

Name SOLUTIONS

Mathematics 1553

Quiz 5

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1. Complete the following definition: *A transformation $T : \mathbb{R}^n \rightarrow \mathbb{R}^m$ is onto if...*

the range of T is \mathbb{R}^m

2. Say that A is an $m \times n$ matrix and T is the associated matrix transformation $T(v) = Av$. Which of the following statements are equivalent to the statement that T is one-to-one? Select all that apply.

- (a) A has a pivot in each column
- (b) $Ax = b$ is consistent for each b in \mathbb{R}^m
- (c) the columns of A are linearly independent
- (d) $Ax = 0$ has only the trivial solution
- (e) the range of T is \mathbb{R}^m
- (f) for each b in \mathbb{R}^m there is at most one x in \mathbb{R}^n with $T(x) = b$

Turn the page!

3. Consider the linear transformation $T : \mathbb{R}^2 \rightarrow \mathbb{R}^2$ that rotates counterclockwise by $\pi/4$ and then reflects over the y -axis.

Find the standard matrix A for T .

$$\begin{pmatrix} -1/\sqrt{2} & 1/\sqrt{2} \\ 1/\sqrt{2} & 1/\sqrt{2} \end{pmatrix}$$

Is T one-to-one?

yes