



# MACHAKOS UNIVERSITY

University Examinations for 2021/2022 Academic Year

SCHOOL OF BUSINESS AND ECONOMICS

DEPARTMENT OF BUSINESS ADMINISTRATION

FIRST YEAR FIRST SEMESTER EXAMINATION FOR

BACHELOR OF COMMERCE

BMS 100: MANAGEMENT MATHEMATICS I

DATE: 2/2/2022

TIME:8.30-10.30 AM

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## INSTRUCTIONS

Answer questions ONE and any other TWO questions.

### QUESTION ONE (30 MARKS)

- a) Using the set builder notation define the following terms
- i) Disjoint sets (1 mark)
  - ii) Difference of sets (1 mark)
  - iii) Cartesian sets (1 mark)
  - iv) Superset (1 mark)
  - v) Complement sets (1 mark)
- b) Identify four types of equations applicable in business, giving examples (4 marks)
- c) An efficiency study of the morning shift at a certain factory indicates that an average worker who arrives on the job at 8.00 am will have produced
- $$Qt = -t^3 + 6tz + 24t$$
- units in  $t$  hours later
- i. Compute the workers rate of production at 11.00 am (3 marks)
  - ii. At what rate is the workers rate of production changing with respect to time at 11.00 am? (2 marks)
- d) Briefly discuss the relevance of management mathematics to organizations. (5 marks)

e) A Firm intends to borrow ksh.2, 000,000 to be invested in either project 1 or project 2.

Period	Project 1(ksh)	Project 2(ksh)
1	900,000	900,000
2	500,000	600,000
3	500,000	600,000
4	550,000	450,000
5	600,000	300,000

The cost of capital is 16% and the project has no salvage value. Using the following appraisal techniques advise the firm on which project to invest.

- i. Net Present Value (NPV) (4 marks)
- ii. Profitability index (4 marks)
- iii. Internal rate of return (3 marks)

### QUESTION TWO (20 MARKS)

a) Comp KENYA lias recorded recent sales for three types of computer software: games, educational software, and utility programs. The following information regarding software purchases was obtained from a survey of 893 customers.

545 purchased games.

497 purchased educational software.

290 purchased utility programs.

297 purchased games and educational software.

196 purchased educational software and utility programs.

205 purchased games and utility programs.

157 purchased all three types of software.

Use a Venn diagram to answer the following questions. How many customers purchased

- i. None of these types of software? (3 marks)
  - ii. Only games? (3 marks)
  - iii. At least one of these types of software? (4 marks)
  - iv. Exactly two of these types of software? (4 marks)
- b) Supply and demand functions for a certain product are:  $p = + 25$  and  $p = -20q + 550$  Respectively. Find market equilibrium point. (6 marks)

### QUESTION THREE (20 MARKS)

- a) Briefly explain the following ways of denoting sets giving appropriate examples
- Roster notation (2 marks)
  - Set builder notation (2 marks)
- b) A manufacturer makes two products i.e. product Q and Product M . The cost of making 15 units of Product Q and 10 units of product M is shs 600.The cost of making 5 units of product Q and 8 units of product M is shs 340.The manufacturer makes a profit of 20% and 25% on each unit of product Q and product M , respectively.
- Formulate a system of simultaneous equations to represent this information and solve the equations to determine the cost of making one unit of product Q and product M. (3 marks)
  - Calculate the selling price of one unit of product Q and product M (3 marks)
- c) Find the turning point on the curve derivative  $y = x^3 - 7.5x^2 + 18x + 6$  and distinguish among them. (4 marks)
- d) A firm has analyzed its operating conditions and has developed the following functions
- Total revenue  $R = 20Q^2 + 400Q$
- Total cost  $C = Q^2 - 40Q + 2000$
- Where Q is the number of units, Determine
- The value of Q that maximizes revenue hence maximum revenue (2 marks)
  - The value of Q that minimizes cost hence minimum cost (2 marks)
  - The price at which profit is maximum (2 marks)

### QUESTION FOUR (20 MARKS)

- a) Consider the following universal set T and its subjects C,D and E

$$T = \{0, 2, 4, 6, 8, 10, 12\}$$

$$C = \{4, 8\}$$

$$D = \{10, 2, 0\}$$

$$E = \{0\}$$

Find

- $D \cap E$  (2 marks)
- $C \cup D^c$  (2 marks)
- $C \cap D \cap E^c$  (3 marks)
- $D^c \cup C^c$  (3 marks)

- b) Let the market supply function of an item be  $q = 160 + 8p$ , where  $q$  denotes the quantity supplied and  $p$  denotes the market price. The unit cost of production is Ksh. 4. It is felt that the total profit should be Ksh. 500. What market price has to be fixed for the item so as to achieve this profit? (5 marks)
- c) A company sells  $x$  units of an items each day at the rate of Ksh. 50 per unit. The cost of manufacturing and selling these units is Ksh. 35 per unit plus a fixed daily overhead cost of Ksh. 1000.
- Determine the profit function. (3 marks)
  - How would you interpret the situation if the company manufactures and sells 400 units of the items a day? (2 marks)

**QUESTION FIVE (20 MARKS)**

- a) What is Break Even Point (BEP) in the cost revenue analysis? (2 marks)
- b) Solve using graphical method the following set of equations (5 marks)
- $$2x + y = 8$$

$$x + 2y = 10$$
  - Solve and graph,  $3x - 4 \leq 8 + x \leq 2 + 7x$  (4 marks)
- c) The equation of a line AB passes through the points A(2,3) and B(-4,5)  
Find
- The equation of the line (3 marks)
  - The gradient of the line (2 marks)
  - The y intercept (2 marks)
  - The value of  $y$  when  $x = 1$  (2 marks)