

Regional Mathematics Olympiad 2015(Assam) Question Paper

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Regional Mathematical Olympiad(RMO) is the first tier in the mathematical Olympiads of India. It was held at 20th December, 2015 all over India. Assam had a special question paper this year different from the national RMO paper. To write RMO in Assam one has to qualify either of Mathelitics or Mathematics Olympiad of the Assam Academy of Mathematics.

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Regional Mathematics Olympiad (Assam)

20 December, 2015

Time: 3 Hours.

Marks: 100

(Attempt as many questions as you can)

1. Each of three girls - Sheila, Leela and Sakeena - has in her purse exactly one of the following objects: a pencil, a ball-pen and an eraser. Out of the following statements exactly one is true and two are false.

A. Sheila has the pencil.

B. Leela does not have the pencil.

C. Sakeena does not have the eraser.

Determine, with complete logical justification, who has what object.

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2. Prove that if m is an integer bigger than 11 then there always exist two distinct composite integers x and y such that $m=x+y$.

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3. Let M be the four-digit integer $abcd$ (in decimal form), so that a is nonzero. We are given that $N=4M$ is also a four-digit integer with the same digits as M but in the reverse order so that $N=dcba$. Determine M .

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4. A triangle with perimeter 11 has integer side lengths. What are its possible areas?

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5. Does there exist a triangle ABC each of whose sides is bigger than a kilometre and such that the condition 'Area (ABC) = 1 square centimetre' holds? Answer with justification.

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6. Determine the set of all arithmetic progressions (A.P.s) with integer terms satisfying the condition 'for each positive integer n the sum of the first n terms of the A.P. is a square.'

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7. Some number of pebbles are placed on a 7×7 chess board, such that each pebble is placed inside a unit square and each unit square has at most one pebble. If each row and column of the chess board contains an even number of pebbles, how many pebbles can there be altogether?

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