AFRICA UNIVERSITY

COLLEGE OF BUSINESS AND MANAGEMENT SCIENCES

NMEC 203: MATHEMATICS FOR ECONOMIST
END OF SEMESTER EXAMINATIONS
NOVEMBER 2024
LECTURER: MR G MANDEWO
TIME: 3 HOURS

INSTRUCTIONS

1. This paper contains **Six** questions.
2. Answer **Four** questions.
3. Start each question on a new page.

Question 1

(a) Demonstrate how functions can be applied in economics in various relationships including:

(i) Demand functions **[3 marks]**
(ii) Cost Functions **[3 marks]**
(iii) Revenue functions **[3 marks]**

(b) A student of economics needs a solid basis in integration, using examples drawn from economics demonstrate the application of the following rules of integration.

(i) Power rule **[4 marks]**
(ii) Sum and difference rule **[4 marks]**
(iii) Exponential rule **[4 marks]**
(iv) Algebraic substitution **[4 marks]**

Question 2

(a) Given the TC function as $TC=Q^3-5Q^2+60Q$

(i) Find AC function **[4 marks]**

(ii) The critical value at which AC is minimized **[5 marks]**

(b) Minimize average cost function $C(Q)=78400+800Q+Q^2$, where C(Q) is the total cost and Q is the production level

(i) Find the production level that will minimize the average cost **[4 marks]**

(ii) Find the minimum average cost **[4 marks]**

(c) Given the demand function of a Food outlet,

$P=56-2Q$

while cost function is

$C(Q)=50+2Q+0.25Q^2$. Find maximizing price, output and maximum profit. **[4 marks]**

(d) The revenue and total cost function for a market production are $R(Q)=125Q-Q^2$. Determine the Marginal revenue when Q = 6 **[4 marks]**

Question 3

(a) Using your own example explain the following concepts in matrices

(i) Square matrix **[2 marks]**
(ii) Zero matrix **[2 marks]**
(iii) Identity matrix **[2 marks]**

(iv) Diagonal matrix **[2 marks]**
(v) Symmetric matrix **[2 marks]**

(b) Illustrate matrix operations that demonstrate

(i) Addition **[2 marks]**
(ii) Subtraction **[3 marks]**
(iii) Scalar multiplication **[5 marks]**
(iv) Matrix multiplication **[5 marks]**

Question 4

(a) A firm's Total cost function is given by the following equation

$$TC = Q^3 - 20Q^2 + 26Q + 90$$

(i) Determine the total variable cost and the total fixed cost. **[3 marks]**
(ii) What is the firm's marginal cost function? **[3 marks]**
(iii) Using two distinct methods, determine the rate of output where the Average Variable cost is at its minimum. **[10 marks]**
(iv) Determine the shutdown decision **[3 marks]**

(b) A common form of production function is the Cobb-Douglas function, expressed as:

$Q=AK^{0.8} L^{0.2}$

You are required to determine
(i) Marginal product of capital, if L is 10 and K is 20 **[3 marks]**
(ii) Marginal Product of Labour, If K is 5 and L is 10 **[3 marks]**

Question 5

a) Using economic numerical examples differentiate between

i) Price elasticity of demand and cross elasticity of demand **[5 marks]**

ii) A demand function and a demand curve **[5 marks]**

iii) Perfect market structure and monopolistic market structure **[5 marks]**

b) Calculate the derivatives of the following function

i) $Y = (2x^2 + 3x)^2$ **[3 marks]**

ii) $Y = (4x + 8) (3x^2 + 5x)$ **[3 marks]**

iii) $Y = 2x + 4\ 3x^2 + 1$ **[4 marks]**

Question 6

(a) Agnes is a campus hustler who sells various items. Last month she observed that she sales dropped from 100 units to 80 units when she increased the price from $1 to $2. Compute, interpret, infer, illustrate **[5 marks]**

(b) In a cinema many seats remain empty. The manager examines the following alternatives:

Decrease in prices 12 % → Increase in entries 15 %

Increase in prices 10 % → Decrease in entries 12 %

Which alternative is chosen if the manager intends to maximize turnover? **[5 marks]**

(c) If the price falls from 6 to 4, the quantity demanded rises from 8000 to 12000. Calculate the price elasticity of demand

What happens to turnover (Price * Quantity) due to the price change? **[5 marks]**

(d) The income elasticities of demand of two goods, A and B, are as follows:

Good A: + 3.0

Good B: - 0.2

Now income rises by 5 %. By how much quantities demanded of A and B will change? **[5 marks]**

Given that TR is equal to price times quantity. Deduce Marginal Revenue (MR) and relate it to the concept of elasticity **[10 marks]**

END OF EXAMINATION