

AI1110 Assignment 1

Dondapati Chandrahas Reddy

AI21BTECH11010

ICSE Grade 10 2019 paper

I. QUESTION 3 (A)

Adding the matrices

Question:

Simplify

$$\begin{pmatrix} \sin^2 A + \cos^2 A & -\sin A \cos A + \cos A \sin A \\ \sin A \cos A - \cos A \sin A & \sin^2 A + \cos^2 A \end{pmatrix} \quad (7)$$

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

Simplifying the elements finally gives

$$\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \quad (8)$$

Solution:

Let,

$$\mathbf{R}(\theta) = \begin{pmatrix} \cos \theta & -\sin \theta \\ \sin \theta & \cos \theta \end{pmatrix} \quad (2)$$

$$\mathbf{I} = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \quad (3)$$

$$\mathbf{J} = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \quad (4)$$

The matrix expression in the question can be written as

$$(\sin A \quad \cos A) \left(\mathbf{R}(A)^T \begin{pmatrix} \mathbf{J} \\ \mathbf{I} \end{pmatrix} \right) \quad (5)$$

Taking dot product of the vectors

$$\begin{pmatrix} \sin^2 A & -\sin A \cos A \\ \sin A \cos A & \sin^2 A \end{pmatrix} + \begin{pmatrix} \cos^2 A & \cos A \sin A \\ -\cos A \sin A & \cos^2 A \end{pmatrix} \quad (6)$$