

Assignment 10

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Abstract—This document contains a solution to find whether the given function T from R^2 into R^2 is linear transformation or not.

Download all latex-tikz codes from

https://github.com/Matish007/Matrix-Theory-EE5609-/tree/master/Assignment_10

1 PROBLEM

Whether the given function T from R^2 into R^2 is linear transformation or not.

$$T\begin{pmatrix} x_1 \\ x_2 \end{pmatrix} = \begin{pmatrix} 1 + x_1 \\ x_2 \end{pmatrix} \quad (1.0.1)$$

2 SOLUTION

If,

$$T(\alpha + \beta) = T(\alpha) + T(\beta) \quad (2.0.1)$$

(2.0.1) is true for our function T then given function T from R^2 into R^2 is linear transformation, otherwise not.

$$\alpha = \begin{pmatrix} a_1 \\ a_2 \end{pmatrix} \quad (2.0.2)$$

$$\beta = \begin{pmatrix} b_1 \\ b_2 \end{pmatrix} \quad (2.0.3)$$

$$\alpha + \beta = \begin{pmatrix} a_1 + b_1 \\ a_2 + b_2 \end{pmatrix} \quad (2.0.4)$$

Using (1.0.1) we get,

$$T\begin{pmatrix} a_1 + b_1 \\ a_2 + b_2 \end{pmatrix} = \begin{pmatrix} 1 + a_1 + b_1 \\ a_2 + b_2 \end{pmatrix} \quad (2.0.5)$$

$$T\begin{pmatrix} a_1 \\ a_2 \end{pmatrix} = \begin{pmatrix} 1 + a_1 \\ a_2 \end{pmatrix} \quad (2.0.6)$$

$$T\begin{pmatrix} b_1 \\ b_2 \end{pmatrix} = \begin{pmatrix} 1 + b_1 \\ b_2 \end{pmatrix} \quad (2.0.7)$$

Substituting (2.0.6),(2.0.7) in RHS of (2.0.1). We get,

$$\begin{pmatrix} 2 + a_1 + b_1 \\ a_2 + b_2 \end{pmatrix} \quad (2.0.8)$$

Comparing (2.0.8) with (2.0.5) we find that they are not equal.

Hence given function T is not a linear transformation.

Counter example can be given as follows:-

$$x_1 = x_2 = 0 \quad (2.0.9)$$

Substituting (2.0.9) in (1.0.1) we get,

$$T\begin{pmatrix} 0 \\ 0 \end{pmatrix} = \begin{pmatrix} 1 \\ 0 \end{pmatrix} \quad (2.0.10)$$

(2.0.10) is clearly false because linear transformation on $\begin{pmatrix} 0 \\ 0 \end{pmatrix}$ will always be equal to $\begin{pmatrix} 0 \\ 0 \end{pmatrix}$