

Assignment 4

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Download all latex codes from

<https://github.com/sachinkarumanchi/EE3900/blob/main/assignment4/assignment4.tex>

PROBLEM(LINEAR FORMS Q-2.13)

If the lines

$$\begin{pmatrix} -3 & 1 \end{pmatrix} \mathbf{x} = 1 \quad (0.0.1)$$

$$\begin{pmatrix} -1 & 2 \end{pmatrix} \mathbf{x} = 3 \quad (0.0.2)$$

are equally inclined to the line

$$\begin{pmatrix} -m & 1 \end{pmatrix} \mathbf{x} = 4 \quad (0.0.3)$$

find the value of m

SOLUTION

the angle θ between two vectors is given by

$$\cos \theta = \frac{\mathbf{m}_1^T \mathbf{m}_2}{\|\mathbf{m}_1\| \|\mathbf{m}_2\|} \quad (0.0.4)$$

let θ_1 and θ_2 be the angle between (0.0.1), (0.0.3) and (0.0.2), (0.0.3) respectively

Given that both lines are equally inclined to (0.0.3), Therefore

$$\cos \theta_1 = \cos \theta_2 \quad (0.0.5)$$

$$\Rightarrow \frac{\begin{pmatrix} -m & 1 \end{pmatrix} \begin{pmatrix} -3 \\ 1 \end{pmatrix}}{\sqrt{10} \times \sqrt{m^2 + 1}} = \frac{\begin{pmatrix} -m & 1 \end{pmatrix} \begin{pmatrix} -1 \\ 2 \end{pmatrix}}{\sqrt{5} \times \sqrt{m^2 + 1}} \quad (0.0.6)$$

$$\Rightarrow \frac{3m + 1}{\sqrt{2}} = m + 2 \quad (0.0.7)$$

$$\Rightarrow m = \frac{2\sqrt{2} - 1}{3 - \sqrt{2}} \quad (0.0.8)$$