MATH 54 - MOCK MIDTERM 1

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Name: ____

Instructions: This is a mock midterm, designed to give you extra practice for the actual midterm. Good luck!!!

1		25
2		15
3		20
4		10
5		10
6		10
7		10
Total		100

Date: Monday, September 12th, 2011.

1. *(25 points, 5 pts each)*

Label the following statements as **T** or **F**.

Make sure to **JUSTIFY YOUR ANSWERS!!!** You may use any facts from the book or from lecture.

(a) If A and B are square matrices, then $(A+B)^{-1} = A^{-1} + B^{-1}$.

(b) If $T : \mathbb{R}^n \to \mathbb{R}^n$ is a one-to-one linear transformation, then T is also onto.

(c) If $\{\mathbf{v_1}, \mathbf{v_2}, \mathbf{v_3}\}$ are linearly independent vectors in $\mathbb{R}^n$, then $\{\mathbf{v_1}, \mathbf{v_2}\}$ is linearly independent as well!

(d) If A is an invertible square matrix, then $(A^T)^{-1} = (A^{-1})^T$

(e) If A is a 3×3 matrix with two pivot positions, then the equation $A\mathbf{x} = \mathbf{0}$ has a nontrivial solution.

2. *(15 points)* Solve the following system (or say it has no solutions):

$$\begin{cases} x + y + z = 0 \\ 2x + 2z = 0 \\ 3x + y + 3z = 0 \end{cases}$$

3. *(20 points)* Find the inverse of the following matrix:

$$A = \begin{bmatrix} 1 & -1 & 1 \\ 1 & 1 & 2 \\ 1 & 0 & 1 \end{bmatrix}$$

4. *(10 points)* What's the next elementary row operation you would use to transform the following matrix in row-echelon form? What is the corresponding elementary matrix?

$$A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & -1 \\ 0 & 2 & 1 \end{bmatrix}$$

5. *(10 points, 5 points each)* Evaluate the following products if they are defined, or say 'undefined'

(a) AB, where:

$$A = \begin{bmatrix} 2 & 5 \\ 0 & 7 \\ -1 & 3 \end{bmatrix}, B = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$$

(b) AB, where:

$$A = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 2 & -1 & 0 \end{bmatrix}, B = \begin{bmatrix} 0 & 1 & 0 \\ 2 & 1 & 3 \\ 0 & 0 & 1 \end{bmatrix}$$

6. *(10 points)* Suppose $T : \mathbb{R}^2 \to \mathbb{R}^2$ is a linear transformation which reflects points in the plane about the origin.

   (a) (5 points) Find the matrix A of T.

   (b) (5 points) Use A to find $T(1, 1)$.

7. *(10 points)* Find a basis for $Nul(A)$ and $Col(A)$, where A is the following matrix:

$$A = \begin{bmatrix} 1 & 1 & 3 \\ 0 & -1 & 1 \\ 0 & 1 & 2 \end{bmatrix}$$