$$where\ \vec{n} = \begin{bmatrix} \sqrt{3} \\ 1 \end{bmatrix} and\ c = -2 \tag{2}$$

Now obtain a new equation,

$$\frac{\vec{n}}{\|\vec{n}\|}x = \frac{c}{\|\vec{n}\|} \qquad where\ \|\vec{n}\|\ is\ the\ norm\ of\ the\ \vec{n} \tag{3}$$

$$\implies \vec{u}x = P \quad where\ u = \begin{bmatrix} \cos\theta \\ \sin\theta \end{bmatrix}\ and\ \vec{P} = \frac{c}{\|\vec{n}\|} \tag{4}$$

Substituting the values of $\vec{n}$ and c, we get

$$\|\vec{n}\| = 2 \tag{5}$$

$$\begin{bmatrix} \sqrt{3}/2 \\ 1/2 \end{bmatrix} x = -1 \tag{6}$$

$$\tag{7}$$

From (4) and (5). we derive,

$$\cos\theta = \sqrt{3}/2\ ; \quad \sin\theta = 1/2 \tag{8}$$

$$P = -1 \tag{9}$$

$$\therefore\ \ \theta = cos^{-1}(\frac{\sqrt{3}}{2}) = sin^{-1}(\frac{1}{2}) = 30^\circ \quad and \quad P = -1 \tag{10}$$