

Linear Algebra: Sample Test 1 Questions on Selections from Chapters 1

Part 1: Fill in the Blank Questions (3 points each - 30 points total) There may be more than one possible answer for a fill-in-the-blank question. Full credit answers are ones that demonstrate deep understanding of linear algebra from class and homework.

1. In linear algebra, a vector means \_\_\_\_\_

2. An augmented matrix corresponding to three equations reduces to

$$\begin{bmatrix} 1 & 0 & 5 \\ 0 & 1 & 2 \\ 0 & 0 & 1 \end{bmatrix}$$

The pivots are \_\_\_\_\_

3. What are the solution(s), if any, in #2? \_\_\_\_\_

4. Multiply  $\begin{bmatrix} 5 & 8 \\ -2 & 3 \end{bmatrix}$  by-hand via  $\begin{bmatrix} -1 \\ 1 \end{bmatrix}$  (show work, but no need to reduce) \_\_\_\_\_

5. Adding two vectors  $\vec{v}_1$  and  $\vec{v}_2$  gives \_\_\_\_\_

6. The row operation which turns  $\begin{bmatrix} 1 & -2 & 1 & 0 \\ 0 & 5 & -2 & 8 \\ 4 & -1 & 3 & -6 \end{bmatrix}$  to  $\begin{bmatrix} 1 & -2 & 1 & 0 \\ 0 & 5 & -2 & 8 \\ 0 & 7 & -1 & -6 \end{bmatrix}$  is (like  $r'_3 = -5r_1 + r_3$ )

\_\_\_\_\_

7. If I use the `implicitplot3d` command in Maple on the equations corresponding to the rows of the augmented matrix

$\begin{bmatrix} 1 & 2 & 3 & 4 \\ 0 & 5 & 6 & 7 \\ 0 & 0 & 8 & 9 \end{bmatrix}$  we would see \_\_\_\_\_ intersecting in \_\_\_\_\_

8. We have repeatedly seen that we must be careful with Maple's linear algebra commands, because we can sometimes get incorrect answers. An example is when:

\_\_\_\_\_

9. In problem set 2, the center of gravity was an example of the linear algebra concept \_\_\_\_\_

10. If  $A$  is an  $n \times n$  matrix, and  $\vec{x}$  and  $\vec{b}$  are  $1 \times n$  vectors, then  $A\vec{x} = \vec{b}$  has \_\_\_\_\_  
solution(s).

## Part 2: Computations and Interpretations (40 points)

There will be some by-hand computations and interpretations, like those you have had previously for homework, clicker questions and in the problem sets. You are not expected to remember page numbers or Theorem numbers, but you are expected to be comfortable with definitions, “big picture” ideas, computations, analyses...

You can expect this section to be a question with numerous parts, adapted from (or combining) questions like by-hand Gaussian of matrices: 1.2 #19, Problem Set 1 #1 or #2 and/or the algebra of vectors: 1.3 Problem #15, 1.4 Problem 13, 1.7 #9, Problem Set 2#2 or #3, for example.

Part 3: True/False (3.75 points each - 30 points total) Follow the directions below each:

**Circle True OR correct the statements as directed:**

- a) The solution set of a linear system involving variables  $x_1, \dots, x_n$  is all lists of numbers  $(s_1, \dots, s_n)$  that makes each equation in the system a true statement when the values  $s_1, \dots, s_n$  are substituted for  $x_1 \dots x_n$ , respectively.

Circle True OR (only if false) correct the statement after is.

- b)  $\begin{bmatrix} 1 & 4 & -2 \\ 0 & -12 + h & 0 \end{bmatrix}$  is consistent as long as  $h$  is not 12

Circle True OR (only if false) correct the statement after is consistent

- c) The vector equation  $x_1 \begin{bmatrix} 5 \\ 0 \end{bmatrix} + x_2 \begin{bmatrix} 1 \\ 2 \end{bmatrix} + x_3 \begin{bmatrix} -3 \\ 4 \end{bmatrix} = \begin{bmatrix} 8 \\ 0 \end{bmatrix}$  is equivalent to the matrix equation
- $$\begin{bmatrix} 5 & 1 & -3 \\ 0 & 2 & 4 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 8 \\ 0 \end{bmatrix}$$

Circle True OR (only if false) correct the statement after equation.

- d) The plane spanned by  $\begin{bmatrix} 1 \\ 4 \\ 7 \end{bmatrix}$  and  $\begin{bmatrix} 2 \\ 5 \\ 8 \end{bmatrix}$  includes many vectors in that plane that are not on the same lines as the spanning vectors, such as  $\begin{bmatrix} 3 \\ 6 \\ 9 \end{bmatrix}$

Circle True OR (only if false) correct the statement after such as

- e) Two vectors that are linearly independent in  $\mathbb{R}^2$  are  $S = \left\{ \begin{bmatrix} 1 \\ 1 \end{bmatrix}, \begin{bmatrix} 2 \\ 2 \end{bmatrix} \right\}$

Circle True OR (only if false) correct the statement after are.

- f) The equation  $\vec{x} = \vec{p} + t\vec{v}$  describes a line through  $\vec{p}$  parallel to  $\vec{v}$

Circle True OR (only if false) correct the statement after describes.

**Circle True OR provide a counterexample:**

- g) If one row in an echelon (Gaussian) form of an augmented matrix is  $[0 \ 0 \ 0 \ 5 \ 0]$  then the associated linear system is inconsistent.

Circle True OR provide a counterexample

- h) Any system of 3 linear equations in 2 unknowns is always inconsistent

Circle True OR provide a counterexample