University of Fort Hare
Together in Excellence

Mathematical Economics
ECO 222/ 222E
Supplementary Exam
DEGREE EXAMINATIONS
JANUARY 2019

Time: 3 Hours

Subject: Mathematical Economics 2B Marks: 100

This paper consist of 4 pages including cover page

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INSTRUCTIONS:

- Answer ALL THREE (3) questions, showing clearly all the calculations.
- All questions carry equal marks
- Use a PENCIL to draw clear diagrams where necessary
- Calculators are allowed
- Answers must be rounded off to two (2) decimal places.

Question 1

1.1 For a production function $q = 36K + 120L - 3K^2 - 4L^2 - 10 + 2KL$

(i) By differentiation find MP of labour L and capital K and sketch the graphs [4]

(ii) Dctcrminc maximum value of q. [6]

1.2 The utility function a consumer derives from consuming the two goods A and B can be assumed to be determined by the utility function $U = 40A^{0.25}B^{0.5}$. If A costs R4 a unit and B costs R10 a unit and the cnsumer's income is R600, **Using the Economics and substitution method** what combination of A and B will maximize utility? [10]

1.3 A firm uses four inputs K, L, N, and M at per unit cost of R50, R30, R25 and R20 respectively. The firm operates with a production function of the form:

$$Q = 160K^{0.3}L^{0.25}N^{0.2}M^{0.25}$$

(i) Use the Lagrange Method to find the maximum output the firm can make given a total cost of R30, 000. [20]

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Question 2

2.1 What total revenue a firm will earn if it charges a price of R715 and its $MR = 969 - 0.15q^2$ [7]

2.2 If a firm faces the marginal cost schedule $MC = 180 + 0.3q^2$ and marginal revenue schedule $MR = 540 + 0.6q^2$

(i) And total fixed costs are R65, what is the maximum profit it can make? (Assume that the second-order condition for a maximum is met. [10]

2.3 The demand curve for a product is $P = 60 - q - q^2$ and the supply function is $P = 10 + 4q$.

(i) Determine the equilibrium price and quantity and the value of the consumer's surplus and producer's surplus at equilibrium.

[5]

(ii) What happens to the values of the consumer's surplus and producer's surplus if a tax of 2 per unit is imposed on the supply of the product?

[5]

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Question 3

3.1 A shopper goes to a supermarket and buys 2 litres of milk, 3 loaves of bread and 2 dozen eggs. The respective prices (in rands) are 1.5 per litre, 2 per loaf and 2.5 per dozen.

(i) Define two vectors, one for quantities of groceries purchased and the other for their prices, show that the product of the two vectors will give the total cost of the basket of groceries.

[5]

(ii) Calculate the total cost of the basket, using matrix multiplication. [5]

(iii)If the price of milk rises by 0.5 rands per litre, the price of bread rises by 0.25 rands per loaf, and the price of eggs falls by 1 rand per dozen, calculate by matrix the change in the cost of the basket of groceries. [5]

3.2 Given the following matrix:

$$A = \begin{pmatrix} 3 & 2 & 3 \\ 2 & 3 & 1 \\ 1 & 2 & 3 \end{pmatrix}$$

(i) Derive the adjoint matrix (Adj.A) [3]

(ii) Use the Sarrus' rule find $|A|$ [3]

(iii)Find the inverse matrix A^{-1} [3]

(iv)Prove that $AA^{-1} = I$ [2]

3.3 Consider the following Keynesian model:

Income function	$Y =$	$C + I + G$
Consumption function	$C =$	$c0 + c1(Y-T)$
Investment function	$I =$	$I0 - I1r$
Demand for money	$Md =$	$do \div d1Y - d2r$
Government Spending	$G =$	$G0$
Supply of money	$Ms =$	$M0$
Total Tax	$T =$	$T0$

(i) Use Cramer's rule to solve for Y and r. [7]

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