



**STRATHMORE INSTITUTE**  
**DIPLOMA IN BUSINESS MANANGEMENT, DIPLOMA IN INTERNATIONAL**  
**RELATIONS AND DIPLOMA IN BUSINESS CREATION & ENTRENEURSHIP**  
**END OF SEMESTER EXAMS**  
**DBM1203 DIR 1202 DE 1105: BUSINESS MATHEMATICS**

**DATE:** December 7<sup>th</sup> 2022

**TIME:** 2 Hours

**INSTRUCTIONS: ANSWER QUESTION ONE AND ANY OTHER TWO QUESTIONS.**

**QUESTION ONE (30 MARKS)**

- a) A manufacturing company determines that the total cost in dollar of producing  $x$  units of a certain product is  $C(x) = 25x + 3500$  units of
- State the type of function (1 mark)
  - Determine the cost of producing 100 units (2 mark)
  - Describe the practical importance of the  $y$  intercept and gradient of the line given by this equation (2 marks)
- b) Let  $A = \{0,1,2,3,4,5\}$  and  $B = \{-6,-5,-2,1,3,7,10,22\}$ . Let  $f : A \rightarrow B$  defined by  $f(x) = x^2 - 2x - 5$ , state the domain, co-domain and range of  $f$  (3marks)
- c) Let  $A = \{5,6,7,8,9\}$ ,  $B = \{2,3,4,5,6,7\}$ ,  $C = \{0,2,4,6,8,10\}$ . List the elements of the following set.
- Find:
- $A \cup B$  (1 marks)
  - $B \cap C$  (1 marks)
  - $(A \cup C) \cap (B - C)$  (3 marks)
- d) Given that  $A = \begin{bmatrix} 3 & 2 \\ 3 & 5 \end{bmatrix}$ , determine
- $|A|$  (2 marks)
  - $A^T$  (1 mark)
- e) In a survey of 1000 households, 275 owned a home computer, 455 a video, 405 two cars, and 265 households owned neither a home computer, nor a video, nor two cars. Given that 145 households owned both a home computer and a video, 195 both a video and two

cars, and 110 both two cars and a home computer, find the number of households surveyed which owned:

- i) A home computer, a video and two cars; (4 marks)
  - ii) Present the information on a Venn diagram (2 marks)
- a) A company produces a product which it sells for \$55 per unit. Each unit cost the firm \$23 in variable expenses, and a fixed cost on annual basis are \$400,000. If  $x$  equals the number of units produced and sold during the year.
- i. Formulate the cost, revenue and profit functions (4 marks)
  - ii. What level of output is required in order to break even (4 marks)

### QUESTION TWO (15 MARKS)

- a) The profit function for a firm is  $P(x) = -10x^2 + 36,000x - 45,000$  where  $x$  is the number of units sold and  $P$  is the annual profit in dollars.
- i. What class of function is this? (1 mark)
  - ii. What is the expected profit if 1,500 units are sold (2 marks)
  - iii. What is the maximum profit? (6 marks)
- b) Use Venn diagram to show that  $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$  (6 marks)

### QUESTION THREE (15 MARKS)

- a) Define the following terms
- i. A set (1 mark)
  - ii. A subset (1 mark)
  - iii. Universal set (1 mark)
- b. One hundred Students were asked whether they had subscribed to any of three mobile telephone networks, Airtel, Safaricom and Orange. The results were: 35 had Airtel line, 38 had Safaricom line, 31 had Orange line, 18 had Airtel and Safaricom, 9 had Airtel and Orange, 4 had Orange and Safaricom and 23 were not connected to any of the lines;
- i. Determine the number of students who have all the three lines (6 marks)
  - ii. Draw a Venn diagram to represent the survey (3 marks)
  - iii. How many students had Airtel and Safaricom but not Orange (1 marks)
  - iv. How many students had Safaricom or Orange but not Airtel (1 marks)
  - v. How many students had at most two lines (1 marks)

**QUESTION FOUR (15 MARKS)**

a) Let  $A = \begin{bmatrix} 1 & 2 \\ 0 & -3 \end{bmatrix}$  and  $B = \begin{bmatrix} 2 & -1 \\ 3 & 1 \end{bmatrix}$ , evaluate  $A^2 + AB + B$  (5 marks)

b) The 12<sup>th</sup> term of an arithmetic progression is 32 and the 5<sup>th</sup> term is 18. Find the 30<sup>th</sup> term and the sum of the first 30 terms. (4 marks)

c) John started his employment with a salary of Sh. 120,000 per annum which was increased by Sh. 10,000 every year up to the top of the scale of Sh. 1,500,000 per annum.

i. In how many years' time does he reach to the top scale? (3 marks)

ii. What is the total amount he would earn during this period (3 marks)

**QUESTION FIVE (15 MARKS)**

a) i) State the difference between *rational* and *irrational* numbers. (2 marks)

ii) Show  $\sqrt{2}$  that is an irrational number (5 marks)

b) Solve the following system using inverse matrix method

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

$$3x - 4y + 3z = 7 \quad (8 \text{ marks})$$

$$-3x + y + 2z = 9$$