

LAIKIPIA



UNIVERSITY

UNIVERSITY EXAMINATIONS

1ST SEMESTER 2023/2024 ACADEMIC YEAR

**FIRST YEAR EXAMINATION FOR THE DEGREE OF
BACHELOR OF SCIENCE IN ECONOMICS &
STATISTICS AND BACHELOR OF AGRIBUSINESS
MANAGEMENT**

ECON 112: MATHEMATICS FOR ECONOMICST I

STREAM:

TIME: 2 HRS

DAY:

DATE:

THIS QUESTION PAPER CONSISTS OF FOUR (4) PAGES

PLEASE DO NOT OPEN UNTIL THE INVIGILATOR SAYS SO.



Instructions: Answer Question ONE and any OTHER TWO questions**QUESTION ONE (30 Marks)**

- a) Justify the need for mathematics in economic analysis. **(5 Marks)**
- b) Distinguish between the following concepts as used in Mathematics for Economist:
- Endogenous and Exogenous variables. **(2 Marks)**
 - Technical and Behavioral functions. **(2 Marks)**
- b) A survey was conducted on the newspaper readership of 3 dailies; the Nation, the Standard and the Taifa, N, S, T respectively and the following data was obtained:
 The number of people who read N, S & T was found to be 55, 45 and 39 respectively.
 The number that read N & T = 19
 The number that read S & N = 15
 The number that read S & T = 14
 Those who read all the 3 newspapers were found to be 4 people only.
 Using a Venn diagram, determine the number of people who:
- Read the Nation only. **(4 Marks)**
 - Read Standard or Taifa but not the Nation. **(3 Marks)**
 - The total number of people interviewed if 5 people read none of the papers. **(3 Marks)**
- c) Economic growth (x) and public debt (y) of a hypothetical economy over a period of 6 years was expressed as $(x - 2y)^6$. Expand the expression and use the terms up to x^3 to evaluate $(2.02)^6$. **(3 Marks)**
- d) The demand and supply functions for sugar in a hypothetical economy are stated as follows:
- $$Q_d = 18 - \frac{2}{3}P \quad \text{demand function}$$
- $$Q_s = -6 + \frac{3}{4}P \quad \text{supply function.}$$
- Where Q_d and Q_s are quantity demanded and supplied P = price and Q = quantity. The values a and b are constants. When the price is Sh. 2, quantity demanded is 9 units.
- Calculate the price and quantity at which the sugar market clears. **(3 Marks)**
- e) You are given the following demand facing a wheat production firm:
- $$P = 30 - \frac{1}{3}Q$$



Where Q and P are the quantity and price of wheat respectively. Find:

- i) The price elasticity of demand for wheat when $P = 10$. **(3 Marks)**
 ii) Interpret the sign and the magnitude of your results. **(2 Marks)**

QUESTION TWO (20 Marks)

- a) The demand function for a commodity is

$$P = 50 - 0.5Q$$

The cost of producing the commodity consists of fixed cost of 200 shillings and variable cost of 0.2 shillings per unit.

- i) Determine the profit function of the commodity. **(6 Marks)**
 ii) Calculate the output level at which $\frac{d\pi}{dQ} = 0$. **(4 Marks)**
- b) The commodity and money markets for a three sector economy are defined by the following equations:

Commodity Market

$$C = 1000 + Y^d \quad \text{Consumption function}$$

$$I = 1500 - 60r \quad \text{Investment function}$$

$$T = 0.25Y \quad \text{Tax function}$$

$$G = 100 \quad \text{Government expenditure}$$

Money Market

$$M_d = 0.20Y - 20r \quad \text{Demand for real money balances}$$

$$M_s = 1500 \quad \text{Supply of real money balances}$$

- i) Derive the IS function for the three sector economy. **(4 marks)**
 ii) Derive the LM function for the three sector economy. **(3 marks)**
 iii) What is the equilibrium income and rate of interest for the economy? **(3 Marks)**

QUESTION THREE (20 Marks)

- a) The total cost function of facing a manufacturing firm is:

$$TC = 50 + 20Q - Q^2 + 0.5Q^3$$

- i) Determine the AFC, ATC, AVC, and MC. **(4 Marks)**
 ii) At what level of Q will the slopes of the MC function and the AVC function be equal to zero? **(4 Marks)**
 iii) Determine the level of Q at which AVC and MC are equal. **(2 Marks)**
 iv) Determine the level of Q at which the slope of VC function equals zero. **(2 Marks)**



- v) Comment on the results in (iii) and (iv). **(1 Mark)**
- vi) What is the value of the slope of the MC function at the point when MC is equal to AVC? **(1 Mark)**
- vii) Comment on the results in (vi). **(1 Mark)**
- b) A firm has the revenue function $R = 100Q - Q^2$ and the cost per unit is $C = Q - 57$. Find the output maximizing level of profit and the maximum profit. **(5 marks)**

QUESTION FOUR (20 Marks)

a) The demand and supply functions of a two-commodity model are as follows:

$$Q_{d1} = 18 - 3P_1 + P_2$$

$$Q_{s1} = -2 + 4P_1$$

$$Q_{d2} = 12 + P_1 - 2P_2$$

$$Q_{s2} = -2 + 3P_2$$

Required: Calculate equilibrium prices and quantities at which the two markets would clear.

(6 marks)

b) The AR and TC for a firm are given by

$$AR = \frac{7}{2} - \frac{1}{2}Q$$

$$TC = \frac{1}{20}Q^3 - \frac{3}{10}Q^2 + 2Q + 1$$

Find;

- i) The output and price levels that will maximize profits. **(6 Marks)**
- ii) The output level that will maximize total revenue. **(4 Marks)**
- iii) The output level that will minimize AVC and MC. **(4 Marks)**

QUESTION FIVE (20 Marks)

The supply and demand functions for a firm are given by

$$Q_s = -5 + \frac{1}{2}P$$

$$Q_d = 10 - \frac{1}{2}P$$

To finance public expenditure in the next fiscal year, the government decides to impose a per unit tax t on output supplied by the firm.

- a) Determine the demand and supply functions for firm before tax. **(2 Marks)**
- b) Determine the demand and supply functions for firm after tax. **(2 Marks)**
- c) The tax rate that will maximize government tax revenue. **(14 Marks)**
- d) The maximum tax rate. **(2 Marks)**

