Printed Name _____ Signature _____

Linear Algebra
Quiz #1

Show your work and clearly label your answers on this quiz.
No scrap paper or notes are allowed.
This quiz is scored out of 50 points. (There are 60 points possible.)
You have 30 minutes to complete the quiz.
To get credit on a problem, you *must* give a clear, well-written explanation, justifying each step.

Problem 1 (5 x 4 points)

(a) Give the lengths of the three sides of the triangle formed by the vectors v, w, and $v - w$, for v and w given below.

(b) Give $\cos\theta$, where θ is the angle between the vectors v and w.

(c) Show that the triangle inequality holds for this triangle.

(d) Show, numerically, that the unit vectors in the direction of v and w also make the angle θ found in (b).

(Hint: draw some pictures to help.)

$$v = \begin{pmatrix} 4 \\ 2 \end{pmatrix}, \; w = \begin{pmatrix} 2 \\ 3 \end{pmatrix}$$

Problem 2 (5 x 3 points)

(a) Write the system of linear equations as a matrix-vector equation, labeling each term.

(b) Rewrite (a) in "column view" (as a linear combination of columns), labeling each term.

(c) Rewrite (a) in "row view" (as dot products of rows), labeling each term.

(Hint: make sure every variable is represented.)

$$\begin{aligned} 3x - 2y + z &= 6 \\ 8x \qquad - 4z &= 2 \end{aligned}$$

Problem 3 (5 x 3 points) Given the matrices

$$A = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 6 & 6 \\ 7 & 8 & 10 \end{pmatrix}, \quad E = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 3 & 0 & 1 \end{pmatrix},$$

(a) What is EA?

(b) What is AE?

(c) What is $3A - 5E$?

Problem 4 (10 points) What is the value of a that makes $v \perp w$, if

$$v = \begin{pmatrix} 1 \\ 6 \\ -3 \\ 4 \end{pmatrix} \text{ and } w = \begin{pmatrix} 5 \\ -2 \\ a \\ 0 \end{pmatrix}?$$