

On this quiz, **show any RREF'd matrices** you use in any given problem.

1. Let $A = \begin{bmatrix} 7 & 9 & 8 \\ 2 & 1 & 7 \\ 1 & 1 & 2 \\ 5 & 7 & 4 \end{bmatrix}$. Define $T : \mathbb{R}^p \rightarrow \mathbb{R}^a$ by $T(\mathbf{v}) = A\mathbf{v}$ for any $\mathbf{v} \in \mathbb{R}^p$. Let $\mathbf{m} = \begin{bmatrix} 5 \\ 8 \\ 3 \end{bmatrix}$ and $\mathbf{s} = \begin{bmatrix} 5 \\ 4 \\ 3 \\ 2 \end{bmatrix}$

1a. What are the values of p and a ? (Label which is which)

1b. Find both $T(\mathbf{m})$ and $T(\mathbf{s})$. If one of them is not possible to find, explain why. Label your answers.

1c. Find all \mathbf{x} for which $T(\mathbf{x}) = \begin{bmatrix} 20 \\ -10 \\ 0 \\ 20 \end{bmatrix}$.

1e. Today is Friday the 13th, so the vector $\mathbf{u} = \begin{bmatrix} 13 \\ 13 \\ 13 \\ 13 \end{bmatrix}$ is extremely unlucky. Explain why \mathbf{u} is not in the image of T .

2. Suppose that T is a transformation from \mathbb{R}^n to \mathbb{R}^m . There are two conditions that T must satisfy in order to be a *linear* transformation. They are:

2a. the equation is true for every pair of vectors \mathbf{u} and \mathbf{v} in \mathbb{R}^n , and

2b. the equation is true for any scalar $\alpha \in \mathbb{R}$ and vector $\mathbf{w} \in \mathbb{R}^n$.

2c. Define $T : \mathbb{R}^2 \rightarrow \mathbb{R}^2$ by $T\left(\begin{bmatrix} s \\ t \end{bmatrix}\right) = \begin{bmatrix} st \\ 3s + 2t + 6 \end{bmatrix}$. Show that T fails to satisfy the equation in (2a) using the vectors $\mathbf{u} = \begin{bmatrix} 8 \\ 7 \end{bmatrix}$ and $\mathbf{v} = \begin{bmatrix} 4 \\ 5 \end{bmatrix}$.