

# Bose Math Olympiad

Senior - 2021

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You have 90 minutes to try the six problems. Write down detailed answers and submit them. You must give precise reasons for your claims.

## Problem 1

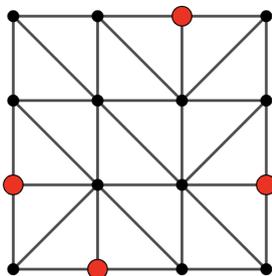
In triangle ABC, angle C is  $75^\circ$ , and the angle B is  $60^\circ$ . The vertex M of isosceles right-angled triangle BCM with hypotenuse BC is located inside triangle ABC. Find the angle MAC.

## Problem 2

Ananya and Sattick were walking in a circular park surrounded by banyan trees. Ananya went around the park, counting the trees. Sattick did the same, but started from a different tree (although went in the same direction). The tree that Ananya counted as the 20th tree, Sattick counted the same tree as the 7th. The tree which Ananya counted as 7th, Sattick counted the same tree as the 94th. How many trees were there around the park?

## Problem 3

In each cell of a  $5 \times 5$  square, exactly one diagonal is drawn. Vertex a cell is free if it is not the end of any of the drawn diagonals. Find the largest possible number of free vertices. [Hint: In this example  $3 \times 3$  square, there are 4 free vertices]



## Problem 4

Ananya has 27 cubes with an edge of 1 cm. 9 of them are red and 18 of them are blue. She glued them together to create a cube with an edge length 3 cm. Is it possible to put the cubes in such a way that the surface of the cube has the same number of red squares and blue squares?

### **Problem 5**

There are 20 points marked on the circle. How many such triplets of chords exist with ends in these points such that each chord in the triple intersects the other two in the triple (possibly at the ends)?

### **Problem 6**

Draw five points A, B, C, D and E on the plane so that you can create exactly eight triangles (no more and no less) with vertices at the points A, B, C, D and E. List the name of these triangles.