# KABARAK UNIVERSITY

## UNIVERSITY EXAMINATIONS

### 2009/20010 ACADEMIC YEAR

## FOR THE DEGREE OF BACHELOR OF COMPUTER SCIENCE AND BACHELOR OF SCIENCE IN ECONOMICS & MATHEMATICS

**COURSE CODE:** **MATH 211**

**COURSE TITLE:** **LINEAR ALGEBRA I**

**STREAM:** **Y2S2 & Y2S1**

**DAY:** **THURSDAY**

**TIME:** **9.00 – 11.00 A.M.**

**DATE:** **12/08/2010**

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**INSTRUCTIONS:**

- Answer question ONE and any other TWO questions
- Begin each question on a separate page
- Show your workings clearly

**PLEASE TURNOVER**

## QUESTION ONE (30 MARKS)

a) Consider the matrices A and B $A = \begin{bmatrix} 2 & 4 \\ -6 & 0 \end{bmatrix}$ $B = \begin{bmatrix} 1 & -5 \\ -3 & 2 \end{bmatrix}$

Find a) A – B ( 4 marks) b) $\frac{1}{2}A + B$ (5 marks)

b) Let A be an invertible matrix. Show that $\det(A^{-1}) = \frac{1}{\det(A)}$ (4 marks)

c) Given **u**=(6,-2,8) and **v**=(4,0,2) compute each of the following

**u** x **v** and **v** x **u** (7 marks)

d) Find the angle between the vectors p = 4i + 6j + 8k and q = 8i – 6j + 4k (6 marks)

e) Show that $(p_1, p_2, p_3)$ is a spanning set for $p_2$, where $p_1(x) = 2 + 3x + x^2$ , $p_2 = 4 - x$ , $p_3 = -1$ (4 marks)

## QUESTION TWO (20 MARKS)

Consider the linear system

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

$$2x_1 - x_2 \quad = 5$$

$$-x_2 + 2x_2 - 6x_3 = 0$$

a) Write down the augmented matrix of the system. (2 marks)

b) Use Gaussian elimination to bring the augmented matrix to row echelon form and indicate which elementary row operations are used in each step. (9 marks)

c) Proceed to obtain the solution using reduced row echelon form using Gauss- Jordan elimination (9 marks)

## QUESTION THREE (20 MARKS)

a) Use cramers rule to find the solution of the following

$$x - y - 3z = 2$$

$$x + y + 4z = 3$$

$$-x + 2y + 5z = -1$$

(10 marks)

b) Determine which of the following collection of vectors are linearly independent

i) $(1,1,1), (3,4,3)^T, (2,1,3)^T, (1,1,3)^T$ (5 marks)

ii) $(2, -1, 5)^T, (1,3,2)^T, (3,2,7)^T$ (5 marks)

**QUESTION FOUR (20 MARKS)**

a) Which of the following are spanning sets

i) $(1,0,0)^T, (0,0,1)^T, (1,2,4)^T$ (3 marks)

ii) $(1,1,1)^T, (1,1,0)^T, (1,0,0)^T$ (3 marks)

iii) $(1,2,4)^T, (2,1,3)^T, (4,-1,1)^T$ (4 marks)

b) Find the inverse of the following using determinant method

$$A = \begin{bmatrix} 1 & 3 & -1 \\ -2 & -6 & 0 \\ 1 & 4 & -3 \end{bmatrix}$$ (10 marks)

**QUESTION FIVE (20 MARKS)**

a) Consider the following vectors in $R^3$

$$b_1 = \begin{bmatrix} 1 \\ -2 \\ 0 \end{bmatrix} \quad b_2 = \begin{bmatrix} 0 \\ 1 \\ 1 \end{bmatrix} \quad b_3 = \begin{bmatrix} -3 \\ 6 \\ 1 \end{bmatrix} \quad \text{and} \quad d_1 = \begin{bmatrix} 1 \\ 3 \\ -1 \end{bmatrix} \quad d_2 = \begin{bmatrix} 2 \\ 0 \\ 1 \end{bmatrix} \quad d_3 = \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}$$

Show that $(b_1, b_2, b_3)$ and $(d_1, d_2, d_3)$ are bases of $R^3$ (6 marks)

b) Determine the angle between the following vectors

i) $\mathbf{a} = (18,-4)$ and $\mathbf{b} = (8,36)$ (5marks)

ii) $\mathbf{u} = (6,-2,12)$ $\mathbf{v} = (8,4,0)$ (5 marks)

a) c) Compute the norms of the given vectors

i) v= (-10,6,18) (2 marks) ii) j=(0,2,0) ( 2 marks)