



Math 2940 Quiz 2

Solutions

September 26th, 2019

Section _____

Name:

NetID:

Let $T : \mathbb{R}^4 \rightarrow \mathbb{R}^4$ be a linear transformation such that:

$$T(x_1, x_2, x_3, x_4) = (0, x_1 + x_2, 2x_2 + x_3, x_3 - x_4)$$

(Note that x_1, x_2, \dots are not vectors but are entries in vectors.)

What is its matrix?

Solution: To figure out the columns of the matrix, we need to figure out what T does to each basis vector:

$$T \left(\begin{bmatrix} 1 \\ 0 \\ 0 \\ 0 \end{bmatrix} \right) = \begin{bmatrix} 0 \\ 1 \\ 0 \\ 0 \end{bmatrix}$$

$$T \left(\begin{bmatrix} 0 \\ 1 \\ 0 \\ 0 \end{bmatrix} \right) = \begin{bmatrix} 0 \\ 1 \\ 2 \\ 0 \end{bmatrix}$$

$$T \left(\begin{bmatrix} 0 \\ 0 \\ 1 \\ 0 \end{bmatrix} \right) = \begin{bmatrix} 0 \\ 0 \\ 1 \\ 0 \end{bmatrix}$$

$$T \left(\begin{bmatrix} 0 \\ 0 \\ 0 \\ 1 \end{bmatrix} \right) = \begin{bmatrix} 0 \\ 0 \\ 0 \\ -1 \end{bmatrix}$$

Putting this all together, the matrix is:

$$T = \begin{bmatrix} 0 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 \\ 0 & 2 & 1 & 0 \\ 0 & 0 & 1 & -1 \end{bmatrix}$$