



Machakos University College

(A Constituent College of Kenyatta University)

SCHOOL OF PURE AND APPLIED SCIENCES

FIRST YEAR SECOND SEMESTER EXAMINATIONS FOR BACHELOR OF ARTS IN
ECONOMICS

EES 100: MATHEMATICS FOR ECONOMICS 1

DATE:

TIME:

INSTRUCTIONS:

- Answer question ONE which is compulsory and any other TWO

SECTION A

Question 1: 30 Marks

(a) Describe the following terms as used in business mathematics

- (i) Null set
- (ii) Singular matrix
- (iii) Breakeven point (6 marks)

(b) Differentiate between each of the following terms:

- (i) Definite and indefinite integrals
- (ii) Finite and infinite sets (4marks)

(c) (i) A company has its total cost function given by $TC = 600 - 5x$ and the total revenue function given by $TR = 20 - x$; where x is the quantity of goods produced. Determine the firm's break even quantity. (4 marks)

(ii) If $y = \frac{2te^t}{\cos 2t}$, determine $\frac{dy}{dt}$ (5 marks)

(d) A company started manufacturing two products A and B. Each unit of A is expected to give a profit of ksh 200 and a unit of B will give ksh 300. Each unit of A requires 3hrs processing through machine I and 2hrs in machine II while each unit of B requires 2hrs processing through machine 1 and 4hrs in machine II. There are only 200 hrs of machine 1 and 250 hrs of machine II available per shift. Formulate equations showing:

- (i) Total profit possible per shift (2marks)
- (ii) Resource (machine time) utilization (3 marks)

- (e) A manufacturer has identified that his marginal cost of producing a unit of his product is given by $MC(x) = 0.000003x^2 - 0.003x - 240$. Given that his total costs are ksh 112,500 when no production is taking place (i.e. his fixed costs). Determine the total cost function. (6 marks)

SECTION B

Question 2

- (a) Patricia runs a small events-organizing company based in Nairobi. She has just received an order to organize an SME development seminar at the Sarova Stanley hotel hosted by the World Bank. She has concluded that there is a linear relationship between her costs and the number of participants attending the seminar. She is billing the World Bank ksh 10,000 per participant while the hotel charges ksh 2500 per participant for meals in addition to ksh 225,000 fixed charge for the hall. Formulate the revenue, cost and profit functions using x as the number of participants attending the event. (6 marks)
- (b) A survey conducted among new students at a local university established that among the enrolled students: 150 enrolled for economics, 200 for statistics, 175 for mathematics, 65 both mathematics and statistics, 80 for mathematics and economics, 50 for both economics and statistics, 20 took all the three subjects, 12 enrolled for psychology with 4 of them taking economics as their only other subject. Represent the above on a Venn diagram showing total enrolment and split them among the subjects. (14 marks)

Question 3

(a) Given that $A = \begin{bmatrix} 2 & 2 \\ 3 & 1 \end{bmatrix}$ $B = \begin{bmatrix} 1 & 1 \\ 3 & 4 \end{bmatrix}$ $C = \begin{bmatrix} 3 & 1 \\ 2 & 2 \end{bmatrix}$

Show that:

- (i) $(A + B)^T = A^T + B^T$
 (ii) $(AB)^T = B^T A^T$
 (iii) $(ABC)^T = C^T B^T A^T$ (6 marks)

- (a) A manufacturer of designer shoe has realized that if he wants to increase his output, he must lower the prices of the prices of his shoes. His total revenue $R(x)$ from output of x shoes is given by: $R(x) = 540x - 2x^2$. His production costs are ksh 10,000 fixed and ksh 40 per unit. Determine
- (i) The level of production that will maximize his revenue. (5 marks)
 (ii) His maximum total revenue. (2 marks)
 (iii) His profits function in terms of output. (2 marks)
 (iv) The level of output that will maximize the profit. (5 marks)

Question 4

- (a) The marginal profit of a company is given as $m\pi = 100 - 2q$ where q is the sales units. It is also established that the company's breakeven point is 5 units, determine the fixed cost of the firm. (8 marks)
- (b) The marginal cost of producing x units is $C = 36 + (x - 8)^2$ and the marginal revenue for selling x units is $R = 100 - 2x$. Determine:

- (i) The profit maximizing output for the firm
- (ii) The value of the maximum profit. (12 marks)

Question 5

- (a) Evaluate $\int_1^4 \left(\frac{x+1}{\sqrt{x}}\right)$ (6 marks)

- (b) A company produces three types of speed regulators X,Y and Z, each of which requires assembly, calibration, and testing;

Type X requires 2 hours for assembly, 3 hours for calibration and 1 hour for testing

Type Y requires 5 hours for assembly, 1 hour for calibration and 2 hours for testing

Type Z requires 3 hours for assembly, 2 hours for calibration and 1 hour for testing. The company has 27 hours for assembly, 20 hours for calibration, and 11 hours for testing.

Use the information provided to:

- (i) Formulate a system of simultaneous equations. (3marks)
- (ii) Calculate the number of speed regulators of each type produced using the crammer's rule given that there is an optimum utilization of resources in the company. (11 marks)