MATH 0223

CHUKA   **UNIVERSITY**

UNIVERSITY EXAMINATIONS

EXAMINATION FOR THE AWARD OF DIPLOMA IN

MATH 0223: LINEAR ALGEBRA I

STREAMS: DIP   **TIME: 2 HOURS**

DAY/DATE:

INSTRUCTIONS: ANSWER QUESTION ONE AND ANY OTHER TWO QUESTIONS

QUESTION ONE

(a)   Given that $A = \begin{bmatrix} -2 & -1 \\ 1 & 0 \\ 3 & -4 \end{bmatrix}$ and B $\begin{bmatrix} 0 & 3 \\ 2 & 0 \\ -4 & -1 \end{bmatrix}$ solve for x in the equations: $2x + 3A = B$

[5 marks]

(b)   Differentiatebetween linear combination and linear dependence.   [5marks]

(c)   Find the general vector on the pane through the point $(2, -1, 2), (1, 2, 1)$ and $(3, 1, 3)$.

[5 marks]

(d)   Find the angle between the vectors$u$ and v, if $u = \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}$ and $v = \begin{pmatrix} 4 \\ 5 \\ -1 \end{pmatrix}$.   [5 marks]

(e)   Write the augmented matrix of the following system of equations hence solve the system

of equations by crammers rule.   [7 marks]

$3x + y - 2z = 2$

$x - 2y + z = 3$

$2x - y - 3z = 3$

(f)   Point P divides the line joining $A(-2, 5)$ to $B\ (4, 2)$ internally in the ratio 2:1. Find the

coordinates of P.   [4 marks]

QUESTION TWO

(a) Find the scalar product of $P = 2i + 4j + k$ and $Q = i + j + l$, hence find the angle

between P and Q.   [5 marks]

(b) If B is a set of elements such that $B = \{(x, y); x = 2y\}$. Test if B is a subspace of R^2.

[5 marks]

(c) Find the Eigen values and Eigen vectors of $\begin{vmatrix} 1 & 2 \\ -1 & 4 \end{vmatrix}$ [10 marks]

QUESTION THREE

(a) Test whether the following vectors are linearly dependent.   [10 marks]

$(3, 1, 2, 4), (1, 1, 1, 1), (4, 0, 2, 6) \text{and} (1, 2, 1, 0)$

(b) Determine the inverse of the matrix below   [10 marks]

$\begin{vmatrix} 1 & 1 & 1 \\ 1 & 2 & 3 \\ 1 & 4 & 9 \end{vmatrix}$

QUESTION FOUR

(a) Reduce the matrix below to the reduced row echlon form.   [12 marks]

$$\begin{matrix} 1 & -1 & 1 & 0 & 2 \\ 2 & -2 & 0 & 2 & 2 \\ -1 & 1 & 2 & -3 & 1 \\ -2 & 2 & 1 & -3 & -1 \end{matrix}$$

(b) Show that

(i) (5, 3, 1) is a linear combination of (5, 0, 0), (0, 1, 1) and (0, 0, 1).   [4 marks]

(ii) (0, 0, 0) is a linear combination of (2, 1, 1), (1, 0, 2) and (-1, -1, 1). [4 marks]