RAM Maths Circle

July 27, 2025

Nagpur

Introduction

This week was an exciting exploration of mathematical patterns and problem-solving. Participants delved into intriguing problems that connected number systems, combinatorics, and sequences. Through hands-on discussions, they uncovered the elegance of binary representations, combinatorial reasoning, and sequence properties, including the fascinating world of triangular numbers. The session fostered curiosity and collaboration, encouraging students to identify patterns and think creatively about mathematical structures.

Problem 1: Gold Rings Problem

In the kingdom of Algebraia, the king pays his workers in gold rings. He wants to be able to pay them for any number of days from 1 day up to 31 days using the minimum number of rings. Each ring has a different weight.

Exploration

This problem introduced the concept of base number systems. Participants investigated how to select a minimal set of distinct weights to represent any number of days from 1 to 31, exploring efficient ways to combine weights and searching for patterns in number representations.

Problem 2: Triangle Counting Problem

If there are n vertical collinear dots and 2 horizontal dots (non-collinear with the n dots) below them, how many triangles can be formed using these dots as vertices of the triangle?

Exploration

Students delved into combinatorial geometry, discussing how the collinearity of the vertical dots and the positioning of the horizontal dots affect triangle formation. They used induction in class to prove their claim.

Introduction to Sequences and Triangular Numbers

Participants examined arithmetic and geometric progressions, focusing on their general terms and summation formulas. They then investigated triangular numbers, defined as the sum of the first n natural numbers, exploring why they are called "triangular" and identifying patterns in their structure. The session included a challenge to investigate numbers that are both perfect squares and triangular.

Task for Students

1. Provide a combinatorial approach to the triangle counting problem.
2. Identify the first two square triangular numbers after 0 and 1. Can you explain why these numbers are both square and triangular?