

Matrix theory Assignment 12

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Abstract—This document contains the concept of linear transformation.

From (2.0.3) and (2.0.4) scalar multiplication property is not satisfied. Hence not a linear transformation.

Download all python codes from

https://github.com/shivangi-975/EE5609-Matrix_Theory/tree/master/Assignment12/Codes

Download latex-tikz codes from

https://github.com/shivangi-975/EE5609-Matrix_Theory/blob/master/Assignment12/Assignment_12.tex

1 PROBLEM

Is the following function \mathbf{T} from \mathbb{R}^2 into \mathbb{R}^2 is linear transformation?

$$\mathbf{T}\begin{pmatrix} x_1 \\ x_2 \end{pmatrix} = \begin{pmatrix} \sin(x_1) \\ x_2 \end{pmatrix}$$

2 SOLUTION

Let,

$$\mathbf{x} = \begin{pmatrix} \pi \\ 0 \end{pmatrix}; \quad \mathbf{y} = \begin{pmatrix} \frac{\pi}{2} \\ 0 \end{pmatrix}$$

$$\mathbf{T}(\mathbf{x} + \mathbf{y}) = \mathbf{T}\begin{pmatrix} \frac{3\pi}{2} \\ 0 \end{pmatrix} = \begin{pmatrix} -1 \\ 0 \end{pmatrix} \quad (2.0.1)$$

$$\mathbf{T}(\mathbf{x}) + \mathbf{T}(\mathbf{y}) = \mathbf{T}\begin{pmatrix} \pi \\ 0 \end{pmatrix} + \mathbf{T}\begin{pmatrix} \frac{\pi}{2} \\ 0 \end{pmatrix} = \begin{pmatrix} 1 \\ 0 \end{pmatrix} \quad (2.0.2)$$

From (2.0.1) and (2.0.2) additive transformation property is not satisfied. Hence not a linear transformation. Now,

$$\mathbf{T}(cx_2) = \mathbf{T}\begin{pmatrix} \frac{c\pi}{2} \\ 0 \end{pmatrix} = \begin{pmatrix} \sin(\frac{c\pi}{2}) \\ 0 \end{pmatrix} \quad (2.0.3)$$

$$c\mathbf{T}(x_2) = c\mathbf{T}\begin{pmatrix} \frac{\pi}{2} \\ 0 \end{pmatrix} = \begin{pmatrix} c \\ 0 \end{pmatrix} \quad (2.0.4)$$