



MURANG'A UNIVERSITY OF TECHNOLOGY
SCHOOL OF AGRICULTURE AND ENVIRONMENTAL
STUDIES

DEPARTMENT OF AGRICULTURE

UNIVERSITY ORDINARY EXAMINATION

2023/2024 ACADEMIC YEAR

FIRST YEAR FIRST SEMESTER EXAMINATION
FOR BACHELOR OF SCIENCE IN AGRICULTURALEONOMICS AND
RURAL DEVELOPMENT

GAE 101: MATHEMATICS FOR ECONOMICS

DURATION: 2 HOURS

INSTRUCTIONS TO CANDIDATES:

1. Answer question **ONE** and any other **TWO** questions.
2. Mobile phones are not allowed in the examination room.
3. You are not allowed to write on this examination question paper.

SECTION A (30 MARKS)

QUESTION ONE (30 MARKS)

- a. Find the equilibrium price for each of the following

$$D = S$$

$$D = 3 - 2P$$

$$S = -1 + 5P$$

(3 marks)

- b. The model

$$D_1 = S_1$$

$$D_1 = 5 - 2P_1 + P_2$$

$$S_1 = -3 + 5P_1 - 2P_2$$

$$D_2 = 2 + 2P_1 - P_2$$

$$S_2 = -43 - 2P_1 + 3P_2$$

- i. Find P_1 and P_2 when the market is at equilibrium. (4 marks)

- ii. Find the demand and supply levels D_i and $S_i \dots i=1,2$ when the market is in equilibrium. (4 marks)

- c. Show that

$$A = \begin{bmatrix} 3 & 6 \\ 2 & 5 \end{bmatrix} \text{ then } A^{-1} = \begin{bmatrix} \frac{5}{3} & -2 \\ \frac{-2}{3} & 1 \end{bmatrix}$$

By showing $AA^{-1} = I$ (5 marks)

- d. Describe the conditions required for a matrix to be in reduced row echelon (6 marks)

- e. Find the solutions to the following equations and explain why the results are different

i. $X+3y=1$

$$2x+6y=3$$

(4 marks)

ii. $X+3y=1$

$$2x+5y=2$$

(4 marks)

SECTION B (40 MARKS) ANSWER ANY TWO QUESTIONS

QUESTION TWO (20 MARKS)

$$\text{Let } A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$$

- i. Find M_{23} (2 marks)
- ii. Find C_{23} (2 marks)

Using Cramer rule solve the equation system

$$X + 2y = 3$$

$$2x + 7y = 5 \quad (2 \text{ marks})$$

Given the following changes $A_{n+1} = f(A_n)$. find the fixed points and the use cobwebs to determine whether the points are contracting or repelling neither

- i. $f(x) = 1/3x + 2$ (3 marks)
- ii. $fx = 3x - 2$ (3 marks)
- iii. $f(x) = x + 2$ (3 marks)

QUESTION THREE (20 MARKS)

We make an initial deposit of KSh. 900 in our bank account. We make additional deposit of 50 at the end of each month for the next two years (24 months). The annual interest rate is 0.048 compounded annually

- a. Let A_n be the account in the account after n months. State the dynamical systems whose solution is the sequence of A_n .
- b. Find the general solution to this dynamic system.
- c. Find the particular solution that satisfies the initial condition.
- d. Use the particular solution to find the amount in account after 2 years.

QUESTION FOUR (20 MARKS)

- a. Find the constrained critical point for each of the following
 - i. $F(x,y) = 5x + 2y, 5x^2 + 2y^2 = 14$ (4 marks)
 - ii. $F(x,y,z) = xyz, 2x + 3y + z = 6$ (4 marks)
 - iii. $F(x,y,z) = 2x + 2y - 2, x - 2y = 0, x + z = 0$ (4 marks)
- b. Maximize $f(x,y) = 2x - x^2 - 4y - y^2$
 - $Stx \geq 0$
 - $y \geq 0$ (3 marks)