

AI1110 Assignment 1

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I. QUESTION 3 (A)

Question:

Simplify

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

Solution:

Substituting $A = \frac{\pi}{4}$ in the question,

$$\sin \frac{\pi}{4} \begin{pmatrix} \sin \frac{\pi}{4} & -\cos \frac{\pi}{4} \\ \cos \frac{\pi}{4} & \sin \frac{\pi}{4} \end{pmatrix} + \cos \frac{\pi}{4} \begin{pmatrix} \cos \frac{\pi}{4} & \sin \frac{\pi}{4} \\ -\sin \frac{\pi}{4} & \cos \frac{\pi}{4} \end{pmatrix} \quad (2)$$

Simplifying the expression,

$$\begin{pmatrix} \sin^2 \frac{\pi}{4} & -\sin \frac{\pi}{4} \cos \frac{\pi}{4} \\ \sin \frac{\pi}{4} \cos \frac{\pi}{4} & \sin^2 \frac{\pi}{4} \end{pmatrix} + \begin{pmatrix} \cos^2 \frac{\pi}{4} & \cos \frac{\pi}{4} \sin \frac{\pi}{4} \\ -\cos \frac{\pi}{4} \sin \frac{\pi}{4} & \cos^2 \frac{\pi}{4} \end{pmatrix} \quad (3)$$

Adding the matrices,

$$\begin{pmatrix} \sin^2 \frac{\pi}{4} + \cos^2 \frac{\pi}{4} & -\sin \frac{\pi}{4} \cos \frac{\pi}{4} + \cos \frac{\pi}{4} \sin \frac{\pi}{4} \\ \sin \frac{\pi}{4} \cos \frac{\pi}{4} - \cos \frac{\pi}{4} \sin \frac{\pi}{4} & \sin^2 \frac{\pi}{4} + \cos^2 \frac{\pi}{4} \end{pmatrix} \quad (4)$$

Simplifying the elements finally gives,

$$\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \quad (5)$$