Assignment 2

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Download all python codes from

https://github.com/Bharat437/Matrix_Theory/tree/master/Assignment2/Codes

and latex-tikz codes from

https://github.com/Bharat437/Matrix_Theory/tree/master/Assignment2

1 Question

simplify

$$\cos\theta\begin{pmatrix}\cos\theta & \sin\theta\\ -\sin\theta & \cos\theta\end{pmatrix}+\sin\theta\begin{pmatrix}\sin\theta & -\cos\theta\\ \cos\theta & \sin\theta\end{pmatrix}$$

2 Explanation

$$\cos\theta\begin{pmatrix}\cos\theta & \sin\theta\\ -\sin\theta & \cos\theta\end{pmatrix}+\sin\theta\begin{pmatrix}\sin\theta & -\cos\theta\\ \cos\theta & \sin\theta\end{pmatrix} \tag{2.0.1}$$

$$\implies \cos\theta\begin{pmatrix}1 & 0\\ 0 & 1\end{pmatrix}\begin{pmatrix}\cos\theta & \sin\theta\\ -\sin\theta & \cos\theta\end{pmatrix} + \sin\theta\begin{pmatrix}0 & -1\\ 1 & 0\end{pmatrix}\begin{pmatrix}\cos\theta & \sin\theta\\ -\sin\theta & \cos\theta\end{pmatrix} \tag{2.0.2}$$

$$\implies \left(\cos\theta\begin{pmatrix}1 & 0\\ 0 & 1\end{pmatrix}+\sin\theta\begin{pmatrix}0 & -1\\ 1 & 0\end{pmatrix}\right)\begin{pmatrix}\cos\theta & \sin\theta\\ -\sin\theta & \cos\theta\end{pmatrix} \tag{2.0.3}$$

$$\implies \left(\begin{pmatrix}\cos\theta & 0\\ 0 & \cos\theta\end{pmatrix}+\begin{pmatrix}0 & -\sin\theta\\ \sin\theta & 0\end{pmatrix}\right)\begin{pmatrix}\cos\theta & \sin\theta\\ -\sin\theta & \cos\theta\end{pmatrix} \tag{2.0.4}$$

$$\implies \begin{pmatrix}\cos\theta & -\sin\theta\\ \sin\theta & \cos\theta\end{pmatrix}\begin{pmatrix}\cos\theta & \sin\theta\\ -\sin\theta & \cos\theta\end{pmatrix} \tag{2.0.5}$$

In (2.0.5), the left matrix rotates a vector by angle $+\theta$. Obviously the right matrix rotates a vector by angle $-\theta$. Then the product of matrices is identity matrix.

$$\implies \begin{pmatrix}1 & 0\\ 0 & 1\end{pmatrix} = \mathbf{I} \tag{2.0.6}$$

Hence it is simplified.