

CHUKA



UNIVERSITY

UNIVERSITY EXAMINATIONS

CHUKA AND EMBU CAMPUS

EXAMINATION FOR THE AWARD OF DIPLOMA IN COMPUTER SCIENCE
MATH 0121: INTRODUCTORY MATHEMATICS

STREAMS: DIP COSC

DAY/DATE: THURSDAY 07/08/2025

TIME: 2 HOURS

8.30 A.M. – 10.30 A.M

INSTRUCTIONS:

ANSWER QUESTION ONE AND ANY OTHER TWO

QUESTION ONE (30 MARKS)

- a) Distinguish between real numbers and complex numbers and give an example in each case. (4 marks)
- b) Identify the property of real numbers being applied in each of the following
- i. $5(2x+7) = 10x+35$
 - ii. $2+0=2$
 - iii. $(11+6) + 5 = 11 + (6+5)$
 - iv. If $5+4=9$ and $9=y$ then $5+4=y$ (4 marks)
- c) Let $U = \{a, b, c, d, e, f, g\}$ and let $A = \{a, b, c, d, e\}$, $B = \{a, c, e, g\}$ and $C = \{b, e, f, g\}$. Find: (i) $(A - C)^c$ (ii) $C - B$ (iii) $A^c - B$ (3 marks)
- d) Draw a truth table to show that $\sim (P \vee Q) = \sim P \wedge \sim Q$. (5 marks)
- e) Illustrate using a Venn diagram that the sets $A = \{1, 3, 5, 9\}$ and $B = \{0, 4, 6, 8\}$ are disjoint. (2 marks)
- f) State without prove the factor theorem. (1 mark)
- g) Find the value of k , given that when $f(x) = x^5 + 4x^4 - 6x^2 + kx + 2$ is divided by $x + 2$, the remainder is 6. (3 marks)

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- h) How many arrangements are there for the letters of the word **COMPETITION**. (2 marks)
- i) Find the sum of the first 21 terms of the series 3.5, 4.1, 4.7, 5.3..... (3 marks)
- j) In a bookshelf, there are 6 books in total. In how many ways can we select 3 different books from them. (3 marks)

QUESTION TWO (20 MARKS)

- a) Given the general quadratic equation $ax^2 + bx + c = 0$, proof the quadratic formula using the completing square method. (6 marks)
- b) Given that $f(x) = 5x - 2$ and $g(x) = 4x + 3$, Evaluate:
- I. $(f + g)(2)$ (2 marks)
- II. $f(2x) - 4g(x)$ (2 marks)
- III. $(f \circ g)(x)$ (3 marks)
- c) Given that $f(x) = 4x - 10$ and $g(x) = \frac{1}{2}x + 3$, show that $(g \circ f)^{-1} = f^{-1} \circ g^{-1}$ (4 marks)
- d) Given that $f(x) = \begin{cases} x^2 + 3 & \text{if } x \leq -2 \\ -1 & \text{if } -2 < x \leq 0 \\ 2 - x & \text{if } x > 0 \end{cases}$
- Evaluate (i) $f(-1)$ (ii) $f(-5)$ (iii) $f(20)$ (3 marks)

QUESTION THREE (20 MARKS)

- a) Find the remainder and the quotient when $x^5 + 1$ is divided by $(x - 1)$. (4 marks)
- b) Solve the following quadratic equation using the completing square method.
- $$2x^2 + 3x + 1 = 0. \quad (4 \text{ marks})$$
- c) Prove the Associative law: $(p \wedge q) \wedge r = p \wedge (q \wedge r)$ using truth tables. (4 marks)
- d) Find the expansion of $(-3x + 5y)^7$ using the binomial theorem. (5 marks)
- e) The sum of the first 3 terms of a geometric series is 26. If the common ratio is 3, find the sum of the first six terms. (3 marks)

QUESTION FOUR (20 MARKS)

- a) Plot a graph of $y = \sin \theta$ for $0^\circ \leq \theta \leq 360^\circ$ at an interval of 30° . (6 marks)
- b) Use the Pascal's triangle to write out the expansion of $(2x - 3y)^5$. (5 marks)
- c) Find θ in the following equation $4\tan^2\theta - 8\tan\theta - 4 = 0$. (4 marks)

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- d) Obtain the remainder then $x^3 - 3x^2 + 6x + 5$ is divided by $x - 2$ using the remainder theorem. Confirm your answer using the long division method. (5 marks)

QUESTION FIVE (20 MARKS)

- a) Given $Z_1 = -2 + 5i$ and $Z_2 = -3 - 4i$ find i) $Z_1 \bar{Z}_2$ ii) $\frac{Z_2}{Z_1}$ iii) $|Z_1 Z_2|$ (7 marks)
- b) A committee of 4 men and 3 women is to be chosen from 7 men and 5 women. How many ways can this be done? (4 marks)
- c) Simplify $\frac{\cos^2 \theta}{1 + \sin \theta} + \frac{\cos^2 \theta}{1 - \sin \theta}$ (4 marks)
- d) If $f(x) = ax + \frac{b}{x}$ and if $f(2) = 9$ and $f(3) = 16$, evaluate a, b and find the values of x for which $f(x) = 0$. (5 marks)
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