



Kasarani Campus
Off Thika Road
Tel. 2042692 / 3
P. O. Box 49274, 00100
NAIROBI
Westlands Campus
Pamstech House
Woodvale Grove
Tel. 4442212
Fax: 4444175

KIRIRI WOMENS' UNIVERSITY OF SCIENCE AND TECHNOLOGY
UNIVERSITY EXAMINATION, 2024/2025 ACADEMIC YEAR
FIRST YEAR, FIRST SEMESTER EXAMINATION
FOR THE DEGREE OF ECONOMICS AND FINANCE

Date: 11th April, 2024
Time: 2.30pm – 4.30pm

KEC 2101 – ECONOMIC MATHEMATICS

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS

QUESTION ONE (30 MARKS)

A survey was conducted on the newspaper readership of three dailies; the Mirror, the Citizen and the Times, M, C, T respectively and the following data was obtained:

The number of people who read M, C & T was found to be 55, 45 and 39 respectively.

The number that read M & T = 19

The number that read C & M = 15

The number that read C & T = 14

Those who read all the 3 were found to be 4 people only.

Required

a) Represent the information in a Venn diagram **(4 Marks)**

Determine the number of people who:

i) Read the Mirror only. **(2 Marks)**

ii) Read Citizen or Times but not the Mirror **(3 Marks)**

iii) The total number of people interviewed if 5 people read none of the papers. **(3 Marks)**

b) The demand function for the citizen newspaper is linear and it is of the form $P = a + bQ$ where P = price and Q = quantity. The values a and b are constants. When the price is Sh. 2, quantity demanded is 9 units. For every increase in price by Sh. 2, quantity demanded falls by 1 unit and vice versa.

Required:

i) Determine the demand function and hence determine the price that leads to a demand of 4 units. **(5 Marks)**

ii) What price results in zero demand? **(2 Marks)**

iii) Determine the rate of change of price per unit with respect to quantity and interpret it. **(3 Marks)**

c) Suppose during your diploma studies while analyzing your project research. Explain how each aids to accomplish your research project. Giving example in each case

- i) Endogenous and Exogenous (2 Marks)
- ii) Behavioral and technical function (2 Marks)
- iii) Algebraic and non-algebraic functions (2 Marks)
- iv) Finite and infinite sets (2 Marks)

QUESTION TWO (20 MARKS)

a) Given the following Cobb Douglas production function: $Q = AK^\alpha L^\beta$ where Q represents output, K and L represents units of Capital and Labor inputs respectively.

- i) Explain the meaning of A , α and β (3 Marks)
- ii) Express the AP_K , AP_L , MP_K and MP_L in terms of Q (6 Marks)

b) Find the critical values of the following function and determine whether or not the values give rise to a local maximum or minimum

$$y = x^3 - 6x^2 + 9x + 105 \quad (5 \text{ Marks})$$

c) Given the demand for beans as, $Q_b = 4850 - 5P_b + 1.5P_p + 0.1Y$, where

Income $Y = 10,000$

Price of beans $P_b = 200$

Price of Peas $P_p = 100$

Required

- i) Find the income elasticity of demand. (3 Marks)
- ii) Find the cross elasticity of demand (3 Marks)

QUESTION THREE (20 MARKS)

a) A company produces a product which it sells for Ksh. 6,000 per unit. Each unit cost Ksh. 1500 in variable expenses, and fixed costs on an annual basis are Ksh. 4,000,000. If q equals the number of units produced and sold during the year

- i) Formulate the linear cost function (2 Marks)
- ii) Formulate the linear revenue function (2 Marks)
- iii) Formulate the linear profit function (2 Marks)
- iv) What does annual profit equal to, if 100,000 units are produced and sold during the year? (2 Marks)
- v) What level of output is required in order to earn zero profit? (2 Marks)

b) The company estimates that the demand for its product fluctuates with the price it charges. The demand function is $Q = 230,000 - 50P$; where Q equals the number of units demanded and P equals the price in Kshs. The total cost of producing Q units of the product is estimated by the function $C = 460,000 + 360Q + 0.0016Q^2$

- i) Determine how many Q units should be produced in order to maximize annual profit **(5 Marks)**
- ii) What price should be charged? **(3 Marks)**
- iii) Calculate the expected annual profit **(2 Marks)**

QUESTION FOUR (20 MARKS)

a) 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. **(4 Marks)**

b) Consider a Three sector economy defined by :

$$Y = C + I + G$$

$$C = a + bY^d \quad (a > 0, \quad 0 < b < 1)$$

Where $Y^d = Y - T$ $T = T^*$, ($T^* > 0$) $I = I^*$, ($I^* > 0$) $G = G^*$, ($G^* > 0$)

Required

- i) Rewrite C as a function of Y **(2 Marks)**
- ii) Find the equilibrium of Y^* and C^* **(3 Marks)**
- iii) Find the rate of change on equilibrium income with respect to G and I **(3 Marks)**
- iv) Calculate the equilibrium values of Y and C given $a = 0.9$, $b = 80$, $I^* = 60$, $G^* = 40$, $T^* = 20$ **(2 Marks)**

c) 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 for the Market. **(6 Marks)**

QUESTION FIVE (20 MARKS)

- a) Given average revenue and average cost functions as $AR = 4 - \frac{1}{4}Q$ and $AC = \frac{4}{Q} + 2 - 0.3Q + 0.05Q^2$ respectively. Determine the level of price and quantity that maximizes the profit of the firm. **(8 Marks)**
- b) Given the following equation $y = 13x_1^2x_2 + 21x_1x_2^3$, obtain the second order derivative with respect to x_1 and x_2 **(4 Marks)**
- c) Suppose the demand function of a commodity is $P = 30 - Q$ and its supply function $P = 15 + 2Q$. Assume pure or perfect competitive market, determine consumer's and producer's surplus. **(8 Marks)**