Winter Bose Math Olympiad - Junior Main

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1 Problems

1. Five friends Amal, Bimal, Kamal, Parimal, and Sreyan want to make a boat. Amal donates 4 sticks of wood, Bimal donates 5 sticks of wood, Kamal donates 5 sticks of wood and Parimal donates 6 sticks of wood. Sreyan says, 'I have no wood stick. I will give 20 gold coins. Please divide it amongst four of you.' How many gold coins should Parimal receive?.

2. In wonderland lives 3 squares, 4 triangles, and 5 circles. Whenever two different shapes meet, they both magically transform into the third type of shape. For example, when a square and a triangle meet, the square becomes a circle and the triangle becomes the circle. After 2020th such transformation, what is the remainder if (number circles − number of triangles) is divided by 3?

3. In ancient Bengal, there were 2020 cities, each connected with another by one or more roads. It is known that there are 4 roads coming out of each city. How many intercity roads were there in ancient Bengal? (The intercity road is a road that connects two cities and has no other city in between).

4. Suppose the ancient Atlantis language has 4 letters , , , . They used these letters to make words of at most 3 letters. How many words are there in the ancient Atlantis language.

5. Suppose there is a 3 cross 3 board and you have two colors: red, blue. How many ways can you color the board?

6. There are two trees A and B on a field such that the distance between A and B is 5 meters. Ayesha is continuously running on the field such that sum of her distances from A and B is always 5 meters. How many times does she visit the midpoint of A and B?

7. Ramanujan starts to list, in ascending order, every positive integer which is not a factor of 17290. What is the tenth number on his list?

8. The numbers 72, 8, 24, 10, 5, 45, 36, 15 are grouped in pairs so that the product of each pair is the same. Which number is paired with 10?

9. Consider all the divisors of 18. Draw one point for each one of them and label them with the divisor. For example, you may label one of the points as 3 as 3 is a divisor of 18.

10. Draw a line segment (edge) between two numbers a and $b, a < b$ if a divides b and there is no c, such that $a < c < b$ and a divides c and c divides b. How many edges will be there?

2 Your Problem Solving Strategies

- Try small cases. Plug in small numbers. Do examples. Consider extreme cases.
- Modify the problem. Generalize and De-Generalize. Look for patterns.
- Draw pictures. Look for symmetry.
- Divide into cases. Work backwards.
- Choose effective notation. Don't be afraid of a little algebra.
- Ask Questions. Argue by contradiction.
- Don't give up after five minutes.