

# Assignment 2

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Download the python code, latex file and the pdf doc from

<https://github.com/Rishab9991/EE5609/tree/master/Assignments/Assignment2>

## Problem 2.2

### Solution:

### Problem 2.1

#### Solution:

$$A = \begin{pmatrix} \cos \alpha & \sin \alpha \\ -\sin \alpha & \cos \alpha \end{pmatrix} \quad (1)$$

$$\Rightarrow A^T = \begin{pmatrix} \cos \alpha & -\sin \alpha \\ \sin \alpha & \cos \alpha \end{pmatrix} \quad (2)$$

Need to prove that  $A^T A = I$  (Identity Matrix)

For this we express each of the matrices as a complex number to find the product of those two matrices  $A^T$  and  $A$ .

We know that a complex number  $\begin{pmatrix} a1 \\ a2 \end{pmatrix}$  can be represented as

$$\begin{pmatrix} a1 \\ a2 \end{pmatrix} = \begin{pmatrix} a1 & -a2 \\ a2 & a1 \end{pmatrix} \begin{pmatrix} 1 \\ 0 \end{pmatrix} \quad (3)$$

$$i.e \ A = \begin{pmatrix} \cos \alpha \\ -\sin \alpha \end{pmatrix} \quad (4)$$

$$A^T = \begin{pmatrix} \cos \alpha \\ \sin \alpha \end{pmatrix} \quad (5)$$

$$\Rightarrow A^T A = \begin{pmatrix} \cos \alpha \\ \sin \alpha \end{pmatrix} \begin{pmatrix} \cos \alpha \\ -\sin \alpha \end{pmatrix} \quad (6)$$

$$\Rightarrow A^T A = I \quad (7)$$

$$A = \begin{pmatrix} \sin \alpha & \cos \alpha \\ -\cos \alpha & \sin \alpha \end{pmatrix} \quad (8)$$

$$\Rightarrow A^T = \begin{pmatrix} \sin \alpha & -\cos \alpha \\ \cos \alpha & \sin \alpha \end{pmatrix} \quad (9)$$

Need to prove that  $A^T A = I$  (Identity Matrix)

For this we express each of the matrices as a complex number to find the product of those two matrices  $A^T$  and  $A$ .

Using (3), we get

$$i.e \ A = \begin{pmatrix} \sin \alpha \\ -\cos \alpha \end{pmatrix} \quad (10)$$

$$A^T = \begin{pmatrix} \sin \alpha \\ \cos \alpha \end{pmatrix} \quad (11)$$

$$\Rightarrow A^T A = \begin{pmatrix} \sin \alpha \\ \cos \alpha \end{pmatrix} \begin{pmatrix} \sin \alpha \\ -\cos \alpha \end{pmatrix} \quad (12)$$

$$\Rightarrow A^T A = I \quad (13)$$

Hence Proved for both **Problem 2.1** and **Problem 2.2**

Using (3), the expressions in (6) and (12) were simplified to obtain I.