AFRICA UNIVERSITY
A United Methodist-Related Institution

"Investing in Africa's future"

COLLEGE OF BUSINESS PEACE LEADERSHIP AND GOVERNANCE

NCSC 102: ALGEBRA

END OF SECOND SEMESTER FINAL EXAMINATIONS

APRIL/MAY 2019

LECTURER: P TARAMBAWAMWE

DURATION: 3 HRS

INSTRUCTIONS

Answer **ALL QUESTIONS**

MARKS FOR EACH QUESTION ARE INDICATED AT THE END OF THE QUESTION.

DO NOT repeat material.

Write legibly.

Question 1

(a) Given B = $\begin{pmatrix} 2 & -2 & 1 \\ 1 & 2 & -1 \\ 3+2x & 4+x & -2 \end{pmatrix}$ Find X if det(B) = -6 **[5 marks]**

(b) Find (i) the determinant and **[5 marks]**

ii. the inverse of matrix A if A = $\begin{pmatrix} 1 & 2 & 3 & 4 \\ 0 & -1 & 3 & -5 \\ 0 & 0 & -1 & -2 \\ 0 & 0 & 0 & 1 \end{pmatrix}$ **[8 marks]**

(c) Let Matrix A = $\begin{pmatrix} 1 & -1 & 2 \\ 2 & 0 & -1 \\ -1 & 2 & -2 \end{pmatrix}$

If adj(A) = $\begin{pmatrix} 2 & -8 & a \\ 5 & c & 5 \\ b & -9 & 2 \end{pmatrix}$ find the values of a , b and c **[9 marks]**

(d) Given that the augmented matrix $\left[\begin{array}{ccc|c} 1 & 3 & -1 & 8 \\ 0 & 3 & 1 & 11 \\ 0 & 0 & 4 & 8 \end{array}\right]$ represents a system of equations, give the solution to the system of equations using the inverse of a matrix. **[10 marks]**

(e) Solve $\begin{pmatrix} 1 & -2 & 1 \\ 2 & -1 & -3 \end{pmatrix}\begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 1 \\ -2 \end{pmatrix}$ and give your answers in terms of s were s = z **[8 marks]**

Q2

a) If vector **a** = ‹4, 0, 3› and vector **b** = ‹–2, 1, 5›,
find:

i.|**a-b**| and **[3 marks]**

the vectors ii 2**a** -3 **b**, **[3.marks]**

ii. 2**a** + 5**b** **[3marks]**

b.

i. Find the equation of the line passing through the points A(3, 5, 2) and B(2, -4, 5). **[4.marks]**

ii. Find the equation of the plane passing through the three points $P_1(1,-1,4)$, $P_2(2,7,-1)$, and $P_3(5,0,-1)$. **[5.marks]**

iii. Find an equation of the plane through the point (5,-2,4) with normal vector **a**=(1,2,3) **[4 marks]**

iv.

Determine the point of intersection and the angle of intersection of the following lines

$$\text{Line 1}: x = 3 + 2t \qquad \text{Line 2}: x = 4 - t$$
$$y = -2t \qquad y = 3 + 5t$$
$$z = 4 - t \qquad z = 2 - t$$

[8 marks]

v. Find the distance between the point Q (1, 3, -2) and the line given by the parametric equations:

$$x = 2 + t, \quad y = -1 - t \quad \text{and} \quad z = 3 + 2t$$

[5 marks]

Q3

The points *A*, *B* and *C* have coordinates (2, –4, 6), (2, –3, –1) and (1, –2, 3).

a) Write down the position vectors of the points *A*, *B* and *C* relative to a fixed origin *O*. **[3 marks]**

b) Write down the equation of the line *AB* in the form

r = **a** + *t***b**. **[3 marks]**

c. The point *D* has coordinates (*a*, *b*, *c*) and lies on the line *AB* such that the line *CD* is perpendicular to the line *AB*. Find the values of *a*, *b* and *c* and hence give the coordinates of the point *D*.**[7 marks]**

d. find the distance from the point P to the given plane

p=(-2,5,-1) , $4x - 3z = 2$ **[6 marks]**

End of Paper

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JUNE 2019

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(b) Find (i) the determinant and **[5 marks]**

ii. the inverse of matrix A if A = $\begin{pmatrix} 1 & 2 & 3 & 4 \\ 0 & -1 & 3 & -5 \\ 0 & 0 & -1 & -2 \\ 0 & 0 & 0 & 1 \end{pmatrix}$ **[8 marks]**

(c) Let Matrix A = $\begin{pmatrix} 1 & -1 & 2 \\ 2 & 0 & -1 \\ -1 & 2 & -2 \end{pmatrix}$

If adj(A) = $\begin{pmatrix} 2 & -8 & a \\ d & c & 5 \\ b & -9 & 2 \end{pmatrix}$ find the values of a , b , c and d**[8 marks]**

(d) Given that the augmented matrix $\left[\begin{array}{ccc|c} 1 & 3 & -1 & 8 \\ 0 & 3 & 1 & 11 \\ 0 & 0 & 4 & 8 \end{array}\right]$ represents a system of equations, give the solution to the system of equations using the inverse of a matrix. **[10 marks]**

(e) Solve $\begin{pmatrix} 1 & -2 & 1 \\ 2 & -1 & -3 \end{pmatrix}\begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 1 \\ -2 \end{pmatrix}$

and give your answers in terms of s were s = z **[8 marks]**

Q2

a) If vector **a** = ‹4, 0, 3› and vector **b** = ‹–2, 1, 5›,
find:

i.|**2a-3b**| **[4 marks]**

ii.-3**a** + 2**b**, **[3 marks]**

iii 2**a** - 5**b**[**3 marks]**

b.

i. Find the equation of the line passing through the points A(3, 5, 2) and B(2, -4, 5). **[4.marks]**

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[10 marks]

v. Find the distance between the point Q (1, 3, -2) and the line given by the parametric equations:

$$x = 2 + t, \quad y = -1 - t \quad \text{and} \quad z = 3 + 2t$$

[5 marks

Q3

a.Two lines A and B, have the following formulas:

$$A = \begin{pmatrix} 4 \\ 0 \\ -2 \end{pmatrix} + \lambda \begin{pmatrix} -4 \\ 8 \\ -2 \end{pmatrix}$$

and

$$B = \begin{pmatrix} 6 \\ -10 \\ -10 \end{pmatrix} + \mu \begin{pmatrix} 2 \\ -6 \\ -2 \end{pmatrix}$$

i) determine whether these two lines intersect **[6 marks]**

ii) find the angle between them. **[5 marks]**

b. Find the line of intersection of the plane given by $3x + 6y - 5z = -3$ and the plane given by $-2x + 7y - z = 24$.**[7 marks]**

End of Paper