



JARAMOGI OGINGA ODINGA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

1ST YEAR 2ND SEMESTER EXAMINATION FOR THE AWARD OF DIPLOMA IN
CONSTRUCTION MANAGEMENT

COURSE CODE: SMA 2121

COURSE TITLE: MATHEMATICS I I

EXAM VENUE

**STREAM: DIPLOMA IN CONSTRUCTION
MANAGEMENT**

DATE:

EXAM SESSION: TWO

TIME: 2.00 HOURS

Instructions:

- 1. Answer ONE (COMPULSORY) and any other two questions only.**
- 2. Candidates are advised not to write on the question paper.**
- 3. Candidates must hand in their answer booklets to the invigilator while in the examination room**

QUESTION ONE (30 marks)

- a) Use the following matrices to evaluate PQ. (2 marks)

$$Q = \begin{bmatrix} 4 & 1 \\ 6 & 2 \\ -2 & 3 \end{bmatrix} \text{ and } P = \begin{bmatrix} 0 & 3 & -5 \\ 1 & 2 & 6 \end{bmatrix}$$

- b) Solve the system of equations using matrices (Gauss- Jordan row operation)
(3marks)

$$x + 2y = 4$$

$$2x + 4y = 8$$

- c) Given a system of equations (7 marks)

$$7x + 2y + z = 21$$

$$3y - z = 5$$

$$-3x + 4y - 2z = -1$$

- i) Express the system in the form of a matrix equation $AB=C$ where A is 3×3 matrix of coefficients of the variables, B and C are suitable column matrices.
- ii) Determine the adjoint of matrix A.
- iii) Hence solve the system of equations.
- d) Show that the line through the points A(6, 0) and B(0, 12) is perpendicular to the line through P(8, 10) and Q(4, 8). Determine the distance of line AQ.

(4 marks)

- e) Evaluate $\lim_{x \rightarrow -3} \frac{x+3}{x^2+4x+3}$ (3 marks)

- f) Differentiate the following functions with respect to x (6 marks)

i) $y = 3x^2 \sin 2x$

ii) $y = x^3 + \frac{4}{3}x^2 - 5x + 7$

iii) $y = \frac{5x+1}{2\sqrt{x}}$

- g) Prove that $\frac{dy}{dx}(\sin x) = \cos x$ (5 marks)

QUESTION TWO (20 marks)

- a) Find the slope of the parabola $y = x^2$ at the point P(2,4). Write an equation for the tangent to the parabola at this point. (4 marks)

- b) Evaluate

(i) $\lim_{x \rightarrow 1} \frac{x^2 + x - 2}{x^2 - x}$ (3 marks)

(ii) $\lim_{x \rightarrow 1} \frac{2x^2 + 5}{x^2 - 7x + 3}$ (3 marks)

- c) Differentiate $f(x) = \frac{x}{x-1}$ (3 marks)

d) Find the points in which the curve $y = x^4 - 2x^2 + 2$ have horizontal tangents?

(4 marks)

e) Find the derivative of $y = \frac{4 \sin 5x}{5x^4}$ (3 marks)

QUESTION THREE (20 marks)

a) Let $A = \begin{bmatrix} 2 & 4 & 8 & -3 \\ 0 & 1 & 2 & 3 \end{bmatrix}$ $B = \begin{bmatrix} -3 & 4 & 0 & 1 \\ 0 & 8 & 2 & 0 \end{bmatrix}$ and $C = \begin{bmatrix} 3 & -2 \\ 7 & 4 \end{bmatrix}$ (10 marks)

Find i) $A + B$

ii) CA

iii) $3A - 4B$

iv) C^{-1}

b) Find the determinant, transpose and the adjoint of 3 by 3 matrix $\begin{bmatrix} 3 & 0 & -1 \\ 4 & 6 & 2 \\ 8 & -2 & 3 \end{bmatrix}$ (10 marks)

QUESTION FOUR (20 marks)

a) Use cramer's rule to solve the system (10 marks)

i) $3x - 2y = 4$
 $6x - y = 13$

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

b) Calculate the slope of the line joining two points $P(0, -1)$ and $Q(4, 1)$ and hence equation of the line PQ . (3 marks)

c) A line passes through the point $W(5, 7)$ and has a gradient $\frac{2}{3}$. Find the x-coordinate on the line when $y=13$ and hence the midpoint of the line. (4 marks)

d) Write the equation of the line that is parallel to line $2x - 4y = 8$ and goes through point $(3, 0)$. (3 marks)

QUESTION FIVE (20 marks)

a) Find the distance between $A(1, 1)$ and $B(3, 4)$ and hence the equation of the line that is perpendicular to the line AB passing through the midpoint of line AB . (5 marks)

b) Find the inverse of the matrix given below. (3 marks)

$$C = \begin{bmatrix} 1 & 5 & -2 \\ 3 & -1 & 4 \\ -3 & 6 & -7 \end{bmatrix}$$

c) Evaluate for $\frac{dy}{dx}$ in the following: (4 marks)

i) $y = (x^2 + 1)(x^3 + 3)$

ii) $y = \sqrt{x^{\pi+2}}$

d) Evaluate $\lim_{x \rightarrow 0} \frac{\sqrt{x^2 + 100} - 10}{x^2}$ (3marks)

e) Calculate the average rate of change of the function over the function: (5 marks)

i) $f(x) = x^3 + 1$ [2,3]

ii) $h(t) = \cot t$ $[\frac{\pi}{4}, \frac{3\pi}{4}]$