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UNIVERSITY OF NAMIBIA

FACULTY	AGRICULTURE, ENGINEERING AND NATURAL SCIENCES		
SCHOOL	AGRICULTURE AND FISHERIES SCIENCES RESOURCES		
DEPARTMENT	ANIMAL PRODUCTION, AGRIBUSINESS AND ECONOMICS		
SUBJECT	MATHEMATICAL ECONOMICS AND LINEAR PROGRAMMING		
SUBJECT CODE	AEC 3612		
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DURATION	**3 HOURS**	**MARKS**	**100**

FIRST OPPORTUNITY EXAMINATION QUESTION PAPER

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This question paper consists of FOUR (4) pages including this front page

Instructions

- Answer all questions and all questions carry equal marks
- Please write legibly and number your questions clearly
- Show your calculations to two decimal places
- Use a calculator
- Start each question on a new page

UNIVERSITY OF NAMIBIA EXAMINATIONS

QUESTION 1 [20 MARKS]

a) What relation (parallel, perpendicular, coincident, or intersecting) does the line $y - 2x - 4 = 0$ have to the following lines?

i. $y - x - 2 = 0$ (2)
ii. $4y - 8x - 16 = 0$ (2)
iii. $5y - 10x - 4 = 0$ (2)
iv. $y - 3x - 4 = 0$ (2)
v. $2y + x - 6 = 0$ (2)

b) Which of the following equations represents demand curves, which represent supply curves, and which represents neither demand nor supply curves? (Assume y represents price and x represents quantity).

(i) $x - 2y = 0$ (2)
(ii) $3x - 4y - 10 = 0$ (2)
(iii) $y - 4 = 0$ (2)
(iv) $x - 3 = 0$ (2)

c) Find the domain of the following defined functions:

$If\ x \in R$, then find the value of $f(x) = \frac{1}{x^2-9}$ (2)

QUESTION 2 [20 MARKS]

a) Prove that;

$i) \begin{vmatrix} 1 & x & y+z \\ 1 & y & z+x \\ 1 & z & x+y \end{vmatrix} = 0$ (5)

$ii) \begin{vmatrix} y+x & x & x \\ y & z+x & y \\ z & z & x+y \end{vmatrix} = 4xy$ (5)

b) Consider an economy with 3 sectors represented by the following:

$$A = \begin{vmatrix} 0.1 & 0.3 & 0.1 \\ 0 & 0.2 & 0.2 \\ 0 & 0 & 0.3 \end{vmatrix}$$

Where the demand levels are given as F_1, F_2, F_3. Find the level of output, $F_1 = 20, F_2 = 0\ and\ F_3 = 100.$ (10)

QUESTION 3 **[20 MARKS]**

Consider a demand function for Omaere at Neudamm farm as $y = 20 - 4x$ and the average cost is given as: $\bar{y}_c = 2$. Given this information, derive and solve the following:

i) Derive the Total revenue function (2)

ii) Derive the total cost function (2)

iii) Derive the total cost after tax (2)

iv) If a tax of t per unit quantity is imposed on the Neudamm Omaere, determine the maximum possible profit and the value of t for which tax revenue is maximized. (9)

v) Determine the maximum possible profit if a $33\frac{1}{3}\%$ sales tax is imposed. (5)

QUESTION 4 **[20 MARKS]**

a) A firm has the production function $TC = 120 + 0.1Q^2$ and sells its output in two separate markets with the demand functions: $Q_1 = 800 - 2P_1$ and $Q_2 = 750 - 2.5P_2$. Find the profit maximizing output and sales in each market, using the Hessian to check SOC for a maximum. (8)

b) Apply the concept of integrals to solve the following:

i) If a firm spends N$650 on fixed costs, what is its total cost function if its marginal cost function is $MC = 82 - 16Q + 1.8Q^2$? (6)

ii) What total revenue will a firm earn if it charges a price of N$715 and its marginal revenue function is $MR = 960 - 0.15Q^2$? (6)

QUESTION 5 **[20 MARKS]**

a) Solve the set of simultaneous linear equations using Cramers' rule:

$$3x_1 + x_2 - x_3 = 2$$
$$x_1 - 2x_2 + x_3 = -9$$
$$4x_1 + 3x_2 + 2x_3 = 1$$ (6)

b) Outline the basic steps for solving a standard LP problem using the simplex method. (3.5)

c) Neudamm butchery produces sausages and minced meat, each of which must be processed through two machine centres. Machine 1 has a maximum of 120 hours available and machine centre 2 has maximum of 180 hours available. Producing sausage requires 6 hours in machine 1 and 3 hours in machine 2, producing minced meat requires 4 hours in machine 1 and 10 hours in machine 2. If profit is N$450 for sausage and N$550 for minced meat,

use the steps you outlined in part C (above) to set-up a Tableau and you will determine the number of sausages and minced meat that should be processed in order to maximize profit at the Neudamm farm butchery. (10.5)

End