JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF MATHEMATICS AND ACTUARIAL SCIENCE

UNIVERSITY EXAMINATION FOR DEGREE OF BACHELOR OF SCIENCE ACTUARIAL

1ST YEAR 2ND SEMESTER 2016/2017 ACADEMIC YEAR

COURSE CODE: SMA 3121

COURSE TITLE: MATHEMATICS II

EXAM VENUE: **STREAM: (Eng, Agric, Community Health.)**

DATE: **EXAM SESSION:**

TIME: 2.00 HOURS

Instructions:

1. **Answer question 1 (Compulsory) and ANY other 2 questions**
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) A line l_1 passes through the points A(4,5) and B(-2,7)

i. Determine the equation of the line l_1 (2mks)

ii. Determine the length of l_1. (2mks)

iii. Determine the equation of l_2, the perpendicular bisector to AB (2mks)

b) Use the cramers rule to solve. (5mks)

$3x + 2y = 12$

$4x - y = 5$

c) Find the derivative of $f(x) = 2x^3 + \frac{x^2}{4} - 3x + 4$. (3mks)

d) Find $\lim_{x \to 1} \frac{x3-1}{x-1}$ (5mks)

e) Find the determinant of the matrix $\begin{bmatrix} 1 & 1 & 3 \\ 0 & 2 & 4 \\ -1 & 1 & 0 \end{bmatrix}$. (4mks)

f) Find the value of the unknown if the matrix

$\begin{bmatrix} 2x + 14 & 4 \\ -3 & 2x \end{bmatrix}$ is a singular matrix. (5mks)

QUESTION TWO (20 marks)

a) Find $\lim_{n \to \infty} \frac{4x^5 - 15x^2 + 4}{3x^5 - 2x}$. (5mks)

b) Solve the system of linear equations below using Cramer's Rule.

$x - 3z = -2$

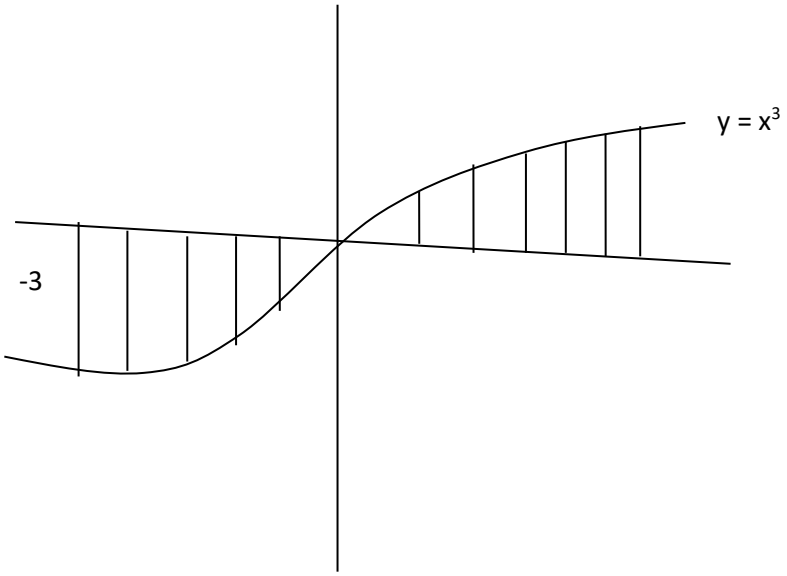
$3x + y - 2z = 5$

$2x + 2y + z = 4.$ (10mks)

c) A line l_2 passes through the point (2,-3) and is perpendicular to the line $3y + 2x - 4 = 0$. Determine the equation of the line l_2. (5mks)

QUESTION THREE (20 marks)

a) Calculate the shaded area in the figure below.



b) The displacement of a particle after t seconds is given by

$S=40t^3 - t^2 - 3t + 3$. Find the.

i) Velocity of the particle when t=2 seconds. (4 mks)

ii) Acceleration of the particle when t=3 seconds. (3 mks)

c) i) Maximum displacement. (3 mks)

iii) Minimum velocity of the particle. (3mks)

QUESTION FOUR (20 marks)

a) Determine the points of discontinuities of the function $f(x) = \frac{x^2+x-6}{x^2-4}$. Hence or otherwise find $\lim_{x\to 2} \frac{x^2+x-6}{x^2-4}$. (7mks)

b) Evaluate $\int_{-1}^{1}(6x^2 + 4x + 2)dx$. (4mks)

c) As blood moves from the heat through major arteries out to the capillaries and back through the veins, the system blood pressure continuously drops. Consider a person whose systolic blood pressure P. (in millimeters of mercury) is given by.

P= $\frac{25t^2+125}{t^2+1}$, $0 \leq t \leq 10$

where t is measured in seconds. At what rate is the blood pressure changing 5 seconds after blood leaves the heart. (8 mks)

QUESTION FIVE (20 marks)

a) Given that $f(x) = 2x^3 - 4x^2$, determine the minima and the maxima. (8mks)

b) Given a system of linear equations

$$x + 2y + 2z = 4$$
$$2x - 3y - z = -5$$
$$-3x + y = -2.$$

(i) Express the system in the form of matrix equation $AB = C$, where A is a 3×3 matrix of coefficients of the variables B and C is a suitable column matrix**.** (2 mks)

(ii) Determine the adjoint of the matrix A**.** (5 mks)

(iii) Hence solve the system of equations using the adjoint**.** (5mks)