Matrix theory Assignment 12

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***Abstract*—This document contains the concept of 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 T from R_2 into R_2 is linear transformation?

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

2 Solution

Let, $T : R^2 \to R^2$ be a function given by:

$$T\begin{pmatrix}x_1\\x_2\end{pmatrix}=\begin{pmatrix}\sin(x_1)\\x_2\end{pmatrix} \tag{2.0.1}$$

Let, $x_1 = x_2 = 0$

$$T\begin{pmatrix}0\\0\end{pmatrix}=\begin{pmatrix}0\\0\end{pmatrix} \tag{2.0.2}$$

Let,$(x_1, x_2) \in R^2$ and $(p_1, q_1) \in R^2$

$$T\begin{pmatrix}x_1+p_1\\x_2+q_1\end{pmatrix}=\begin{pmatrix}\sin(x_1+p_1)\\x_2+q_1\end{pmatrix} \tag{2.0.3}$$

Now,

$$T\begin{pmatrix}x_1\\x_2\end{pmatrix}+T\begin{pmatrix}p_1\\q_1\end{pmatrix}=\begin{pmatrix}\sin(x_1)\\x_2\end{pmatrix}+\begin{pmatrix}\sin(p_1)\\q_1\end{pmatrix} \tag{2.0.4}$$

$$\implies \begin{pmatrix}\sin(x_1)+\sin(p_1)\\x_2+q_1\end{pmatrix} \tag{2.0.5}$$

Since equation (2.0.3)≠ equation (2.0.5).Hence not a linear transformation

3 Example

$$T\begin{pmatrix}\pi\\0\end{pmatrix}=\begin{pmatrix}\sin(\pi)\\0\end{pmatrix}=\begin{pmatrix}0\\0\end{pmatrix} \tag{3.0.1}$$

$$2T\begin{pmatrix}\frac{\pi}{2}\\0\end{pmatrix}=2\begin{pmatrix}\sin(\frac{\pi}{2})\\0\end{pmatrix}=\begin{pmatrix}2\\0\end{pmatrix} \tag{3.0.2}$$

Since equation (3.0.1)≠ equation (3.0.2).Hence not a linear transformation