



# **MAASAI MARA UNIVERSITY**

**REGULAR UNIVERSITY EXAMINATION  
2023/2024 ACADEMIC YEAR  
FIRST YEAR FIRST SEMESTER**

**SCHOOL OF PURE APPLIED AND HEALTH  
SCIENCES  
BACHELOR OF SCIENCE MATHEMATICS**

**COURSE CODE:MAT 1104  
COURSE TITLE: FOUNDATION OF PURE  
MATHEMATICS**

**DATE: 30/1/2024**

**TIME: 0830-1030 HRS**

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**INSTRUCTIONS TO CANDIDATES**

1. This paper contains **FOUR** (4) questions
2. Answer question **ONE** (1) and any other **TWO** (2) questions
3. Do not forget to write your Registration Number.

*This paper consists of **FOUR** printed pages. Please turn over*

### QUESTION ONE (30 MARKS)

- a) Let  $U=\{1,2,3,4,5,6,7,8,9,10\}$ ,  $A=\{1,2,3,4\}$ ,  $B=\{3,4,5,6,7\}$ , and  $C=\{2,4,6,8,10\}$ , find;
- i.  $(A \cup B)^c$  [2 marks]
  - ii.  $(B \cap C) \cap A$  [2 marks]
  - iii.  $A^c \setminus (C \setminus B)^c$  [3 marks]
- b) Test the validity of the following arguments;
- If it rains, Erick will be sick.  
Erick was not sick.  
It did not rain. [4 marks]
- c) Prove that  $(B \vee \sim A) \wedge A = A \wedge B$ . [4 marks]
- d) For the complex number  $z = 3 + 4i$  find;
- i. Modulus of  $z$  [1 mark]
  - ii. Argument of  $z$  [2 marks]
  - iii. Represent the complex number in an argand diagram. [2 marks]
- e) Prove by contradiction that  $\sqrt{2}$  is not a rational number. [5 marks]
- f) Which of these are propositions? What are the truth values of those are propositions? [5 marks]
- a. Do not pass bye
  - b.  $x + 1 = 5$  if  $x = 1$
  - c. Donald trump won the Us elections in the year 2020 let  $p$  and  $q$  be the propositions.

### QUESTION TWO-20 MARKS

- a) Translate the following English sentence into a logical expression and determine its validity, “you can access laboratory only if you are not a science student and you are a second year student”. [4 marks]
- b) Let  $Z = \frac{i-1}{2i+3}$ , find;
- i. Inverse of  $Z$  [4 marks]
  - ii.  $Z^5$  [4 marks]

- c) A survey of graduate students at the University of Florida's film school revealed the following information;
- 51 admire Moe,
  - 49 admire Larry,
  - 60 admire Curly,
  - 34 admire Moe and Larry,
  - 32 admire Larry and Curly,
  - 36 admire Moe and Curly,
  - 24 admire all three of the Stooges,
  - 1 admires none of the Three Stooges.

- i. How many people were surveyed?
- ii. How many admire Larry and Curly only?
- iii. How many admire Moe and Curly only?
- iv. How many admire Moe and Larry only?
- v. How many admire exactly 2 stooges?
- vi. How many admire at least 2 stooges?
- vii. How many admire exactly one of the Stooges? **[8 marks]**

**QUESTION THREE - 20 MARKS**

- a. Given  $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$ ,  $A = \{2, 4, 6, 8\}$ ,  $B = \{1, 3, 4, 5, 7\}$ ,  $C = \{7, 8\}$ , find
- i.)  $A \cap B$  **[2 marks]**
  - ii.)  $(A \cap C) \cap (A \cup B)$  **[3 marks]**
- b. If  $A = \{0, 1, 2\}$  and  $B = \{c\}$ , find  $A \times B$  **[2 marks]**
- a) Show that if  $n$  is a positive integer, then  $1 + 2 + 3 + \dots + n = \sum_{i=1}^n i = \frac{n(n+1)}{2}$ . **[7 marks]**
- b) Express the Boolean expression  $E = ((xy)z) + ((x+z)(y+z))$  in Sum of product form. **[7 marks]**

**QUESTION FOUR - 20 MARKS**

- a) Find the power set of  $A = \{1, 2, 3\}$ . **[2 marks]**
- b) Using a carefully constructed truth table, show that the compound propositions  $(p \rightarrow q) \wedge (q \rightarrow p)$  and  $p \leftrightarrow q$  are logically equivalent. **[5 marks]**
- c) Using Boolean laws of algebra of logic, show that  $\sim (p \vee q) \vee (\sim p \wedge q) = \sim p$ . **[4 marks]**

- d) Prove by deduction that the difference between two squares of any two consecutive integers, is equal to the sum of those integers. **[4 marks]**
- e) Prove by contrapositive that if  $m$  and  $n$  are any integers such that their product is even, then  $m$  is even or  $n$  is even. **[5 marks]**

**# END #**