



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 $g(x) = 2x^2 + 1$
- Find $f \circ g(x)$ (3 marks)
 - Find $(f \circ g)^{-1}(x)$ (3 marks)
 - 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 $B = \{a, b, c, 2,5\}$.
- Prove that $(A \cap B)^c = A^c \cup B^c$ (4 marks)
 - 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
- $\cos 50^\circ \sin 40^\circ - \cos 40^\circ \sin 50^\circ$ (2 marks)
 - $\cos 80^\circ \sin 20^\circ - \sin 80^\circ \cos 20^\circ$ (2 marks)
- b) Use quadratic formula to solve $x^2 + 2x + 10 = 0$ in the form $a \pm bi$. (4 marks)
- c) Determine the 7th term of the following sequence
- $$\frac{x^2}{x+1}, \frac{x^5}{(x+1)^2}, \frac{x^8}{(x+1)^3}, \dots \dots$$
- (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)