Name SOLUTION

Mathematics 1553

Quiz 4

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1. What does it mean for vectors $v_1, \ldots, v_k$ to be *linearly independent*? Give the definition.

The set $\{v_1, \ldots, v_k\}$ is linearly independent if the vector equation

$$c_1 v_1 + \cdots + c_k v_k = 0$$

has only the trivial solution.

2. Which of the following sets of vectors are linearly independent? *Hint: No calculations are required.*

$\left\{ \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}, \begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix}, \begin{pmatrix} 10 \\ 20 \\ 30 \end{pmatrix} \right\}$ (DEPENDENT) INDEPENDENT

$\left\{ \begin{pmatrix} 1 \\ 2 \\ 0 \end{pmatrix}, \begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix}, \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix} \right\}$ DEPENDENT (INDEPENDENT)

$\left\{ \begin{pmatrix} 9 \\ 2 \\ 3 \end{pmatrix}, \begin{pmatrix} 3 \\ 1 \\ 0 \end{pmatrix}, \begin{pmatrix} 7 \\ 1 \\ 7 \end{pmatrix}, \begin{pmatrix} 2 \\ 4 \\ 6 \end{pmatrix} \right\}$ (DEPENDENT) INDEPENDENT

Turn the page!

3. Suppose that A is a 3×2 matrix and that T is the linear transformation $T(v) = Av$.

What is the domain of T?

$\mathbb{R}^2$

Is it possible for T to be one-to-one?

(YES) NO

4. Write down the standard matrix for the linear transformation $T : \mathbb{R}^2 \to \mathbb{R}^2$ that rotates clockwise by $\pi/2$ and then orthogonally projects to the x-axis.

$$T(e_1) = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$$

$$T(e_2) = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$$

$$\begin{pmatrix} 0 & 1 \\ 0 & 0 \end{pmatrix}$$