

Score:

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**SM 261 – Matrix Algebra – Quiz 10**  
**Section 1.9 – The Matrix of a Linear Transformation**

1. Show that  $T$  is a linear transformation by finding the matrix that implements the

mapping:  $T(\vec{x}) = \begin{bmatrix} x_1 + x_2 + 2x_3 \\ -x_1 + 4x_2 + 3x_3 \\ 3x_1 + 1x_2 + 4x_3 \end{bmatrix}$ .

$$T(\vec{x}) = \begin{bmatrix} 1 & 1 & 2 \\ -1 & 4 & 3 \\ 3 & 1 & 4 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$$

↑  
A

2. Determine if the transformation is (a) one-to-one and (b) onto.

$$\text{RREF}(A) = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 0 & 0 & 0 \end{bmatrix}$$

a) not one-to-one because there are only 2 pivots  $\Rightarrow A\vec{x} = \vec{0}$  has more than a trivial solution.

b) Not onto  $\mathbb{R}^3$  because columns of  $A$  do not span  $\mathbb{R}^3$  (i.e. not linearly independent)