

# Matrix theory Assignment 1

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**Abstract**—This document contains the solution to calculate the angle between 2 vectors  $\mathbf{a}$  and  $\mathbf{b}$ .

Download all python codes from

<https://github.com/gaurav-1205/EE5609-MatrixTheory/A1>

and latex-tikz codes from

<https://github.com/gaurav-1205/EE5609-MatrixTheory/A1/latex>

So, we get  $\cos\theta$  to be,

$$\cos\theta = \frac{-1}{3}$$

Therefore,

$$\theta = \cos^{-1}\left(\frac{-1}{3}\right)$$

$$\Rightarrow \theta = 1.9106^c$$

$$\Rightarrow \theta = 109.47^\circ$$

## 1 PROBLEM

Find the angle between 2 vectors  $\mathbf{a} = \begin{pmatrix} 1 \\ 1 \\ -1 \end{pmatrix}$  and

$$\mathbf{b} = \begin{pmatrix} 1 \\ -1 \\ 1 \end{pmatrix}$$

Therefore, the angle between the 2 vectors is **109.47°**.

## 2 SOLUTION

The angle between 2 vectors is given by

$$\cos\theta = \frac{\mathbf{a}^T \mathbf{b}}{\|\mathbf{a}\| * \|\mathbf{b}\|}$$

Computing the numerator

$$\mathbf{a}^T \mathbf{b} = \begin{pmatrix} 1 & 1 & -1 \end{pmatrix} * \begin{pmatrix} 1 \\ -1 \\ 1 \end{pmatrix}$$

$$\Rightarrow \mathbf{a}^T \mathbf{b} = -1$$

Computing the denominator

$$\|\mathbf{a}\| * \|\mathbf{b}\| = \sqrt{(1)^2 + (1)^2 + (-1)^2} * \sqrt{(1)^2 + (-1)^2 + (1)^2}$$

$$\Rightarrow \|\mathbf{a}\| * \|\mathbf{b}\| = \sqrt{3} * \sqrt{3}$$

$$\Rightarrow \|\mathbf{a}\| * \|\mathbf{b}\| = 3$$