



(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

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