Name: **Quiz 3**

Instructions: This quiz is closed book, closed note, and an individual effort. **Show all work to receive full credit.** Unless the question specifies, you should provide an exact answer. If you get stuck, please attempt to explain what you want to do. This may give more partial credit.

WRITE THIS PARAGRAPH ON WHAT YOU SUBMIT ALONG WITH A SIGNATURE AND DATE.

I, _____, will not under any circumstance use an online source, my peers, my notes, or any other resource besides my own knowledge to complete this quiz. I will show all my work to demonstrate my knowledge on the topic.

1. Construct a matrix with the required properties or explain why it is not possible.

   a. Column space contains $\begin{bmatrix}1\\1\\0\end{bmatrix}$, $\begin{bmatrix}0\\0\\1\end{bmatrix}$, row space contains $\begin{bmatrix}1\\2\end{bmatrix}$, $\begin{bmatrix}2\\5\end{bmatrix}$.

   b. Column space has basis $\begin{bmatrix}1\\1\\3\end{bmatrix}$, nullspace has basis $\begin{bmatrix}3\\1\\1\end{bmatrix}$.

2. Determine of the following pairs are orthonormal, orthogonal, independent or any combination. Show work testing each!

   a. $\begin{bmatrix}1\\0\end{bmatrix}$ and $\begin{bmatrix}-1\\1\end{bmatrix}$

   b. $\begin{bmatrix}.6\\.8\end{bmatrix}$ and $\begin{bmatrix}.4\\-.3\end{bmatrix}$

3. Find A^TA if the columns are unit vectors, all mutually perpendicular (all perpendicular to each other).

4. Given the following set of points, find the below: $(0,0),(1,8),(3,8),(4,20)$.

   a. Find the line of best fit for the points.

   b. Find the closest parabola to the points (You may use a calculator to do some of the arithmetic).

   c. Find the closest cubic to the points (You may use a calculator to do some of the arithmetic).

5. Let $\mathbf{a}$, $\mathbf{b}$, and $\mathbf{c}$ be the following:

$$\mathbf{a} = \begin{bmatrix} 1 \\ 1 \\ 2 \end{bmatrix}, \mathbf{b} = \begin{bmatrix} 1 \\ -1 \\ 0 \end{bmatrix}, \text{ and } \mathbf{c} = \begin{bmatrix} 1 \\ 0 \\ 4 \end{bmatrix}.$$

   a. Show the vectors are linearly independent (i.e. $[\mathbf{a}\ \mathbf{b}\ \mathbf{c}]\ \mathbf{x} = \mathbf{0}$ if $\mathbf{x} = \mathbf{0}$).

   b. Find orthonormal vectors $\mathbf{q}_a$, $\mathbf{q}_b$, and $\mathbf{q}_c$.