



*(Knowledge for Development)*

**KIBABII UNIVERSITY**  
**UNIVERSITY EXAMINATIONS**  
**2021/2022 ACADEMIC YEAR**  
**FIRST YEAR SECOND SEMESTER**  
**SPECIAL/SUPPLEMENTARY EXAMINATION**  
**FOR THE DEGREE OF BACHELOR OF EDUCATION**  
**MATHEMATICS**

**COURSE CODE: MAA 121/MAT 102**

**COURSE TITLE: FOUNDATION MATHEMATICS II**

**DATE: 29/07/22**

**TIME: 11.00 AM -1.00 PM**

---

**INSTRUCTIONS TO CANDIDATES**

Answer Question One and Any other TWO Questions

TIME: 2 Hours

This Paper Consists of 3 Printed Pages. Please Turn Over.

### QUESTION ONE (30 MARKS)

- (a) Using examples define (4 mks)  
(i) A matrix  
(ii) A vector
- (b) Find B if  $(2I + B^T)^{-1} = \begin{bmatrix} -3 & 1 \\ -2 & 1 \end{bmatrix}$  (5 mks)
- (c) If  $\mathbf{a} = i - 5k$  and  $\mathbf{b} = 2i - 3j + 2k$  evaluate  $\mathbf{b} \cdot (\mathbf{a} \times 2\mathbf{b})$  (5 mks)
- (d) Find the angle between two vectors  $2i - 3j - 5k$  and  $-i + 4j - k$  (6 mks)
- (e) Given that  $A = \begin{bmatrix} -8 & -6 & -12 \\ 0 & 1 & 4 \end{bmatrix}$  and  $B = \begin{bmatrix} 9 & 6 \\ 4 & -1 \\ 7 & 0 \end{bmatrix}$  find  $(A - B^T)^T$  (3 mks)
- (f) Find the solution of the following system of linear equations using augmented matrices (7 mks)

$$3x + 4y + z = 1$$

$$4x + 3y - z = -2$$

$$2x + 3y = 0$$

### QUESTION TWO (20 MARKS)

- (a) Use Cramer's rule to find  $x_1$ ,  $x_2$ , and  $x_3$ , (10 mks)

$$x_1 - 2x_2 + 3x_3 = 9$$

$$-x_1 + 3x_2 + 4 = 0$$

$$2x_1 - 5x_2 + 5x_3 = 17$$

- (b) Compute the rank of  $\begin{bmatrix} 1 & 1 & -1 & 4 \\ 2 & 1 & 3 & 0 \\ 0 & 1 & -5 & 8 \end{bmatrix}$  (6 mks)

- (c) Given  $A = \begin{bmatrix} 2b & -2b \\ 4 & -b \end{bmatrix}$  has determinant of 8 find  $b$  (4 mks)

**QUESTION THREE (20 MARKS)**

- (a) Using the inversion algorithm find the inverse of the matrix  $\begin{bmatrix} 2 & 7 & 1 \\ 1 & 4 & -1 \\ 1 & 3 & 0 \end{bmatrix}$  (10 mks)
- (b) Compute the adjoint of P given

$$\begin{bmatrix} 10 & 4 & -3 \\ 0 & -2 & 5 \\ 2 & 0 & -7 \end{bmatrix} \quad (10 \text{ mks})$$

**QUESTION FOUR (20 MARKS)**

- (a) Find the projection of  $i - 2j + 7k$  on  $-4i + 6j - 3k$  (4 mks)
- (b) Show that  $\|a \times b\| = \|a\| \|b\| \sin \theta$  (5 mks)
- (c) Given that  $A = \begin{bmatrix} 6 & -2 \\ 4 & -3 \end{bmatrix}$  and  $B = \begin{bmatrix} -9 & -2 \\ 4 & 12 \end{bmatrix}$   
Prove that  $\det(AB) = \det A \det B$  (5 mks)
- (d) Reduce the system into row-echelon form hence by backward substitution solve it

$$x - 2y + 2z = 3 \quad (6 \text{ mks})$$

$$2x + y + z = 0$$

$$x + z = -2$$

**QUESTION FIVE (20 MARKS)**

- (a) Given  $a = \langle 6, 1, -2 \rangle$  and  $b = \langle 4, -3, 1 \rangle$  compute
- (i)  $a \times b$  (3 mks)
- (ii)  $b \times -3a$  (4 mks)
- (b) If  $\det A = 10$  and  $\det B = -9$  calculate  $\det(A^2 B^{-1} A^T B^3)$  (5 mks)
- (c) Compute the determinant of  $\begin{bmatrix} 1 & -1 & 0 \\ 1 & 0 & -1 \\ -6 & 2 & 3 \end{bmatrix}$  (5 mks)
- (d) Determine if the two vectors are parallel, orthogonal or neither  
 $-i - 4j - 3k$  and  $2i + 3j - k$  (3 mks)