MACHAKOS UNIVERSITY

University Examinations 2021/2022 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

FIRST YEAR FIRST SEMESTER SPECIAL/SUPPLEMENTARY EXAMINATION FOR BACHELOR OF SCIENCE IN AGRICULTURAL EDUCATION AND EXTENSION

KCU 101: FUNDAMENTALS OF MATHEMATICS

Date: Time: 2 hours

Instructions to the Candidate:

1. *This paper consists of **Five** questions.*
2. *Answer **Question 1** and any other **Two** questions.*
3. *You **must** have a scientific calculator for this paper.*

Question One (30 *Marks*)

a) Simplify the following algebraic expression.

$$\frac{3}{x-1}+\frac{x}{x+2}$$ (3 marks)

b) Define a linear equation in one variable. (1 mark)

c) State whether the following equations are linear

i. $x-6=\frac{x}{3}$ (1 mark)

ii. $x^2+2x=8$ (1 mark)

d) Solve the following quadratic equation

$$x^2+5x=24$$ (3 marks)

e) Find the values of x which satisfy the following inequalities.

i. $|3x+2|\geq 4$ (2 marks)

ii. $x^2 \leq 5x - 6.$ (3 marks)

f) A car rental company charges 30dollars a day and 15cents a mile for renting a car. Helen rents a car for two days, and her bill comes to 108 dollars. How many miles did she drive? (4 marks)

g) Solve the following system of linear equations.

$$x - 2y - z = 1$$
$$y + 2z = 5$$
$$z = 3$$

(3 marks)

h) Evaluate the following integral $\int \frac{3}{2x+2} dx$ (3 marks)

i) Find the derivative of the following $f(x) = x^3 + x^4$ (2 marks)

j) Students in Machakos University posted the following grades after their continuous assessment test; 34.61, 34.57, 34.40, 34.63, 34.63, 34.51, 34.49, 34.61, 34.52, 34.55, 34.58, 34.53, 34.44, 34.48 and 34.40.

i. Calculate the mean mark (2 marks)
ii. Calculate the median (2 marks)

Question Two (20 *marks*)

a) Find an equation of the line through the point (5,2) that is parallel to the line $4x+6y+5=0$. (5 marks)
b) The initial bacterium count in a culture is 500. A biologist later makes a sample count of bacteria in the culture and finds that the relative rate of growth is 40% per hour.
   i. Find a function that models the number of bacteria after t hours. (3 marks)
   ii. How many bacteria are in the culture after 10 hours? (5 marks)
   iii. After how many hours will the bacteria count reach 80, 000? (7 marks)

Question Three (20 *marks*)

a) Solve the following system of linear equations using Gaussian elimination method.

$$x - 2y + 3z = 1$$
$$x + 2y - z = 13$$
$$3x + 2y - 5z = 3$$

(4 marks)

b) A factory produces two agricultural pesticides, A and B.

- For every barrel of pesticide, A, the factory emits 0.25 kg of carbon monoxide (CO) and 0.60 kg of sulfur dioxide (SO2).
- For every barrel of pesticide B, the factory emits 0.50 kg of CO and 0.20 kg of SO2.

Pollution laws restrict the factory's output of CO to a maximum of 75 kg per day and its output of SO2 to a maximum of 90 kg per day.

i. Find a system of inequalities that describes the number of barrels of each pesticide the factory can produce per day and still satisfy the pollution laws. Graph the feasible region. (8 marks)

ii. Would it be legal for the factory to produce 100 barrels of pesticide A and 80 barrels of pesticide B per day? (2 marks)

iii. Would it be legal for the factory to produce 60 barrels of pesticide A and 160 barrels of pesticide B per day? (2 marks)

c) Solve the equation $2x = 1 - \sqrt{2 - x}$ and state how many solutions it has (4 marks)

Question Four (20 *marks*)

a) Find the slope and y-intercept of the line $3y - 2x = 1$ (4 marks)

b) The table below shows the masses of 60 first year students in a class.

Mass (Kg)	90-99	100-109	110-119	120-129	130-139	140-149	150-159
Number of students	2	6	17	16	12	6	1

i. Calculate the mean (3 marks)

ii. Calculate the median (3 marks)

iii. Solve the following equation for x: $3^{x+2} = 7$ (4 marks)

c) A carnival has two plans for tickets:

- Plan A:5 dollars as entrance fee and 25 cents for each ride.
- Plan B:2 dollars as entrance fee and 50cents for each ride.

How many rides would you have to take for Plan A to be less expensive than Plan B? (6 marks)

Question Five (20 *Marks*)

a) With the help of exponents, simplify the following algebraic expressions:

i. $\sqrt{49x^2 + 49}$ (4 marks)

ii. $\sqrt[3]{x^4}$ (2 marks)

iii. $\sqrt{25b}$ -$\sqrt{b^3}$ (3 marks)

b) Evaluate the following definite integrals.

i. $\int_0^1 (x+1)^3 \ dx$ (3 marks)

ii. $\int_0^1 \frac{dx}{(3x+1)^4}$ (4 marks)

c) A rectangular building lot is 8ft longer than it is wide and has an area of 2900 ft^2. Find the dimensions of the lot (4 marks)