# CU Boulder

Math 2130

Test 1

Section 002 (Instructor Farid Aliniaeifard)

Friday, Oct 6, 2017, 10:00 - 10:40 am

NAME (print):_____
(Family) (Given)

SIGNATURE:_____

STUDENT NUMBER:_____

**Instructions:**

1. Time allowed: 40 minutes.
2. NO CALCULATORS OR OTHER AIDS
3. There are 5 questions on 5 pages. Last page is blank.
4. Questions can be solved in more than one way.
5. You are expected to write clearly and carefully.

| Question | Points | Marks |
|---|---|---|
| 1 | 5 | |
| 2 | 5 | |
| 3 | 5 | |
| 4 | 5 | |
| 5 | 5 | |
| Total | 25 | |

1. (5 points) Let

$$\begin{array}{rrrl} & -2x_2 & +x_3 & = 1 \\ x_1 & -2x_2 & & = 1 \\ 2x_1 & -4x_2 & & = 2 \end{array}$$

Is the system consistent? if so write the solution set.

2. (5 points) For each of the following give the definition.

   (a) Linear independent set of vectors.

   (b) Span of a set of vectors

   (c) Basis for a subspace.

3. (5 points)

   (a) Show that
   $$T(x_1, x_2, x_3) = (3x_2 - x_1, 2x_1 + x_3)$$
   is a linear transformation.

   (b) Find the standard matrix for $T$.

   (c) Is $T$ onto?

   (d) Is $T$ one-to-one?

4. (5 points) Let

$$v_1 = \begin{bmatrix} 1 \\ 0 \\ 3 \end{bmatrix}, v_2 = \begin{bmatrix} -1 \\ 1 \\ -1 \end{bmatrix}, v_3 = \begin{bmatrix} -1 \\ 2 \\ 1 \end{bmatrix}$$

   (a) Is $\{v_1, v_2, v_3\}$ linearly independent?

   (b) Find a basis $\beta$ for $Span\{v_1, v_2, v_3\}$.

   (c) Is $b = \begin{bmatrix} 1 \\ 1 \\ 5 \end{bmatrix}$ in $V$? if so write $[b]_\beta$.

5. (5 points) Mark each statement True or False. Justify only one of them.

   (a) The dimension of the null space of $A$ is the same as the number of free variables in equation $Ax = 0$.

   (b) The matrix $\begin{bmatrix} a & b \\ c & d \end{bmatrix}$ is not invertible if $ab = cd$.

   (c) A linear transformation is onto if the standard matrix of $T$ has pivot position in each column.

The end. Have a great weekend