MUNHUMUTAPA SCHOOL OF COMMERCE

DEPARTMENT OF ECONOMICS

BACHELOR OF COMMERCE DEGREE

LEVEL 2 SEMESTER 1

EXAMINATION QUESTION PAPER

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| **MODULE CODE** | **HEF212** |
| **MODULE NARRATION** | **QUANTITATIVE METHODS** |
| **DATE** | **2024** |
| **DURATION** | **3 HOURS** |



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**INSTRUCTIONS TO CANDIDATES:**

1. Answer any **four** (4) questions.
2. All question carry equal marks.
3. Start each answer on a fresh page.
4. Show all workings, where applicable.

## QUESTION 1

(a)The demand and supply in a market are $Q^d = \sqrt{8-P}$ and $Q^s = \sqrt{P}$

(i) Sketch both the demand & supply curves with price on the y-axis. [3 marks)

(ii) Calculate the equilibrium price and quantity [2 marks]

(ii) Solve for the consumer and producer surplus. [8 marks]

(b) If the demand and supply functions in a competitive market are;

$$Q^d = 50 - 0.2P \quad Q^s = -10 + 0.3P$$

and the rate of adjustment of price when the market is out of equilibrium is

$\frac{dP}{dt} = 0.4(Qd - Qs)$.

Derive and solve the relevant difference equation to get a function for *P* in terms of *t* given that price is 100 in time period 0. Comment on the stability of this market. [12 marks]

**[Total 25 marks]**

## QUESTION 2

(a) A person has utility function $U(x,y) = \frac{1}{3}In(x) + \frac{1}{4}Iny$. Suppose that the price per unit of $x$ is R3.02 and the price per unit of $y$ is R1.76. Also the person receives R37 and spends all on the two commodities. Solve his utility maximizing problem. [9 marks]

(b) Let $R(Q)$ be the total revenue function and $C(Q)$ be the total cost function

$$R(Q) = 1000Q - 2Q^2$$

$$C(Q) = Q^3 - 62Q^2 + 1600Q + 1500$$

*(i)* State the profit function $\Pi\ (Q)$ and find the profit-maximizing output $Q$. [6 marks]

(ii) At what output level is the marginal revenue of the firm equal to zero. [5 marks]

(c) Solve the differential equation $\frac{dy}{dt} = 6y + 27$ if the value of *y* is 18 when *t* = 0. [5 marks]

[Total 25 marks]

## QUESTION 3

(a) Use Cramers` Rule to solve for $x_1$, $x_2$ and $x_3$ from the following system of equations.

$$x_1 - 2x_2 - x_3 = 0$$

$$-2x_1 + x_2 - x_3 = 7$$

$$x_1 - x_2 = -3$$

[13 marks]

b) Given that A = $\begin{pmatrix} 2 & 2 \\ 1 & 5 \end{pmatrix}$ B = $\begin{pmatrix} 2 & 0 \\ 3 & 2 \end{pmatrix}$ I= $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$

i) Find transpose of A [3 marks]

ii) Find inverse of B [5 marks]

iii) Find matrix C that satisfy (A-2I)C=**I** [7 MARKS]

[Total 25 marks]

## QUESTION 4

(a) Compute the rank of each of the following matrices

(i) $\begin{pmatrix} 2 & -4 & 2 \\ -1 & 2 & 1 \end{pmatrix}$ [5 marks]

(ii) $\begin{pmatrix} 1 & 6 & -7 & 3 \\ 1 & 9 & -6 & 4 \\ 1 & 3 & -8 & 4 \end{pmatrix}$ [5 marks]

Iii) Calculate the determinant of matrix A is given by

$$A = \begin{pmatrix} x^2-y^2 & x+y & x \\ x-y & 1 & 1 \\ x-y & 1 & y \end{pmatrix}$$ [5marks]

c) A person has utility function $U(x,y) = \frac{1}{3}In(x) + \frac{1}{4}Iny$. Suppose that the price per unit of $x$ is R3.02 and the price per unit of $y$ is R1.76. Also the person receives R37 and spends all on the two commodities. Solve his utility maximizing problem. [10 marks]

**[Total 25 marks]**

## QUESTION 5

a) Given utility function $U = (x+2)(y+1)$ and price of x, y and budget (B) being , $P_x = 4$ $P_y = 6$ $B = 130$

   i) Write down the Lagrangian function **[4 marks]**

   ii) Find the optimal level of purchase $\bar{x}$ and $\bar{y}$ **[5 marks]**

   iii) Is the second order sufficient condition for a maximum satisfied **[4 marks]**

   iv) Does the answer in (ii) give any comparative static information? **[2 marks]**

b) Find the relative extremum of the average cost function $AC = f(Q) = Q^2 - 5Q + 8$

**[5 marks]**

c) Find the relative extrema of the function $y = f(x) = x^3 - 12x^2 + 36x + 8$ **[5 marks]**

**[Total 25 marks]**

**END OF EXAMINATION**