

PRINT Your Name: _____

There are 10 problems on 4 pages. Each problem is worth 5 points. SHOW your work. **CIRCLE** your answer. **CHECK** your answer whenever possible.

No Calculators.

1. Define "one-to-one". Use complete sentences.

The linear transformation $T: \mathbb{R}^n \rightarrow \mathbb{R}^m$ is one-to-one if
for each vector $b \in \mathbb{R}^m$, there is at most one $x \in \mathbb{R}^n$ with $T(x) = b$.

2. Define "onto". Use complete sentences.

The linear transformation $T: \mathbb{R}^n \rightarrow \mathbb{R}^m$ is onto if
for each vector $b \in \mathbb{R}^m$, there is at least one $x \in \mathbb{R}^n$ with
 $T(x) = b$

3. Suppose A is an $n \times n$ matrix and $Ax = 0$ has a unique solution. Let b be a vector in \mathbb{R}^n . How many solutions does $Ax = b$ have? Explain.

$Ax = b$ has exactly one solution. The first sentence tells us that A is invertible, so the unique solution to $Ax = b$ is $x = A^{-1}b$.