



**KISII UNIVERSITY**

**UNIVERSITY EXAMINATIONS**

**SPECIAL EXAMINATION**

**FIRST YEAR EXAMINATION FOR THE AWARD OF  
DEGREE IN BACHELOR OF EDUCATION SCIENCE**

**FIRST SEMESTER 2021/2022**

**(JULY, 2022)**

**MATH 112: BASIC MATHEMATICS**

**STREAM: Y1 S1**

**TIME: 2 HOURS**

**DAY: WEDNESDAY, 8.00 AM – 10.00 AM**

**DATE: 27/07/2022**

**INSTRUCTIONS:**

- 1. Do not write anything on this question paper.**
- 2. Answer Question ONE (Compulsory) and any other TWO Questions.**

**QUESTION ONE (COMPULSORY)**

- a) i) Distinguish between a tautology and a contradiction. (2 marks)  
ii) Write the negation of the statement “If I recover from my illness, I will go to Church.” (2 marks)
- b) Find the power set of  $A = \{1,2,3,4\}$  (4 marks)
- c) Given  $A = \{c, d, f, i\}$ ,  $B = \{b\}$ ,  $E = \{e, f, g\}$  and  $U = \{a, b, c, d, e, f, g, h, i\}$ . Show that  $A - E = A \cap B^c$  (5 marks)
- d) i) A basket contains 4 apples, 5 oranges and 8 bananas. How many ways can 2 apples, 1 orange and 2 bananas be chosen? (4 marks)  
ii) In how many ways can an even number greater than 2 000 be formed from the digits 1,2,3,4? (4 marks)
- e) Let  $z_1 = -4 + 6i$  and  $z_2 = 3 - 5i$ , find
  - i)  $z_1 - z_2$  (2 marks)
  - ii)  $z_1 \times z_2$  (3 marks)
- f) i)
  - ii) Determine the number of ways a basketball coach can select five players from a team of twelve players to participate in a match. (3 marks)

g) Determine the inverse function of the following function

$$f: x \rightarrow \frac{4x+5}{7x-6}; x \neq \frac{6}{7} \quad (3 \text{ marks})$$

**Question Two (20 marks)**

- a) Given  $f(x) = 2x + 1$  and  $g(x) = 2x^2 + 1$
- i) Find  $f \circ g(x)$  (3 marks)
  - ii) Find  $(f \circ g)^{-1}(x)$  (3 marks)
  - iii) Evaluate  $f \circ g(-3)$  (2 marks)
- b) Let  $A = \{1,2,3,4,5\}$  and  $B = \{a, b, c, d\}$  find  $A \otimes B$  (2 marks)
- c) Prove that  $\sqrt{2}$  is not a rational number. (8 marks)
- d) State the domain and range of the function represented by the following ordered points  $\{(2,6)(3,9)(4,12)(5,15)(6,18)\}$  (2 marks)

**Question Three (20 marks)**

- a) Draw a Venn diagram to illustrate  $A \cup (B \cap C)$  (2 marks)
- b) i) Given  $a = 3 - i$  and  $b = 1 + 2i$  find the modulus of  $2a + b$  (3 marks)
- ii) If  $Z = \frac{1+i}{3+yi} + \frac{3+2i}{y+3i}$  and given that  $Re(z) = Im(z)$  find the value of  $y$ . (5 marks)
- c) Using the universal set  $U = \{a, b, c, d, e, 1,2,3,4,5\}$ , set  $A = \{1,2,3\}$  and set  $B = \{a, b, c, 2,5\}$ .
- i) Prove that  $(A \cap B)^c = A^c \cup B^c$  (4 marks)
  - ii) Find  $A \Delta B$  (3 marks)
- d) Simplify  $nC_{n-1}$  (3 marks)

**Question Four (20 marks)**

- a) Use trigonometric identities or otherwise to write the following in a more simplified form
- i)  $\cos 50^\circ \sin 40^\circ - \cos 40^\circ \sin 50^\circ$  (2 marks)
  - ii)  $\cos 80^\circ \sin 20^\circ - \sin 80^\circ \cos 20^\circ$  (2 marks)
- b) Use quadratic formula to solve  $x^2 + 2x + 10 = 0$  in the form  $a \pm bi$ . (4 marks)
- c) Determine the 7<sup>th</sup> term of the following sequence  $\frac{x^2}{x+1}, \frac{x^5}{(x+1)^2}, \frac{x^8}{(x+1)^3}, \dots$  (4 marks)
- d) i) Show that  $1 + \cot^2 \theta = \operatorname{cosec}^2 \theta$  (4 marks)
- ii) Simplify

$$\frac{1}{1+\cos x} + \frac{1}{1-\cos x} \quad (4 \text{ marks})$$

**Question Five (20 marks)**

- a) State the converse, inverse and contra-positive of the following implication  
“If  $\theta = 60^\circ$  then  $\cos\theta = \frac{1}{2}$ .” (3 marks)
- b) A test has 5 questions in Section A and 3 questions in Sections B. A student has to choose any 3 questions and 2 questions from sections A and B respectively and answer the questions in any order. Find how many ways the student
- i) Can choose the questions to answer (3 marks)
- ii) Can order the questions she answers (3 marks)
- c) Verify that the proposition  $(p \wedge q) \wedge \sim(p \vee q)$  is a contradiction (5 marks)
- d) Show that  $\sim(p \wedge q)$  is logically equivalent to  $\sim p \vee \sim q$  (6 marks)