



KOGI STATE UNIVERSITY, KABBA

FACULTY OF SCIENCE AND COMPUTING (Department of Mathematical Sciences)

COURSE TITLE: GENERAL MATHEMATICS I COURSE CODE: MTH101 UNIT: 2

Session: 2023/2024 Semester: FIRST Date: 3/5/2024 Time allowed: 2 Hours.

Instructions: ANSWER THREE QUESTIONS, QUESTION ONE IS COMPULSORY

1. (a) Prove by Mathematical Induction that: $1^2 + 2^2 + 3^2 + \dots + n^2 = \frac{n(n+1)(2n+1)}{6}$
(bi) Derive the quadratic formula by solving the equation $ax^2 + bx + c = 0$ using completing the square approach,
(bii) hence, use the result obtained in (bi) to solve $3x^2 + 2x - 7 = 0$
(c) If $z_1 = 3 + 2i, z_2 = 4 + 3i$, evaluate $\frac{z_1}{z_2}$
(d) Find the 7th term of an Arithmetic Progression whose first term is 102 and common difference is -3
(30marks)
2. (a) Let $\mu = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$
 $A = \{1, 2, 3, 4\}, B = \{2, 4, 6, 8\}, C = \{3, 4, 5, 6\}$
Find (i) A'
(ii) B'
(iii) $(A \cap C)'$
(iv) $(A \cup B)'$
(v) $(A')'$
(vi) $(B - C)'$
(b) Solve the equation: $3 - 3\cos \theta = 2\sin^2 \theta$ giving values of θ from 0° to 360°
(20marks)
3. (a) Expand $(2x - 3y)^5$ using binomial theorem
(b) The seventh term of an Arithmetic Progression is 15 and the fourth term is 9. Find the common difference and the first four terms of the sequence
(c) Find the equation of the circle with centre $(2, -3)$ and radius 4
(20marks)
4. (a) Find the centre and radius of the circle: $x^2 + y^2 - 10x + 6y + 30 = 0$
(b) Given that $z_1 = 7 - 7i, z_2 = 3 + 2i$
Evaluate (i) $z_1 z_2$ (ii) $4z_1 z_2$ (iii) $|z_1 z_2|$
(c) Prove the trigonometry identity: $\cot^2 \theta = \operatorname{cosec}^2 \theta - 1$
(20marks)
5. (a) Out of 250 programmers, 75 can program in Python, 47 can program in Java and 60 can program in C++. There are 30 who can program in both Python and Java, 22 who can program in both Java and C++ and 7 who can program in both C++ and Python and 5 who can program in all the three programming language. Find
(i) How many can program in at most one of them?
(ii) How many can program in Python and exactly one of the other two languages?
(b) Without using table, find the value of $\sin(60 + 45)^\circ$, leaving your answer in surd form.
(c) Prove that $\cos^2 \theta + \sin^2 \theta = 1$
(20marks)