



(University of Choice)

**MASINDE MULIRO UNIVERSITY OF SCIENCE
AND TECHNOLOGY**

(MMUST)

SCHOOL BASED

UNIVERSITY MAIN EXAMINATIONS

2023/2024 ACADEMIC YEAR

FIRST YEAR FIRST SEMESTER EXAMINATION

FOR THE DEGREE

OF

BACHELOR OF EDUCATION

COURSE CODE: BCB 102

COURSE TITLE: BUSINESS MATHEMATICS

DATE: FRIDAY, 15TH/12/2023 TIME: 2:00-4:00PM

INSTRUCTIONS TO CANDIDATES

Answer question ONE and any other TWO questions

TIME: 2 HOURS

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 3 Printed Pages. Please Turn Over.



QUESTION ONE

- a) The table below shows the number of items A, B and C sold in two shops on three particular days of the week.

		Shop one					Shop two		
		Mon	Tue	Wed			Mon	Tue	Wed
	A	12	17	13		A	17	9	12
	B	4	18	10		B	16	7	10
	C	11	16	7		C	12	14	9

The prices of the three products A, B and C in Shop one and Shop two are shown below

	Price (shs) Shop One		Price (shs) Shop Two
A	32	A	38
B	17	B	40
C	25	C	42

Required

- Determine the total market share **(2 marks)**
 - Determine the total revenue generated by each product in shop one **(3 marks)**
 - Determine the total revenue generated by each product in shop two **(3 marks)**
- b) A business manager wants to make an investment in a project whose cost is \$2 million. The cost is expected to remain constant in nominal terms. He can save \$40,000 annually to fulfill his desire. How long should he wait if his savings earned an interest rate of 13%? **(4 Marks)**
- c) A company determined its daily rate of advertising expenditures to cost the firm sh. 5 440. Marketing specialists estimated that the rate at which profit will be generated from the promotional campaign will be estimated by the function $\frac{dR}{dt} = 8\,000 - 40t^2$ where t represents the day of the campaign and $\frac{dR}{dt}$ is measured in shillings per day. Note that profit is exclusive of advertising expenses.

Required

- Sketch the functions $\frac{dR}{dt}$ and $\frac{dC}{dt}$ on the same graph where C represents the total cost **(4marks)**
 - When should the company stop the campaign? **(2 marks)**
 - What are the total advertising expenditures expected to equal during the campaign period? **(2 marks)**
 - What net profit will be expected? **(4 mark)**
- d) Define the following terms as used in Markovian analysis:
- Transition matrix **(2 marks)**
 - Equilibrium state **(2marks)**
 - Input output analysis **(2 marks)**

QUESTION TWO

- a) The marginal cost function of a certain product is given by $MC = \frac{1}{25}x - 3x^2$ and the cost of rent is 600.

Required:

- i. Determine the total cost function of the product (2 marks)
 - ii. Determine the average cost to produce 3 units of the product (2 marks)
- b) The total revenue of a product is given by $TR = 29x - 3x^2$ and its average cost function is given by $C = 5 - 60x^{-1}$

Required:

- i. Determine the total cost function (2 marks)
 - ii. Determine the profit function (2 marks)
 - iii. Determine the quantity of the product that will maximize the profits (2 marks)
 - iv. Calculate the maximum profit (3 marks)
- c) Solve the following functions (2 marks)

$$x - 9 = \frac{72}{x - 8}$$

$$\frac{6}{4x + 1} + \frac{8}{5x - 1} = 10$$

- d) Differentiate the following equations stating the rule applicable.

i) $Y = (2x + 5)^7$ (2 marks)

ii) $Y = \frac{3x^3 + 2}{x^5}$ (2 marks)

- e) Integrate the following function

i) $Y = \frac{2}{4}x^6 + 5x^3 + 2$ (1 marks)

QUESTION THREE

- a) An investment costs \$100, 000 and has the following string of cash-flows, year one to six. Residual value is \$40,000. The cost of capital is 12% per annum. Depreciation is given as \$10,000. Assume tax rate to be 25%.

Year	Returns
1	50,000
2	45,000
3	36,000
4	43,000
5	56,000
6	24,000

Required,

Compute the

- i) Net present value (8 marks)
- ii) Internal rate of return (5 marks)

- b) A certain commodity has a linear function that passes through the general point (P, Q) : when $P = 8\ 000, Q = 800$ and when $P = 3\ 000, Q = 550$.

Required:

- i. Obtain the linear function that passes through the points given above (5 marks)
- ii. State whether the function in (i) above is a demand function or a supply function (2marks)

QUESTION FOUR

- a) Highlight four applications of markovian processes (2marks)
- b) A consumer survey among 2100 consumers performed by Cocacola Company during the month of February 2018 revealed the following switching patterns among 800 users of Fanta brand, 100 consumers shifted their loyalty to Krest brand and 200 consumers shifted their loyalty to Stoney brand, the rest remained loyal to brand. Among 700 users of Krest 250 consumers shifted their loyalty to Fanta brand, 150 consumers shifted to Stoney brand while the rest remained steadfast to Krest. Among 600 users of Stoney brand 300 consumers shifted their loyalty to Fanta and 50 consumers migrated to Krest brand while the rest were hard-core royals to Stoney brand.

Required

- i) Transition matrix representing the above switching patterns (2marks)
 - ii) Respective market shares two months later (6 marks)
 - iii) Market share in the longrun (4 marks)
- c) For a certain demand function, $P = D(q) = \frac{20}{q+1}$ and the supply function, $P = S(q) = q+2$.

Compute:

- i) Equilibrium quantity and price (3 marks)
- ii) Consumer and producer surpluses (3 marks)

QUESTION FIVE

- a) Money has time value. True or not? Justify your argument
b) From the following matrices:

(3 marks)

$$C = \begin{bmatrix} 2 & 4 & 8 \\ 3 & 5 & 7 \\ 6 & 9 & 4 \end{bmatrix} \quad D = \begin{bmatrix} 6 & 8 \\ 3 & 4 \\ 5 & 2 \end{bmatrix} \quad E = \begin{bmatrix} 5 & 3 & 2 \\ 9 & 5 & 4 \end{bmatrix}$$

- i Get inverse of C
ii $C \times D$
iii $C \times E$
iv CD transpose

(10 marks)

(2 marks)

(2marks)

(3 marks)