

Assignment 16

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Download codes from

<https://github.com/KUSUMAPRIYAPULAVARTY/assignment16>

1 QUESTION

Let T be the linear operator on R^3 defined by

$$T(x_1, x_2, x_3) = \quad (1.0.1)$$

$$(3x_1 + x_3, -2x_1 + x_2, -x_1 + 2x_2 + 4x_3) \quad (1.0.2)$$

What is the matrix of T in the standard ordered basis of R^3 ?

2 SOLUTION

The standard ordered basis for R^3 is

$$\{\mathbf{e}_1, \mathbf{e}_2, \mathbf{e}_3\} = \left\{ \begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix}, \begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix}, \begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix} \right\} \quad (2.0.1)$$

$$\mathbf{x} = \begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix} \quad (2.0.2)$$

The matrix of T in the standard ordered basis is

$$\mathbf{T} = (T(\mathbf{e}_1) \quad T(\mathbf{e}_2) \quad T(\mathbf{e}_3)) \quad (2.0.3)$$

$$T(\mathbf{e}_1) = \begin{pmatrix} 3 \\ -2 \\ -1 \end{pmatrix} \quad (2.0.4)$$

$$T(\mathbf{e}_2) = \begin{pmatrix} 0 \\ 1 \\ 2 \end{pmatrix} \quad (2.0.5)$$

$$T(\mathbf{e}_3) = \begin{pmatrix} 1 \\ 0 \\ 4 \end{pmatrix} \quad (2.0.6)$$

$$\text{Hence, } \mathbf{T} = \begin{pmatrix} 3 & 0 & 1 \\ -2 & 1 & 0 \\ -1 & 2 & 4 \end{pmatrix} \quad (2.0.7)$$

$$\text{and } T(\mathbf{x}) = \mathbf{T}\mathbf{x} \quad (2.0.8)$$