



**NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY**

**FACULTY OF HEALTH, NATURAL RESOURCES AND APPLIED SCIENCES
SCHOOL OF NATURAL AND APPLIED SCIENCES
DEPARTMENT OF MATHEMATICS, STATISTICS AND ACTUARIAL SCIENCES**

QUALIFICATION: BACHELOR OF ECONOMICS	
QUALIFICATION CODE: 07BECO	LEVEL: 5
COURSE CODE: MFE511S	COURSE NAME: MATHEMATICS FOR ECONOMISTS 1A
SESSION: JUNE 2023	PAPER: THEORY
DURATION: 3 HOURS	MARKS: 100

FIRST OPPORTUNITY EXAMINATION QUESTION PAPER	
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MODERATOR:	MR E. MWAHI

INSTRUCTIONS
<ol style="list-style-type: none">1. Answer ALL the questions in the booklet provided.2. Show clearly all the steps used in the calculations.3. All written work must be done in blue or black ink and sketches must be done in pencil.4. Decimal answers must be rounded to 4 decimals places

PERMISSIBLE MATERIALS

1. Non-programmable calculator without a cover.

THIS QUESTION PAPER CONSISTS OF 3 PAGES (Including this front page)

QUESTION 1 (30 marks)

1.1 Simplify the following expressions.

1.1.1 $\frac{(a+b)^2 - c^2}{a^2 + ab + ac + bc} \times \frac{a^2 + ab - ac - bc}{a + b + c} \div \frac{2a^2 - ac - c^2}{a^2 - c^2}$ [7]

1.1.2 $\frac{14^{n+4} + 7^{n+3} \times 2^{n+3}}{13 \times 14^{n-1} + 14^n}$ [5]

1.1.3 $\log_2 5 \times \log_3 \sqrt{8} \times \log_5 3$ [4]

1.2 Solve each of the following equations:

1.2.1 $\log_3 \left[\left(\log_{\frac{1}{2}} y \right)^2 - 3 \log_{\frac{1}{2}} y + 5 \right] = 2$ [8]

1.2.2 $4x^2 + 5x - 6 = 0$ (use completion of squares method) [6]

QUESTION 2 (25 marks)

2.1 The Investment-Savings (IS) and Liquidity Preference – Money Supply (LM) models of a certain 3-sector economy, $Y = C + I + G$, economy compose the following:

$$\begin{aligned} & \boxed{IS} \\ C &= 100 + 0.75Y_d; Y_d = Y - T \\ I &= 50 - 25i \\ G &= T = 50 \end{aligned}$$

$$\begin{aligned} & \boxed{LM} \\ M^d &= Y - 25i \dots \text{demand} \\ M_s &= 250 \dots \text{supply} \end{aligned}$$

Derive the IS and LM equations and hence determine the equilibrium levels of income and rate of interest. [10]

2.1 Consider the following production function for bus transportation in a city:

$$Q = \alpha L^{\beta_1} F^{\beta_2} K^{\beta_3}$$

where , L = Labour input in worker hours

F = Fuel input in gallons

K = Capital input in number of busses

Q = Output in millions of bus mileage

and the estimate of the various parameters using historical data given as:

$$\alpha = 0.012; \beta_1 = 0.45; \beta_2 = 0.35; \beta_3 = 0.20$$

- 2.2.1 Define α [2]
- 2.2.2 State with reason what type of returns to scale are present in this production function. [4]
- 2.2.3 Suppose that number of busses increases by 12%. By what percentage will output increase? [4]
- 2.2.4 Assume that labour hours = 8 hours, the fuel input = 11500 litres, and number of buses = 60, what will be the **total mileage output** for these buses? [5]

QUESTION 3 (20 marks)

- 3.1 The demand function for a certain commodity is $p(x) = 10 - 0.001x$, where p is measured in N\$ and x is the number of units. The total cost of producing x items is $C(x) = 50 + 5x$.
By using a derivative approach, determine the level of production that maximises the profit? [10]

- 3.2 Given the production

$$Q = K^2 + 2L^2$$

- 3.2.1 Determine the marginal products of $\frac{\partial Q}{\partial K}$ and $\frac{\partial Q}{\partial L}$ [2]
- 3.2.2 Show that $MRTS = \frac{2L}{K}$ and $K \frac{\partial Q}{\partial K} + L \frac{\partial Q}{\partial L} = 2Q$ [3]
- 3.3 Use implicit differentiation to determine $\frac{dy}{dx}$ for the implicit function $3x^3 + 5xy^2 - 4y^3 = 8x^2$ and determine the slope of this curve at (1,1). [5]

QUESTION 4 (25 marks)

- 4.1 Determine the following integrals:

4.1.1 $\int \left(\frac{x^3 + 2x^2 - 4x + 1}{\sqrt{x}} \right) dx$ [6]

4.1.2 $\int_{-2}^3 e^{\frac{-x}{2}} dx$ [5]

- 4.2 The supply functions of for bailes of vintage clothes from Angola is given (in N\$) by $S(x) = x^2 + 10x$, and the demand function (in N\$) by $D(x) = 900 - 20x - x^2$.

- 4.2.1 Find the (Q, P) point at which supply and demand are in equilibrium [4]
- 4.2.2 Find the consumer surplus [5]
- 4.2.3 Find the producer surplus [5]

.....END OF EXAMINATION.....