MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY

(MMUST)

MAIN CAMPUS

UNIVERSITY EXAMINATIONS

2023/2024 ACADEMIC YEAR

FIRST YEAR FIRST SEMESTER EXAMINATION FOR THE DIPLOMA IN GENERAL AGRICULTURE AND HORTICULTURE

COURSE CODE: DAG 051

COURSE TITLE: INTRODUCTION TO AGRICULTURAL

MATHEMATICS

DATE: 6.12.23   **TIME: 3-5PM**

INSTRUCTIONS TO CANDIDATES

- Answer questions in section A and any TWO questions in section B.
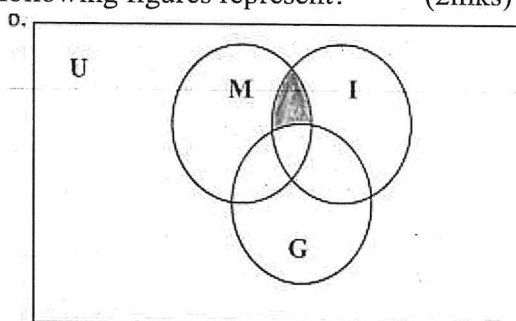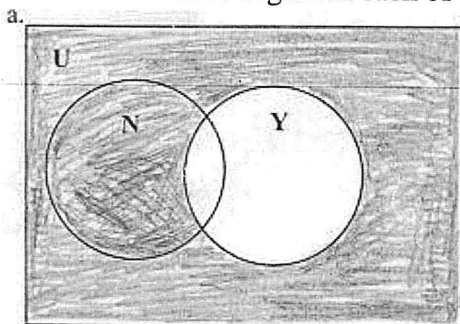
TIME: 2 Hours

MMUST observes ZERO tolerance to examination cheating

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SECTION A: Answer all questions (30 Marks)

QUESTION ONE

a) Find the product of $(x + a)$ and $(x - b)$ (2mks)

b) Estimate the area of a spherical object if the radius tends to 3cm   (2mks)

c) What does the shaded region in each of the following figures represent?   (2mks)

d) A singular matrix is given by $A = \begin{pmatrix} x & -2 \\ 1 & x+2 \end{pmatrix}$ determine the value of x using quadratic formula.   (5mks)

e) Differentiate $y = \dfrac{1}{(2x^2 - 3x + 5)^2}$ (3mks)

f) How many terms of the sequence $1, 3, 9, 27, \ldots$ must be taken for the sum to exceed 1,000?   (3mks)

g) Find all the Eigen values and the corresponding Eigen vectors for matrix A   (6mks)

$$A = \begin{pmatrix} 2 & 2 \\ 5 & -1 \end{pmatrix}$$

h) Solve $\int \frac{2}{3}x^2 + 2x + 3x^{-1} + 2 \, dx$ (2mks)

i) Suppose the total cost, $C(q)$, of producing a quantity q of a product is given by the equation,

$$C(q) = 5000 + 5q$$

The average cost per unit quantity, $A(q)$, equals the total cost, $C(q)$, divided by the quantity produced, q. Find the limiting value of the average cost per unit as q tends to ∞. In other words, find $\lim\limits_{q \to \infty} A(q)$ (5mks)

SECTION B: Answer any two questions (40 marks)

QUESTION TWO

a) The first, second and fifth term of an AP form consecutive terms of a GP Find the common ratio. (4mks)

b) Evaluate $\lim\limits_{x \to 0} \left(\dfrac{2x^2 - 3x + 4}{x} + \dfrac{5x - 4}{x} \right)$, if it exists (4mks)

c) A rectangular block has base dimensions cm by cm. Given that its volume is 1 800 cm3, prove that the total surface area, A cm^2 is
$$A = 12x^2 + \frac{3000}{x}.$$
Calculate the value of x for which A has a stationary value. Find this value of A and determine whether A is a maximum or a minimum (12mks)

QUESTION THREE

a) Find the maximum point m of the expression $\frac{1}{3}m^3 - \frac{1}{2}m^2 - 12m + 26$ (4mks)

b) Show that the solution of $ax^2 + bx + c = 0$ is given by $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ (4mks)

c) Solve the following system of linear simultaneous equations using matrix method
$$x + 2y + 3z = 2$$ (7mks)
$$y + 4z = 2$$
$$5x + 6y = 3$$

d) A bucket is in the form of a frustum of a cone. The curved surface area of the bucket is 120π cm^2. The top and bottom radius of the bucket is 8 cm and 4 cm. What is the slant height? (5mks)

QUESTION FOUR

a) Find $\frac{dy}{dx}$ if $y = (2x^2 - 1)^{\frac{1}{4}}$ (5mks)

b) Show that $\dfrac{1}{\tan x + \cot x} = \sin x . \cos x$ (5mks)

c) If 1000 students in MMUST had assembled for a public lecture and the organizing committee discovered that 300 students were doing Mathematics courses, 350 Physics courses, 450 Horticulture courses, 100 were doing both Mathematics and Physics, 150 both Mathematics and Horticulture, 75 both Physics and Horticulture while 10 students were not doing any of the three courses.

   i) Let x be the number of students doing both the three courses and represent this information on a Venn diagram (2mks)

   ii) Calculate the value of x (3mks)

   iii) How many students were doing Mathematics and Physics but not Horticulture courses (3mks)

   iv) How many students were only doing one course (2mks)

QUESTION FIVE

a) Find the third derivative of $y = x^4 + 15x^2 + 9x - 12$ (3mks)

b) Solve the following (5mks)

    i) $\int_0^2 \frac{1}{4}(x + 1)dx$

    ii) $\int (3x^2 - x + 1)dx$

    iii) $\int_{-2}^5 (2x^3 + 3x^2 - 3x + 1)dx$

c) Solve $1 + \cos\theta = 2\sin^2\theta$ and find all the solutions for $0° \leq \theta \leq 360°$ (5mks)

d) If I is identity matrix, $A = \begin{pmatrix} 2 & 1 \\ 0 & 1 \end{pmatrix}$, $B = \begin{pmatrix} 2 & -1 & 3 \\ 0 & 1 & 2 \end{pmatrix}$ and $C = \begin{pmatrix} 3 & 5 \\ -1 & 2 \end{pmatrix}$, solve the following

    i. AB (1mk)

    ii. $A^2 + 2A - 3I$ (3mk)

    iii. $A + C - B^T A$ (3mks)