Math 3A
Spring 2016
Quiz 3
04/19/2016
Time Limit: 15 Minutes

Name (Print): ____________________

Student ID ____________________

This exam contains 3 pages (including this cover page) and 1 problems. Check to see if any pages are missing. Enter all requested information on the top of this page, and put your initials on the top of every page, in case the pages become separated.

You may *not* use your books, notes, or any calculator on this exam.

You are required to show your work on each problem on this exam. The following rules apply:

- **If you use a "theorem" you must indicate this** and explain why the theorem may be applied.
- **Organize your work**, in a reasonably neat and coherent way, in the space provided. Work scattered all over the page without a clear ordering will receive very little credit.
- **Mysterious or unsupported answers will not receive full credit**. A correct answer, unsupported by calculations, explanation, or algebraic work will receive no credit; an incorrect answer supported by substantially correct calculations and explanations might still receive partial credit.
- If you need more space, use the back of the pages; clearly indicate when you have done this.

Problem	Points	Score
1	10	
Total:	10	

Do not write in the table to the right.

1. Consider the transformation $T : \mathbb{R}^3 \to \mathbb{R}^3$ given by

$$T(\mathbf{x}) = \begin{pmatrix} 2x_1 + x_2 + \alpha x_3^2 \\ 2x_1 + 2x_2 + 2x_3 \\ hx_3 + q \end{pmatrix}, \text{ where } \mathbf{x} = \begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix}; \tag{1}$$

in which, h and q are real numbers.

(a) (2 points) What are the conditions on q and α such that the transformation is linear? Explain why.

(b) (3 points) **From now we suppose that** $q = 0$ **and** $\alpha = 0$. Write the stardard matrix $\mathbf{A}_T$ of the transformation T. (**Hint:** remember that $\mathbf{A}(:, i) = T(\mathbf{e}_i)$.)

(c) (2 points) What is the condition on h such that the transformation T is **NOT** one-to-one? Explain briefly.

(d) (3 points) **Suppose that** $h = 0$, then

$$\mathbf{A} = \begin{bmatrix} 2 & 1 & 0 \\ 2 & 2 & 2 \\ 0 & 0 & 0 \end{bmatrix}. \tag{2}$$

Compute the set of all $\mathbf{x} \in \mathbb{R}^3$ such that $T(\mathbf{x}) = 0$, (**Hint:** compute in parametric form the solution set of $\mathbf{A}\mathbf{x} = 0$)