

Printed Name _____ Signature _____

Linear Algebra
Exam #1

Show your work and clearly label your answers on this exam.

No scrap paper or notes are allowed, but you may use a scientific or accounting calculator (no phones or computers). Use 6 digits of precision throughout your calculations (and answers), although fractions will likely make for more intelligible answers.

This quiz is scored out of 100 points.

(There are 120 points possible.)

To get credit on a problem, you *must* give a clear, well-written explanation, justifying each step.

NOTE: Graphing calculators are *not* allowed.

For each of the following systems of equations, do the following:

- (i) (5 pts) Convert the system into a matrix equation of the form $A\vec{x} = b$.
- (ii) (5 pts) Give the dot product of each pair of column vectors of A .
(For example, if A has four columns, then you will compute $\binom{4}{2} = 6$ dot products.)
- (iii) (5 pts) Give the unit vector in the direction of each column vector of A .
- (iv) (10 pts) Attempt to solve the system $A\vec{x} = b$. Clearly state your result, whether the system has no solution, a unique solution, or infinitely many solutions.
- (v) (10 pts) If the system has a unique solution, compute the factorization $A = LDU$ and the inverse A^{-1} . If the system does not have a unique solution, state why this factorization does not exist.

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Problem 1

$$\begin{aligned} -x + 3y + -2z &= 7 \\ -4x + 14y - 6z &= -10 \\ 3x - 10y &= 4 \end{aligned}$$

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Problem 2

$$-x + 3y + -2z = 7$$

$$-4x + 14y - 6z = -10$$

$$3x - 10y + 5z = 4$$

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Problem 3

$$-x + 3y + -2z = 0$$

$$-4x + 14y - 6z = 0$$

$$3x - 10y + 5z = 0$$