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

1) **Solution:**

$$A = \begin{pmatrix} \cos\alpha & \sin\alpha \\ \text{-}\sin\alpha & \cos\alpha \end{pmatrix} \tag{1}$$

$$\implies A^T = \begin{pmatrix} \cos\alpha & \text{-}\sin\alpha \\ \sin\alpha & \cos\alpha \end{pmatrix} \tag{2}$$

Need to prove that A^TA = 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

$$\begin{pmatrix} a1 \\ a2 \end{pmatrix} = \begin{pmatrix} a1 & \text{-}a2 \\ a2 & a1 \end{pmatrix} \begin{pmatrix} 1 \\ 0 \end{pmatrix} \tag{3}$$

$$i.e\ A = \begin{pmatrix} \cos\alpha \\ \text{-}\sin\alpha \end{pmatrix} \tag{4}$$

$$A^T = \begin{pmatrix} \cos\alpha \\ \sin\alpha \end{pmatrix} \tag{5}$$

$$\implies A^T A = \begin{pmatrix} \cos\alpha \\ \sin\alpha \end{pmatrix} \begin{pmatrix} \cos\alpha \\ \text{-}\sin\alpha \end{pmatrix} \tag{6}$$

$$\implies A^T A = I \tag{7}$$

2) **Solution:**

$$A = \begin{pmatrix} \sin\alpha & \cos\alpha \\ \text{-}\cos\alpha & \sin\alpha \end{pmatrix} \tag{8}$$

$$\implies A^T = \begin{pmatrix} \sin\alpha & \text{-}\cos\alpha \\ \cos\alpha & \sin\alpha \end{pmatrix} \tag{9}$$

Need to prove that A^TA = 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,

$$i.e\ A = \begin{pmatrix} \sin\alpha \\ \text{-}\cos\alpha \end{pmatrix} \tag{10}$$

$$A^T = \begin{pmatrix} \sin\alpha \\ \cos\alpha \end{pmatrix} \tag{11}$$

$$\implies A^T A = \begin{pmatrix} \sin\alpha \\ \cos\alpha \end{pmatrix} \begin{pmatrix} \sin\alpha \\ \text{-}\cos\alpha \end{pmatrix} \tag{12}$$

$$\implies A^T A = I \tag{13}$$

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

Hence Proved for both (a) and (b).