Matrix Theory Assignment 9

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EE20RESCH11005

***Abstract*—This problem demonstrate a method to find nature linear transformation.**

All the codes for the figure in this document can be found at

https://github.com/Ritesh622/Assignment_EE5609/tree/master/Assignment_9

1 Problem

Let**T** and **U** be the linear operators on $\mathbb{R}^2$ defined by

$$\mathbf{T}\left(x_1, x_2\right) = \left(x_2, x_1\right) \tag{1.0.1}$$

and

$$\mathbf{U}\left(x_1, x_2\right) = \left(x_1, 0\right) \tag{1.0.2}$$

How would you describe T and U geometrically ?

2 solution

Geometrically, in the x-y plane, **T** is the reflection about the diagonal x = y and **U** is a projection onto the x-axis.

Let suppose

$$\mathbf{x_1} = \begin{pmatrix}1\\2\end{pmatrix}, \mathbf{x_2} = \begin{pmatrix}3\\4\end{pmatrix} \tag{2.0.1}$$

After applying linear operator **T** on it,

$$\mathbf{x_1} = \begin{pmatrix}3\\4\end{pmatrix}, \mathbf{x_2} = \begin{pmatrix}1\\2\end{pmatrix} \tag{2.0.2}$$

After applying linear operator **U** on it,

$$\mathbf{x_1} = \begin{pmatrix}1\\2\end{pmatrix}, \mathbf{x_2} = \begin{pmatrix}0\\0\end{pmatrix} \tag{2.0.3}$$

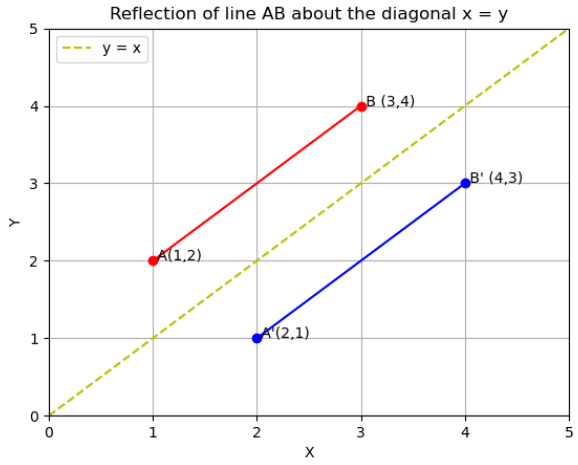

Fig. 1: Reflection of line AB about the x = y

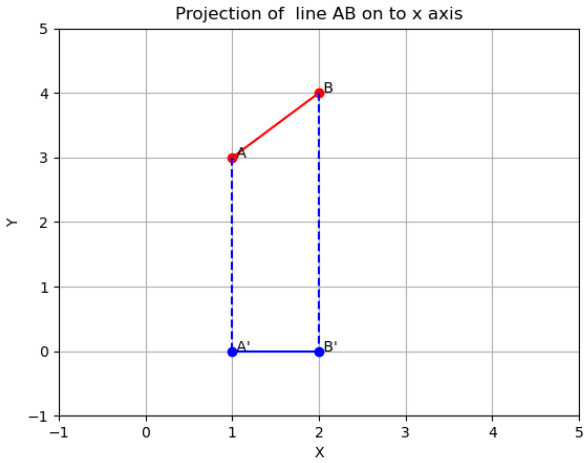

Fig. 2: Projection of AB onto x-axis