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KIRIRI WOMENS' UNIVERSITY OF SCIENCE AND TECHNOLOGY UNIVERSITY EXAMINATION, 2024/2025ACADEMIC YEAR FIRST YEAR, SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE (BUSINESS ADMINISTRATION)

Date: 12th August, 2024 Time: 8.30am -10.30am

KBA 2106 MANAGEMENT MATHEMATICS 11

INSTRUCTIONS TO CANDIDATES

ANSWER **QUESTION ONE** (COMPULSORY) AND ANY OTHER TWO QUESTIONS

QUESTION ONE (30 MARKS)

- At a certain factory, the marginal cost is $3(x 4)^2$ dollars per unit when the level of production a) is x units. By how much will the total manufacturing cost increase if the level of production is raised from 6 units to 10 units? (5 marks)
- Use relevant examples to explain the concept 'transpose' as used in matrix algebra. b)
- Find the minimum point for the cost function $c = q^2 30q + 200$ where q is the quantity c) produced. (3 marks)

Given the matrix $A = \begin{pmatrix} 2 & 0 & 4 \\ -1 & 2 & 1 \\ 1 & 2 & 3 \end{pmatrix}$. Find A^{-1} and hence compute $A^{-1}A$. (3 marks) d)

e) Find the derivatives of the following functions with respect to x:

i)
$$y = \frac{x^3 + x}{2x + 1}$$
 (3 marks)

ii)
$$y = \sqrt{(x^2 - 2x + 5)^3}$$
 (3 marks)

Mwihoko Enterprises in Mwihoko Town has derived its Total Cost (TC) and total revenue (TR) f) to be $TC = 80Q + Q^2 + 100$ and TR = 120Q. Find the profit maximization output.

(3 marks)

(3 marks)

A small-scale manufacturer has production facilities for producing two different products. Each g) product requires three different operations: grinding, assembling and testing each unit of product I requires 15, 20 and 10 minutes to grind, assembling and test respectively; whereas each unit of product II requires 7.5, 40 and 45 minutes for grinding, assembling and testing. The production run calls for at least 7.5 hours of grinding time, at least 20 hours of assembling time, and at least 15 hours of testing time. If each unit of product I costs 60 dollars and each unit of product II costs 90 dollars to manufacture. Develop a linear program that can be used to determine the number of units for each product the firm should produce in order to minimize the costs of operations. (4 marks) (3 marks)

Evaluate the given limit $\lim_{x\to -1} \frac{\sqrt{x+2}+2}{x+4}$ h)

QUESTION TWO (20 MARKS)

a) A company is manufacturing two types of products A and B. Production is limited to 80 units of product A and 60 units of product B. Production of each of these products require 5 units and 6 units of electronic components respectively. The electronic components are supplied by another manufacturer and the supply is limited to 600 units per day. The company has 160 employees, i.e., the labour supply amounts to 160-man days. The production of 1 unit of product A requires 1 man day of labour and the production of 1 unit of product B requires 2-man days of labour. Each unit of these products is sold at a profit of 50 dollars and 80 dollars respectively. Formulate a linear programming problem and use graphical method to determine the number of units of each product so that the profit is maximum.

(7 marks)

(5 marks)

- b) Transline Classic Transport Company estimates its cost function to be $TC = Q^3 + 5Q^2 + 50$ where Q represents the number of passengers transported each day between Kisii and Nairobi. If in a particular day the company transported 100 passengers, find the company's marginal cost for that particular day.
- c) In a certain tourist hotel there are 2 major dishes beef and fish. The marketing manager is interested in the eating habits of the customers in this hotel. He discovered that of those who ate beef on a particular day 50% do so the following day while the rest change to fish. Of those who eat fish 45% change to beef. If the eating level as at yesterday was 25% for beef and 75% for fish. Assuming that these conditions satisfy Markov conditions, Determine:-

i)	Transition Matrix	(3 marks)
ii)	Eating levels at the equilibrium point	(5 marks)

QUESTION THREE (20 MARKS)

- a) Spark fresh company produces three products every day. Their total production on a certain day is 45 tons. It is found that the production of the third product exceeds the production of the first product by 8 tons while the total combined production of the firsthand third product is twice that of the second product. Determine the production level of each product using matrix method. (11 marks)
- b) Evaluate $\int_{2}^{5} (4x^{3} + 3x^{2} + 10x 5) dx$

(4 marks)

c) Consider the following matrices

$$A = \begin{pmatrix} 2 & 4 \\ 3 & 6 \\ 1 & 8 \end{pmatrix} \text{ and } B = \begin{pmatrix} 5 & 4 \\ 2 & 4 \\ 9 & 1 \end{pmatrix}$$

Compute $A^T B$

(5 marks)

QUESTION FOUR (20 MARKS)

a) Use matrix method to solve for x, y and z in the following simultaneous linear equations:

$$2x + 3y + 4z = 1$$

$$x + 2y + 3z = 1$$

$$x + 4y + 5z = 2$$
(8 marks)

- b) Differentiate the function $y = (x^2 5)^4(2x + 1)$.
- c) A company produces two types of pens, say, A and B. Pen A is of superior quality and pen B is of lower quality. Profits of pen A and B are Ksh. 5 and Ksh. 3 respectively. Raw material required for each pen of type A is twice as that of pen of type B. The supply of raw material is sufficient only for 1000 pens of type B. Pen A requires special clips and 400 such clips are available per day. Pen B also requires a particular type of clip and 700 such clips are available per day. Develop a linear programming problem and solve it graphically

(8 marks)

(3 marks)

(4 marks)

QUESTION FIVE (20 MARKS)

- a) We need to enclose a rectangular field with a fence. We have 500 feet of fencing material and a building is on one side of the field and so won't need any fencing. Determine the dimensions of the field that will enclose the largest area.
- b) Find the third derivative of the function $y = 3x^4 + 2x^3 6x^2 + 4x + 5$ (6 marks) (2 marks)

c) Solve the system of linear equations using substitution method -3x + y = 16

$$2x - y = -14$$

d) Bidii Company Limited manufactures large scale units. The marginal cost for the company is estimated at Ksh. (92 - 2y) thousands, where y is the number of units of output per week. The fixed costs are Kshs. 800,000. It is also estimated that the marginal revenue is Kshs. (112 - 2y) thousands.

Required; Estimate:

- i) The equation for total cost
- (3 marks) ii) The equation for total revenue
 - (3 marks)
- iii) Hence establish the break even situation for the company.

(3 marks)