



MACHAKOS UNIVERSITY

University Examinations for 2021/2022 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

FOURTH YEAR FIRST SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (INFORMATION TECHNOLOGY)

SIT 404: MANAGEMENT MATHEMATICS

DATE: 18/3/2022

TIME: 8:30 – 10:30 AM

INSTRUCTIONS

- Answer question ONE which is compulsory and any other TWO

QUESTION ONE (COMPULSORY) (30 MARKS)

- (a) Describe the following terms as used in management mathematics
- (i) Domain
 - (ii) Breakeven point (2 marks)
- (b) Given that $y = \frac{3x^3 - 2\sqrt{x} + 5\sqrt[3]{x^4}}{x^2}$ evaluate $\frac{dy}{dx}$ (6 marks)
- (c) 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)
- (d) If the total costs are given by $c(x) = 360 + 10x + 0.2x^2$ and total revenue are given by $R(x) = 50x - 0.2x^2$
- (i) Form the profit function. (2 marks)
 - (ii) Determine the maximum profit point. (4 marks)
- (e) Evaluate the value of the integral $\int_1^4 \left(\frac{x+1}{\sqrt{x}}\right) dx$ (6 marks)
- (f) 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 (6 marks)

QUESTION TWO (20 MARKS)

- (a) A manufacturer has identified that his marginal cost of producing a unit product is given $mc(x) = 0.000003x^2 - 0.003x - 240$. 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. (6 marks)
 - (ii) The number of units which the total cost is minimized (4 marks)
- (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. (6 marks)
 - (ii) Calculate the selling price of one unit of product p and product q. (4 marks)

QUESTION THREE (20 MARKS)

- (a) The marginal cost of producing x units of a company is $mc = x^2 + 100 - 16x$ and marginal revenue from selling x units is $R = 2(50 - x)$.
- (i) Determine the profit maximizing output for the firm. (2 marks)
 - (ii) Assuming the constant terms to be zero determine the equations for the total cost and total revenue. (8 marks)
- (b) 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. (6 marks)
 - (ii) The number of units which the total cost is minimized (4 marks)

QUESTION FOUR (20 MARKS)

- (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 $y=3$. (6 marks)
- (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 $y=20$. (6 marks)
- (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 given by $profit \pi = 48x + 60y + 10xy - 10x^2 - 6y^2$. Determine the values of x and y that maximize profit. (8 marks)

QUESTION FIVE (20 MARKS)

- (a) The Max ltd employed a cost accountant who developed two functions to describe the operations of the firm .He found the marginal revenue function to be $MR = 25 - 5x - 2x^2$ and the marginal cost function to be $MC = 15 - 2x - x^2$ where x is the level of output. Using the above information determine the profit maximizing output and the total output (10 marks)
- (b) Jones ltd has acquired a second-hand machine for making spanners with a 45000 units capacity per run; the financial manager has come up with the equation below that represents the total cost function for the machine.

$$C(x) = 250000 + 0.08x + \frac{200,000,000}{x}$$

- (i) Determine how many spanners should be produced to maximize total cost (7 marks)
- (ii) Calculate the minimum cost of the company (3 marks)