Assignment-13

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***Abstract*—In this document, we find whether the given function T from $\mathbf{R}^2$ into $\mathbf{R}^2$ is a linear transformation or not.**

Download all latex-tikz codes from

https://github.com/poojah15/EE5609_Assignments/tree/master/Assignment_13

1 Problem Statement

Verify whether $T(x_1, x_2) = (x_1 - x_2, 0)$ is a linear transformation or not.

2 Solution

Let **V** and **W** be the vector spaces. The function $T : \mathbf{V} \to \mathbf{W}$ is called a linear transformation of **V** into **W** if for all **u** and **v** in **V** and for any scalar k in field **F**,

$$T(k\mathbf{u} + \mathbf{v}) = kT(\mathbf{u}) + T(\mathbf{v}) \tag{2.0.1}$$

Given,

$$T\begin{pmatrix} x_1 \\ x_2 \end{pmatrix} = \begin{pmatrix} 1 & -1 \\ 0 & 0 \end{pmatrix}\begin{pmatrix} x_1 \\ x_2 \end{pmatrix} \tag{2.0.2}$$

Consider,

$$T(k\mathbf{x} + \mathbf{y}) = \begin{pmatrix} 1 & -1 \\ 0 & 0 \end{pmatrix}(k\mathbf{x} + \mathbf{y}) \tag{2.0.3}$$

$$= \begin{pmatrix} k & -k \\ 0 & 0 \end{pmatrix}\mathbf{x} + \begin{pmatrix} 1 & -1 \\ 0 & 0 \end{pmatrix}\mathbf{y} \tag{2.0.4}$$

$$= k\begin{pmatrix} 1 & -1 \\ 0 & 0 \end{pmatrix}\mathbf{x} + \begin{pmatrix} 1 & -1 \\ 0 & 0 \end{pmatrix}\mathbf{y} \tag{2.0.5}$$

$$T(\mathbf{x} + \mathbf{y}) = kT(\mathbf{x}) + T(\mathbf{y}) \tag{2.0.6}$$

Therefore, the given function T is a linear transformation.