



# MACHAKOS UNIVERSITY

University Examinations 2019/2020 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES

University Supplementary Examinations  
**BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY**  
**SIT 404: MANAGEMENT MATHEMATICS**

DATE:

TIME:

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**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 management mathematics

- (i) Domain
- (ii) Breakeven point (2marks)

(b) 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)

(c) A firm's demand function is given by  $p = 100 - 2x$  and its cost function is  $C(x) = 20x + 3000$ . Determine the optimum level of output for profit maximization (6marks)

(d) Differentiate between the terms definite and indefinite integrals. (2marks)

(e) Evaluate the value of the integral  $\int_1^4 \left(\frac{x+1}{\sqrt{x}}\right) dx$  (6 marks)

(f) A manufacturer has identified that his marginal cost of producing a unit 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).

- (i) Determine the total cost function. (6marks)

- (ii) The number of units which the total cost is minimized (4marks)

## 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. (6marks)
- (b) 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. (5marks)
  - (ii) His maximum total revenue. (2marks)
  - (iii) His profits function in terms of output. (2marks)
  - (iv) The level of output that will maximize the profit. (5marks)

## Question 3

- (a) Given  $C = 36 + (q - 8)^2$ , where  $C$  is the marginal cost of producing  $q$  units and  $R = 100 - 2q$  Where  $R$  is marginal revenue from selling  $q$  units.
- (i) Determine the profit maximizing output for the firm. (2marks)
  - (ii) Derive the equations for the total cost and total revenue (assume the constant terms to be zero). (8marks)
- (b) A manufacturer makes two products  $p$  and  $q$ . the cost of making 15 units  $p$  and 10 units of  $q$  is sh 600. The cost of making 5 units  $p$  and 8 units of product  $q$  is sh 340. The manufacturer makes a profit of 20% and 25% on each unit of product  $p$  and product  $q$  respectively.
- (i) Calculate the cost of making one unit of product  $p$  and product  $q$ . (6marks)
  - (ii) Calculate the selling price of one unit of product  $p$  and product  $q$ . (4marks)

## Question 4

- (a) Given that  $k = 2x^2y^3 + 3\sqrt{xy}$ , determine  $\frac{\partial k}{\partial x}$  and  $\frac{\partial k}{\partial y}$  when  $x=2$  and  $y=3$ . (6marks)
- (b) A company that manufactures computers has determined that its production function is given by  $p(x, y) = 50x + 800y + 3x^2y + x^3 - \frac{y^4}{4}$  where  $x$  is the size of labor

force(measured in work-hour) and  $y$  is the capital(measured in units \$100) invested. Determine the marginal productivity of labor and capital when  $x=50$  and  $y=20$ . (6marks)

- (c) The total profit for a firm has been found to be related to the expenditure when utilizing  $x$  units of skilled labor and  $y$  units of unskilled labour. The function is give by

$profit \pi = 48x + 60y + 10xy - 10x^2 - 6y^2$ . Determine the values of  $x$  and  $y$  that maximize profit.

(8marks)

### Question 5

- (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)