GEORGIA TECH SCHOOL OF MATHEMATICS

MATH 1502

CALCULUS II, SECTION K

Quiz # 10

November 17 2010

First Name : ____

Last Name : ____

1. Let $\mathbf{v}_1 = \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}$, $\mathbf{v}_2 = \begin{bmatrix} 1 \\ -1 \\ 0 \end{bmatrix}$, $\mathbf{v}_3 = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$. What is the dimension of the subspace S they span in $\mathbb{R}^3$?

$$\dim(S) \ =$$

(Use this page for your calculations)

2. Let A be an $p \times q$ matrix with $p < q$. Let A has linearly independent rows. Are the following matrices invertible ?

$A^t A$ *YES* ☐ *NO* ☐

AA^t *YES* ☐ *NO* ☐

Why ?

3. Let $\mathbf{v}_1 = \begin{bmatrix} 2 \\ 1 \\ 0 \end{bmatrix}$, $\mathbf{v}_2 = \begin{bmatrix} 3 \\ 2 \\ 2 \end{bmatrix}$, $\mathbf{v}_3 = \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}$. If $\mathbf{b} = \begin{bmatrix} 2 \\ 2 \\ -2 \end{bmatrix}$, find real numbers $\lambda_1, \lambda_2, \lambda_3$ such that $\mathbf{b} = \lambda_1 \mathbf{v}_1 + \lambda_2 \mathbf{v}_2 + \lambda_3 \mathbf{v}_3$.

$$\begin{bmatrix} \lambda_1 \\ \lambda_2 \\ \lambda_3 \end{bmatrix} = \begin{bmatrix} \quad\quad\quad\quad \\ \\ \end{bmatrix}$$

(Use this page for your calculations)

4. Let A a 3×3 matrix such that the equation $A^t\mathbf{x} = 0$ only when $\mathbf{x}$ is a multiple of $\mathbf{v} = \begin{bmatrix} 1 \\ -2 \\ 1 \end{bmatrix}$. Let then $\mathbf{b} = \begin{bmatrix} \sqrt{3} \\ \sqrt{3} \\ \sqrt{3} \end{bmatrix}$. Does $A\mathbf{x} = \mathbf{b}$ has a solution ? If yes is it unique ?

$A\mathbf{x} = \mathbf{b}$ *has a solution* YES ☐ NO ☐

The solution is unique YES ☐ NO ☐

5. Find the orthogonal projection onto the subspace $S \subset \mathbb{R}^3$ spanned by the vectors $\mathbf{v}_1 = \begin{bmatrix} 1 \\ -1 \\ 1 \end{bmatrix}$ and $\mathbf{v}_2 = \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}$.

$$P_S = \begin{bmatrix} \quad & \quad & \quad \\ \quad & \quad & \quad \\ \quad & \quad & \quad \end{bmatrix}$$

(Use this page for your calculations)