JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF BIOLOGICAL, PHYSICAL, MATHEMATICS AND ACTUARIAL SCIENCES

UNIVERSITY EXAMINATION FOR DEGREE OF BACHELOR OF PUBLIC HEALTH, SCI, AGRI, ENGINEERING

SPECIAL RESITS DECEMBER 2022

MAIN REGULAR/SIAYA/KISUMU

COURSE CODE: WMB 9102

COURSE TITLE: MATHEMATICS II

EXAM VENUE: **STREAM: HEALTH SCI, AGRI, ENGINEERING**

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 $l_1, 2x - 3y + 4 = 0$ is parallel to another linel_2 passing through the point $(2, -3)$.

   i) Find equation of line l_2.(4mks)

   ii) Another line l_3 is perpendicular to line l_2 and passes through the point $(3,0)$. Determine the equation of the line.(4mks)

b) Find the determinant of the following matrix.

$\begin{bmatrix} -5 & 0 & -1 \\ 1 & 2 & -1 \\ -3 & 4 & 1 \end{bmatrix}$.(4mks)

c) Determine the limit below

$\lim_{x\to\infty} \frac{2x+5}{4x^2-3x+9}$. (4mks)

d) Given that $f(x) = \begin{cases} 3x + 2 \; if \; x < 1 \\ 2x^2 + 4x - 1 \; if \; x \geq 1 \end{cases}$. Determine the limit of $f(x)$ if it exists.(6mks)

e) If $f(x) = 2x^3 - 3x^2 + 10$. Find $f'(x)$ and hence find $f'(-1)$. (4mks)

f) Evaluate $\int_1^2 (3x^2 + 2x)dx$. (4mks)

QUESTION TWO (20 marks)

a) Consider the following systems of equations

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

$4x + y - 3z = 11$

$3x - 2y + 5z = 21.$

Use Cramer's rule to solve the systems of equations above. (10mks)

b) Use the adjoint matrix method to solve the following system of linear equations

$-4x - 2y - 9z = -8.$

$-3x - 2y - 6z = -3.$

$-x + y - 6z = 7.$ (10mks)

QUESTION THREE (20 marks)

a) Determine the area bounded by the curve $y = x^2 - 2x - 8$ and the x −axis. (6mks)
b) Find the maxima and the minima for$y = 5x^3 + 2x^2 - 3x$.(8mks)
c) A stone is thrown in the air. Its height s at any time t, in seconds is given by $s = 5 + 20t - 5t^2$. What is the maximum height attained?(6mks)

QUESTION FOUR (20 marks)

a) The equation of the line passing through the points A (−7, −3) and B(8, 2) is $ay = x + b$.
   i) Find a and b. (4mks)
   ii) Determine $|AB|$. (2mks)

b) Find the equation of the perpendicular bisector of the line segment joining the points (2, −5) and (4, 3) and passing through the point (2, 3). (4mks)
c) Find the point of intersection of the lines $y = \frac{1}{2}x - 1$ and $y = -2x - 1$. (4mks)
d) Determine the solution to the following ordinary differential equation. (6mks)
   $9xy^{/} + 5y = 3x$.

QUESTION FIVE (20 marks)

a) Use Gauss Jordan-row elimination method to solve the following system of linear equations.

$$5x + 2y = -5$$
$$3x - y = -14.$$ (4mks)

b) Use definition of limit to prove that $\lim_{x \to -1} (1 - 7x) = 8.$ (6mks)

c) Differentiate the function $y = \frac{\cos x + 1}{e^{-3x^2}}$. (5mks)

d) Evaluate $\int \sin(x^3)\, 12x\, dx.$ (5mks)