



*(Knowledge for Development)*

**KIBABII UNIVERSITY**  
**UNIVERSITY EXAMINATIONS**  
**2020/2021 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: 30/09/21**

**TIME: 8.00 AM -10.00 AM**

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**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 diagonal matrix
  - (ii) A vector
- (b) If  $\mathbf{a} = 2i - 5j$  and  $\mathbf{b} = i - j + 2k$  evaluate  $3\mathbf{b} \cdot (\mathbf{a} \times \mathbf{b})$  (5 mks)
- (c) Find the angle between two vectors  $-2i + 3j - 7k$  and  $i - 4j - 6k$  (6 mks)
- (d) Find M if  $(M^T - 2I)^{-1} = \begin{bmatrix} -2 & -1 \\ 3 & 0 \end{bmatrix}$  (5 mks)
- (e) Given that  $A = \begin{bmatrix} -2 & 6 & -6 \\ 3 & 1 & -4 \end{bmatrix}$  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)

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

$$2x + 4y + 2z = 0$$

$$3x - 2z = 5$$

### QUESTION TWO (20 MARKS)

- (a) Given  $\mathbf{a} = \langle -3, 1, 2 \rangle$  and  $\mathbf{b} = \langle -4, 3, 1 \rangle$  compute
- (i)  $\mathbf{a} \times \mathbf{b}$  (3 mks)
  - (ii)  $\mathbf{b} \times -2\mathbf{a}$  (4 mks)
- (b) If  $\det A = 7$  and  $\det B = -8$  calculate  $\det(A^2 B^{-1} A^T B^3)$  (5 mks)
- (c) Compute the determinant of  $\begin{bmatrix} -1 & -2 & -3 \\ 4 & 1 & 1 \\ -1 & 3 & 0 \end{bmatrix}$  (5 mks)
- (d) Determine if the two vectors are parallel, orthogonal or neither  $-3i - j + 3k$  and  $2i + 4j - k$  (3 mks)

### QUESTION THREE (20 MARKS)

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

$$18x_1 + 2x_2 - 2x_3 = 2$$

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

$$5x_1 + x_2 - x_3 = 4$$

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

- (c) Given  $A = \begin{bmatrix} -2b & 2b \\ -3 & b \end{bmatrix}$  has determinant of 9 find  $b$  (4 mks)

### QUESTION FOUR (20 MARKS)

- (a) Find the inverse of the matrix  $\begin{bmatrix} 1 & -1 & 0 \\ 1 & 0 & -1 \\ -6 & 2 & 3 \end{bmatrix}$  (10 mks)

- (b) Compute the adjoint of P given

$$\begin{bmatrix} 18 & -3 & -2 \\ 0 & 1 & 5 \\ -2 & 0 & 7 \end{bmatrix} \quad (10 \text{ mks})$$

### QUESTION FIVE (20 MARKS)

- (a) Find the projection of  $2i - 2j + 7k$  on  $-5i + j - 3k$  (4 mks)

- (b) Show that  $\|a \times b\| = \|a\|\|b\|\sin\theta$  (5 mks)

- (c) Given that  $A = \begin{bmatrix} -1 & 2 \\ 5 & -3 \end{bmatrix}$  and  $B = \begin{bmatrix} 9 & -2 \\ 4 & -1 \end{bmatrix}$

Prove that  $\det(AB) = \det A \det B$  (5 mks)

- (d) Reduce the system into row-echelon form hence by backward substitution solve it

$$2x + 2y + 2z = 4 \quad (6 \text{ mks})$$

$$-x + 3y + 2z = 8$$

$$4x + 5y + z = 6$$

END