Section:______ **Name:** ________________________________ January 29, 2026

Linear Algebra and Differential Equations Tutorial
Quiz 02

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1. (2 points) For each one of the following matrices, determine whether the matrix is invertible, and find its inverse if it exists. Show all work.

(a) $\begin{bmatrix} 2 & -3 \\ -4 & 6 \end{bmatrix}$ (b) $\begin{bmatrix} 11 & 3 \\ -3 & -1 \end{bmatrix}$

Solution: A 2×2 matrix $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ is invertible if $ad - bc \neq 0$ and the inverse is

$$A^{-1} = \frac{1}{ad - bc} \begin{bmatrix} d & -b \\ -c & a \end{bmatrix}.$$

(a) The determinant is $2(6) - (-4)(-3) = 0$, so the matrix is not invertible.

(b) The determinant is $-11 + 9 = -2$, so the matrix is invertible and the inverse is

$$A^{-1} = -\frac{1}{2} \begin{bmatrix} -1 & -3 \\ 3 & 11 \end{bmatrix} = \begin{bmatrix} 1/2 & 3/2 \\ -3/2 & -11/2 \end{bmatrix}$$

2. (2 points) Let $T : \mathbb{R}^3 \to \mathbb{R}^2$ be defined by

$$T\left(\begin{bmatrix} x \\ y \\ z \end{bmatrix}\right) = \begin{bmatrix} x + 2z \\ 2 \end{bmatrix}.$$

Determine whether T is a linear transformation. Clearly justify your answer to receive full credit.

Solution: This is **not** a linear transformation for several reasons. A quick one to check is that a linear transformation must send the zero vector to the zero vector, whereas

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

so T cannot be a linear transformation.

Problem	**Score**
1	/ 2
2	/ 2
Total	/ 4