

Assignment 1

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Abstract—This document explains the concept of finding the angle between the two vectors

Download all python codes from

<https://github.com/neharani289/ee14014/blob/master/Assignment%201%20Matrix%20Theory%20.ipynb>

and latex-tikz codes from

<https://github.com/neharani289/ee14014>

1 PROBLEM

Find the angle between the lines $(1 - \sqrt{3})x = 5$
 $(\sqrt{3} - 1)x = -6$

2 ANGLE BETWEEN THE TWO VECTORS :

Consider the two vectors , $\mathbf{n1}$ and $\mathbf{n2}$,

Dot product between two vectors $\mathbf{n1}$ and $\mathbf{n2}$ is given by ,

$$\mathbf{n1}^T \mathbf{n2} = \|\mathbf{n1}\| \|\mathbf{n2}\| \cos \theta \quad (2.0.1)$$

Where angle between the vectors \mathbf{a} and \mathbf{b} is denoted by θ

3 SOLUTION

$$\text{Let , } \mathbf{n1} = \begin{pmatrix} -1 \\ \sqrt{3} \end{pmatrix} \mathbf{n2} = \begin{pmatrix} -\sqrt{3} \\ 1 \end{pmatrix}$$

Angle between the vectors is given by,

$$\theta = \cos^{-1} \left(\frac{\mathbf{n1}^T \mathbf{n2}}{\|\mathbf{n1}\| \|\mathbf{n2}\|} \right) \quad (3.0.1)$$

$$\|\mathbf{n1}\| = \sqrt{(-1)^2 + (\sqrt{3})^2} = \sqrt{4} \quad (3.0.2)$$

$$\|\mathbf{n2}\| = \sqrt{(-\sqrt{3})^2 + (1)^2} = \sqrt{4} \quad (3.0.3)$$

$$\mathbf{n1}^T \mathbf{n2} = (-1)(-\sqrt{3}) + (1)(\sqrt{3}) = 2\sqrt{3} \quad (3.0.4)$$

$$\theta = \cos^{-1} \left(\frac{2\sqrt{3}}{(\sqrt{4})(\sqrt{4})} \right) \quad (3.0.5)$$

$$= \cos^{-1} \left(\frac{2\sqrt{3}}{4} \right) \quad (3.0.6)$$

$$\theta = 30^\circ \quad (3.0.7)$$

Result : Angle between the vectors $\mathbf{n1}$ and $\mathbf{n2}$ is : $\theta = 30^\circ$