Math 2210Q (Fall 2014) **Test 1**
Instructor: Michael Chou September 25, 2014

Name:

Instructions:

- All answers must be written clearly.
- You may use a calculator.
- You must show all your work in order to receive credit.
- Be sure to erase or cross out any work that you do not want graded.
- If you need extra space, you may use the back sides of the exam pages (if you do, please write me a note so that I know where to look).

Estimate your grade. The closer your guess the more extra points you receive;

perfect guess: 3 points,
within one point: 2 points,
within two points: 1 point

Question:	1	2	3	4	5	6	7	8	Total
Points:	8	6	8	26	24	8	8	12	100
Score:									

Actual grade:

Question:	1	2	3	4	5	6	7	8	Total
Points:	8	6	8	26	24	8	8	12	100
Score:									

1. Which of the following matrices is in reduced row echelon form? Circle all that apply. (8)

A. $\begin{bmatrix} 2 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 2 \end{bmatrix}$ B. $\begin{bmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ C. $\begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ D. $\begin{bmatrix} 1 & 0 & -6 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{bmatrix}$

E. None of these

2. The system of equations given by the augmented matrix (6)

$$\left[\begin{array}{cc|c} 3 & 9 & 6 \\ 1 & 3 & 2 \end{array}\right]$$

A. is inconsistent.
B. is consistent and has exactly one solution.
C. is consistent and has more than one solution.

3. Describe the solution set to the following system of linear equations (if infinitely many solutions, use parametric form): (8)

$$\begin{aligned} x_1 + x_2 + x_3 &= 4 \\ 2x_1 + 4x_3 &= 8 \\ 2x_1 + x_2 + 3x_3 &= 8 \end{aligned}$$

4. Suppose $S = \left\{ \begin{bmatrix} 1 \\ 0 \\ 4 \\ 3 \end{bmatrix}, \begin{bmatrix} 1 \\ -1 \\ 2 \\ 1 \end{bmatrix}, \begin{bmatrix} 0 \\ 2 \\ 3 \\ 1 \end{bmatrix} \right\}$.

(a) Is the set S linearly independent? (Show how you arrive at your answer.) (9)

(b) Is $\begin{bmatrix} 0 \\ 2 \\ 1 \\ 3 \end{bmatrix}$ in Span S? (Show how you arrive at your answer.) (9)

(c) Give an example of a vector in Span S that is not in S. (8)

5. Let $L : \mathbb{R}^3 \to \mathbb{R}^3$ be the linear transformation defined by $L\left(\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}\right) = \begin{bmatrix} x_1 + x_2 \\ x_2 - x_3 \\ 2x_3 - x_1 \end{bmatrix}$

(a) Verify that the standard matrix for L is the matrix $A = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & -1 \\ -1 & 0 & 2 \end{bmatrix}$. (9)

(i.e. show how to find the standard matrix for L, or show that $L(\vec{x}) = A\vec{x}$.)

(b) Show that the columns of A span $\mathbb{R}^3$. (9)

(c) Is L onto? Explain. (6)

6. Let $T : \mathbb{R}^2 \to \mathbb{R}^2$ be the transformation defined by $\begin{bmatrix} x \\ y \end{bmatrix} \mapsto \begin{bmatrix} x+y \\ y-1 \end{bmatrix}$. Is T a linear transformation? (8)

7. Suppose $L : \mathbb{R}^3 \to \mathbb{R}^2$ is a linear transformation. Can L be one-to-one? Explain. (8)

8. Let $A = \begin{bmatrix} 1 & 2 \\ 0 & 1 \\ -1 & 1 \end{bmatrix}$, and $B = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & -1 \end{bmatrix}$.

(a) Compute AB. (6)

(b) Compute $A(B^T)$. (6)

BONUS: What is one of Michael's favorite guilty pleasure TV shows?