Printed Name _____ Signature _____

Linear Algebra
Quiz #3

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

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 and roots will likely make for more intelligible answers.

This quiz is scored out of 55 points. (There are 65 points possible.)

You have 40 minutes to complete the quiz.

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

Problem 1 (10+5+10+5 pts) Consider the system $A\vec{x} = b$ given by

$$\begin{aligned} 4x_1 + 12x_2 - 8x_3 - 32x_4 - 24x_5 &= 24 \\ -12x_1 - 36x_2 + 22x_3 + 86x_4 + 70x_5 &= -72 \\ 20x_1 + 60x_2 - 44x_3 - 180x_4 - 124x_5 &= 120. \end{aligned}$$

(a) What is the reduced row echelon form of the coefficient matrix A?

(b) What are the pivot variables? What are the free variables?

(c) What is the solution $\vec{x}$ to the system $A\vec{x} = b$? Give in terms of the special solution(s).

(d) What is the dimension of the solution set? What geometric shape does the solution have, inside what space?

Problem 2 (10+5+10+5+5 pts) Consider the system $A^t\vec{y} = 0$ given by A in Problem 1.

(a) What is the reduced row echelon form of the coefficient matrix A^t?

(b) What are the pivot variables? What are the free variables?

(c) What is the solution $\vec{y}$ to the system $A^t\vec{y} = 0$? Give in terms of the special solution(s).

(d) What is the dimension of the solution set? What geometric shape does the solution have, inside what space?

(e) What is $b \cdot \vec{y}$? What does that hint to you about the spaces in which these vectors exist?