MACHAKOS UNIVERSITY

University Examinations for 2022/2023 Academic Year

SCHOOL OF BUSINESS, ECONOMICS AND HOSPITALITY AND TOURISM MANAGEMENT

DEPARTMENT OF ECONOMICS

FIRST YEAR FIRST SEMESTER EXAMINATION FOR

BACHELOR OF ECONOMICS AND FINANCE

BACHELOR OF ECONOMICS AND STATISTICS

BACHELOR OF ECONOMICS

EES 100- MATHEMATICS FOR ECONOMISTS 1

DATE: **TIME:**

INSTRUCTIONS

- (i)   **Answer question one (Compulsory) and any other two questions**
- (ii)   **Do not write on the question paper**
- (iii) **Show explicitly all formulas and calculations**
- (iv)   **Non – programmable calculators may be used.**
- (v)   **Note that there is no borrowing in the exam room; a candidate MUST have his/her own stationeries.**

QUESTION ONE (30 MARKS)

a)   Given A = [1,2,3,5], B = [1,2,4,6], C = [1,2,3,4,7] prove that

$AU(B \cap C) = (AUB) \cap (AUC)$ (4 marks)

b)   Consider the following two commodity market model in which both demand and supply functions are assumed to be linear

$$Qd_1 = 8 - 2P_1 + P_2$$
$$Qs_1 = -5 + 3P_1$$
$$Qd_1 = Qs_1$$
$$Qd2 = 16 + P_1 - P_2$$
$$Qs_2 = -1 + 2P_2$$
$$Qd_2 = Qs_2$$

Determine the equilibrium quantity and price for each of the commodities   (6 marks)

c)   The following expressions give the demand and average total cost function of a firm:

$$P = 6 - \tfrac{3}{4} Q$$

$$ATC = Q - 2/5 + 5/q$$

i)   Calculate the total revenue for the firm.   (2 marks)

ii) Determine the corresponding profit function.   (3 marks)

d)   Find dy/dx for :

i) $Y = \dfrac{X^2 - 1}{X + 1}$ (3 marks)

ii) $Y = (X^2 + 4X - 6)^3$ (3 marks)

e)   Complete the table below by indicating the type of the given numbers as either natural or whole or integer or rational or irrational.

Number	117	0	-12.64039	-½	6.36	-3
Table						

                                                                                  (6 marks)

f)   With aid or relevant examples and illustrations, distinguish between a "Relation" and a "Function"   (3 marks)

QUESTION TWO (20 MARKS)

a)   The monthly demand for T-shirts in Nairobi City is given by;

$$P = -0.05X + 25; \quad (0 < X < 400)$$

Where P denotes the wholesale unit price in Kenya shillings, and X denotes the number of T-shirts demanded. The monthly cost function for these T-shirts is given as:

$$C(x) = -0.001X^2 + 2X + 200$$

i.)   Find the revenue and profit functions   (6 marks)

ii.) Find the marginal cost, marginal revenue, marginal average cost, and marginal profit functions.   (8 marks)

b)   In a survey of 100 students at the school of Economics, it was found that 50 students used the University's library, 40 had their own library and 30 borrowed books. Of these, 20 used both the university library and their own. 15 used their own library and borrowed books, and 10 used the university library and borrowed books. Using a Venn diagram, determine the number of students who used all three sources of books.   (6 marks)

QUESTION THREE (20 MARKS)

a)   Suppose that a factory manager is setting up a production schedule for two models of a new product. Model A requires 4 resistors and 9 transistors. Model B requires 5 resistors and 14 transistors. From its suppliers, the factory gets 335 resistors and 850 transistors. How many of each model should the manager plan to make each day so that all the resistors and transistors are used?   (8 marks)

b)   Expand the following expression   (6 marks)

$(a + x)^5$

c)   Simplify the following using exponent and logarithms rules:

                                                                                                              (6 marks)

     i. $x = y^{1/4} \times y^{3/4}$ iv. $n = (x^{3/4})^8$

     ii. $y = x^2 / X^{3/2}$ v. $M = x^2 y^3 / x^4 y$

     iii. $x = \log_3 9$ vi. $X = \log_4 2$

QUESTION FOUR (20 MARKS)

a)   Given the following equation

           $3X - 5y = 15;$

     i.)   Find the slope of the linear curve given by the above equation   (4 marks)

     ii.)   Find the vertical intercept of the curve   (3 marks)

     iii.)   Write an equation for the line that passes through (-2, 5) and (1, 7). (3 marks)

b)   Consider a production function

     $Q = AL^{\propto}$ $0 < \propto < 1;$ $A > 0$

     Required

     i.   Find the marginal product of L   (3 marks)

     ii.   Determine the slope of MPL   (2 marks)

     iii.   What is the sign of the slope of MPL   (2 marks)

     iv.   Determine what happens to MPL as L increases; explain and illustrate. (3 marks)

QUESTION FIVE (20 MARKS)

a) An individual's level of consumption is 120 when he has Zero income, and his consumption rises by 85 for every 100 unit s additions to his income (8 marks)

Determine

    i)   The individual's consumption function (2 marks)

    ii)   His Marginal propensity to consume (MPC) (2 marks)

    iii)   His Marginal Propensity to save (MPS) (2 marks)

b) If Kenya's National Income was 3 trillion in 2014, and assume that it grew at 4% per year, what will be Kenya's National Income in the year 2034? (5 marks)

c) Find the value of x in the following functions:

    i. $f(x) = 2x + 3$; find $f(-2)$ (3 marks)

    ii. $f(x) = x^2 - x + 7$; find $f(2y)$ (3 marks)

    iii. $f(x) = x^2 - 3$; find $f(a - 1)$ (3 marks)