

1st SEM. 2019/2020



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UNIVERSITY OF SWAZILAND

FINAL EXAMINATION PAPER

PROGRAMME: BSc. in Agricultural Economics and Agribusiness
Management Year II

COURSE CODE: AEM 203

TITLE OF PAPER: MATHEMATICS FOR ECONOMISTS

TIME ALLOWED: 2: 00 HOURS

INSTRUCTION: 1. ANSWER ALL QUESTIONS
2. EACH QUESTION CARRIES 25 MARKS

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THE CHIEF INVIGILATOR

Question 1. (25 marks)

1.1 Given the following technological coefficient of a two sector economy;

$$M = \begin{bmatrix} 0.3 & 0.1 \\ 0.2 & 0.4 \end{bmatrix}$$

The government has planned the level of final demand given below

demand vector $D = \begin{bmatrix} 100 \\ 400 \end{bmatrix}$

determine the levels of total output that will enable the economy to realize the planned level of final demand ?
(8 points)

1.2 A firm has the following total cost and demand functions

$$TC = 50 + 80Q - 6Q^2 + \frac{1}{3}Q^3$$

$$Q = 120 - P$$

What is the level of profits, when $Q = 6$?
(8 points)

1.3 . A multiproduct firm is faced with the following cost function and a production constraint. The production constrains is stipulated in terms of production quota.

$$\text{Cost function : } C = 2Q_1 + 4Q_2 - Q_1Q_2 + 10$$

$$\text{Production quota: } Q_1 + Q_2 = 16$$

- a) Set up a constrained cost minimization problem from the information given.
- b) Construct the corresponding Lagrangian function.
- c) Determine the critical values of Q_1 and Q_2 .
- d) Confirm that the critical values present a minimum
(9 points)

Question 2. (25 marks)

- 2.1 Given $Q = 30 - 3p + 0.02y$, where Q is quantity demanded, p is price, and y is income, and given $p = 60$ and $y = 1000$
Find the a) price elasticity of demand.
b) income elasticity of demand (12 points)

- 2.2 The owner of a café has found that the relationship among the daily demand for ice-cream and the prices charged for ice-cream (i) and cool drinks (c) is expressed by means of the equation $D = 67 - 245i + 56c$, where D is measured in liters, i in cents per liter and c in cents per can.

Calculate the partial derivatives $\frac{\partial D}{\partial i}$ and $\frac{\partial D}{\partial c}$. Explain the meaning of these derivatives. (13 points)

Question 3. (25 marks)

- 3.1 Find MPK and MPL for the following production function $Q = 16K^{1/2}L^{1/4}$ and determine whether or not the function is characterized with diminishing returns to factor inputs. (8 points)

- 3.2 Calculate the definite integrals.

a) $\int_0^1 e^x dx$

b) $\int_1^2 x(x^2 + 6) dx$ (8 points)

- 3.3 An analysis of the financial statements of a coal mine, indicates that when x tons of coal are extracted a day, the income and cost (E) of the mine are respectively;

$$I(x) = 300x - 2x^2$$

$$C(x) = x^2 - 2x + 500.$$

The mine is taxed at a rate of 30% on its gross profit.

- Determine a. the value of x which maximize the income.
b. the gross profit and the value of x which maximizes it.
c. the net profit and the value of x which maximizes it. (9 points)

Question 4. (25 marks)

4.1 Consider the following demand function for good a

$$Q_a = 200 - 4p_a - 2p_r + 0.2y$$

Where Q_a = Quantity of good a in demand.

p_a = price of good a.

P_r = price of some related goods r.

Y = consumer income.

Given $p_a = 20$, $p_r = 24$, $y = 2000$,

Find the following elasticity and interpret your results.

- a) Own price elasticity of demand
 - b) Cross-price elasticity of demand
 - c) Income elasticity of demand
- 4.2 Find consumers' surplus, given the following demand function and equilibrium price. $P = 50 - 0.5Q$; $P_e = 30$. (8 points)
- 4.3 Find producers' surplus, given the following supply function and equilibrium price. $P = 3 + 2Q$; $P_e = 9$. (9 points)

END OF PAPER