

**DISTANCE EDUCATION
MATH 1300
SUMMER TERM 2016 - D02**

Assignment 3

Unit 3: Systems of linear equations

Total Marks: 60

Due Date: **June 25, 2016.**

SHOW ALL WORK to get full marks. Leave answers as exact answers; leave fractions in the form a/b . For example, Write $1/3$, DO NOT use decimals such as 0.3333. Word problems should have sentence answers with units. Fractions must be in the most simplified terms. READ THE ASSIGNMENT SUBMISSION RULES FILE.

- [8] 1. Determine whether the matrix given below is in row echelon form, reduced row echelon form, both, or neither.

$$(a) \begin{bmatrix} 1 & -2 & 0 & 1 \\ 0 & 0 & 1 & -2 \end{bmatrix} \quad (b) \begin{bmatrix} 1 & 3 & 4 \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{bmatrix} \quad (c) \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 2 & 0 \end{bmatrix} \quad (d) \begin{bmatrix} 1 & 3 & 0 & 2 & 1 \\ 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

2. For the following system

$$2x_1 + x_2 - 2x_3 = 2$$

$$x_1 + x_2 + 3x_3 = 1$$

$$3x_1 + 2x_2 - x_3 = 1$$

- [1] (a) Put the system into an augmented matrix.
[9] (b) Use elementary row operations to get the matrix into **reduced row-echelon form**.
[1] (c) Solve the system.
- [12] 3. The augmented matrix from a system of linear equations has the following row echelon form.

$$\left[\begin{array}{ccccc|c} 1 & 1 & -1 & 0 & 0 & 3 \\ 0 & 1 & 1 & 0 & 0 & 2 \\ 0 & 0 & 1 & -3 & 2 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{array} \right]$$

- (a) How many equations does the system have?
(b) How many variables does the system have?
(c) How many of the variables are independent variables?
(d) Write out the solution set for the system.
- [9] 4. Consider the system of linear equations

$$x - 2y = -1$$

$$3x + ay = b$$

where a and b are real numbers.

- (a) Write the augmented matrix for the system of linear equations.
- (b) Use elementary row operations to reduce the augmented matrix to row-echelon form.
- (c) Determine for what values of a and b does the system have infinitely many solutions.
- (d) Determine for what values of a and b does the system have no solution.
- (e) Determine for what values of a and b does the system have a unique solution.

5. Lilly, John and Maggie went to their local sports store. Lilly bought one basketball and three baseballs and paid 35.00. John bought three basketballs and one football and paid 80.00. Maggie bought one football and three baseballs and paid 95.00. Let x = price of a basketball, y = price of a football and z = price of a baseball.

- [3] (a) Write out three linear equations representing the total cost of the purchases made by Lilly, John and Maggie.
- [1] (b) Write out the augmented matrix for the system of three linear equations found in part (a).
- [5] (c) Use elementary row operations to put the augmented matrix in part (b) in **reduced row-echelon form**.
- [1] (d) What is the price per basketball? What is the price per football? What is the price per baseball?

6. Consider the homogeneous question

$$ax + by + cz = 0 \quad (1).$$

Let (x_1, y_1, z_1) , (x_2, y_2, z_2) and (x_3, y_3, z_3) be a solution to (1).

- [6] (a) Show that $(x_3 + x_2 - x_1, y_3 + y_2 - y_1, z_3 + z_2 - z_1)$ is a solution to equation (1).
- [4] (b) Show that for any real numbers k and m , $((k + m)x_1, (k + m)y_1, (k + m)z_1)$ is a solution to equation (1).