RAM Maths Circle

January 4, 2026

Nagpur

Introduction

Today's session was a brush-up lecture revisiting earlier topics. The aim was to review core techniques, refresh standard tricks, and give students practice on representative problems drawn from prior material. Problems taken are listed below.

Problems

Complex Numbers & Logic

1. Simplify the following expression:

$$S = i^{2023} + i^{2024} + i^{2025} + i^{2026}.$$

2. Let $x = 3 + i$. Find the value of the expression (without calculating x^3 directly):

$$x^3 - 6x^2 + 11x - 8.$$

Geometry & Patterns

3. **Integer triangle.** Two sides of a triangle have lengths 5 cm and 12 cm. If the third side must be an integer, how many distinct (non-congruent) triangles can be formed?

Arithmetic Progression (AP)

4. The angles of a triangle are in arithmetic progression. If the smallest angle is 40°, find the other two angles.

5. The numbers $(k-1)$, $(2k+1)$, $(4k-3)$ form three consecutive terms of an arithmetic progression. Find the value(s) of k and the three terms.

6. The sum of the first n terms of an AP is given by $S_n = 3n^2 + n$. Find the first term a and the common difference d.

Exploration

- The session focused on revisiting earlier concepts and strengthening familiarity with standard techniques and logical patterns.
- Complex number work highlighted periodicity of i and recognising algebraic structure to avoid unnecessary expansion.
- The geometry problem reinforced careful use of the triangle inequality and distinguishing valid triangles from degenerate ones.
- AP problems helped students recall formulas, relate given expressions to a and d, and check conditions like angle sums.
- Students discussed approaches, shared reasoning, and identified common mistakes, encouraging clarity of thinking rather than just answers.

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