

Friday, September 4

Student Number: \_\_\_\_\_

There are 2 problems. Stop now and make sure you have both problems. If you do not have them both, then request a new quiz. The points for each problem is listed with that problem.

Show all of your work and follow the directions provided. Partial credit will be given for partial solutions. *CALCULATORS ARE NOT ALLOWED!*

Problem	Score
1 _____	
2 _____	
<u>Total</u> _____	

**RULES:**

1. *NO ELECTRONIC DEVICES ON QUIZ DAYS ARE ALLOWED!*
2. *TURN OFF AND PUT AWAY YOUR PHONE!* If the quiz proctor sees or hears your phone *at any time on a quiz day*, your quiz will not be graded and you will receive a grade of zero for the quiz.
3. Leave your quiz face up on your desk until the quiz proctor tells everyone to begin.
4. When the quiz proctor announces the end of the quiz, you have one minute to give your quiz to the proctor. If the proctor does not have your quiz within one minute after the end of the quiz, your quiz will not be graded.
5. At any point before or during the quiz, the quiz proctor may request that you change your seat. Please do so promptly.
6. Close all purses and backpacks and place them under your chair with your phone inside and off.
7. Only your quiz, your writing implements, and possibly a drink may be on your desk during the quiz.
8. No supplemental material, such as notes, are allowed during the quiz.
9. The quiz proctor may ask you to present a photo ID at any point during the quiz. If you do not have one, then you will be asked to surrender your quiz, and the quiz will not be graded.

HINT: If a problem provides very little space for the answer, then the answer requires only very little space, i.e. it is a short answer question.

1. [a](15 points) Under what conditions is the set  $S \subset \mathbb{R}^n$  a subspace of  $\mathbb{R}^n$ .

[b](15 points) Let  $A$  be a linear transformation from  $\mathbb{R}^n$  to  $\mathbb{R}^m$  with  $m < n$ . Give the definition for the *null space* of  $A$  and provide a simple lower bound for its dimension.

2. Consider the system

$$\begin{aligned} -x_1 & \quad \quad + 4x_3 = 200 \\ -x_1 + x_2 + 9x_3 & = 200 \\ 2x_1 - x_2 + 7x_3 & = 200 . \end{aligned}$$

(a)(10 points) Write the augmented matrix corresponding to this system.

(b)(20 points) Reduce the augmented system in part (a) to echelon form.

(c)(10 points) Describe the set of solutions to the given system.