MAC 3105-2A Print Name _____
Quiz 7
07/06/2017 Signature _____

INSTRUCTIONS:

- Write answer in the space provided after the problems.
- Clearly show ALL work and circle/box answer.
- I is the **Identity Matrix** of the required dimension.
- Keep Calm and Enjoy Linear

UNLESS SPECIAL INSTRUCTED, WE ONLY CONSIDER **REAL** NUMBERS.

1. True of False. Let A be a 4×4 **Real** matrix.

(1) The dot product of two vectors is always non-negative.

(2) The length of a vector is always positive.

(3) If $\{u_1, u_2, u_3\}$ is an orthogonal set, then the matrix whose column vectors are u_1, u_2, u_3 has rank 3.

(4) Let $H \subset V$ be a linear subspace, then $\dim H + \dim H^{\perp} = \dim V$.

2. Let $u = [1, 2, 3, 4]^T$, $u_1 2 = [1, 1, -1, -1]^T$ and $u_2 = [0, 1, -1, 2]^T$. Let H be the plane generated by u_1, u_2. Find u_H and $u_{H^\perp}$.

3. Let $T\colon \mathbb{R}^3 \to \mathbb{R}^3$ be a linear transform that is represented by

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

(1) Show that the column vectors of A form an orthogonal set.
(2) Show that the row vectors of A does NOT form an orthogonal set.
(3) Find A^TA. Notice that it's NOT equal to AA^T.

4. Find the distance from the point $(1, 1, 1, 1)$ to the plane $x + y + z + w = 0$ in $\mathbb{R}^4$.