

Southern California Mathematical Olympiad

The Southern California Mathematical Olympiad (SCMO) is an annual mathematical contest sponsored by the Math Zoom Academy. It's a 2 round contest. The first round runs at the end of October, and is administered in Southern California schools and Math Zoom Academy sites in California. The final round runs at the beginning of December, at a location in Southern California. The 2009 SCMO Final Round will be held on Sunday, December 6.

The SCMO aims to stimulate the interest of high school students in mathematics and develop their problem solving abilities. The competition is designed to be a fun and exciting experience. The SCMO consists of the First Round and the Final Round. The First Round has two parts. Part I contains 10 short answer questions. These questions cover the subject areas of algebra (functions, equations, trigonometry, logarithm, complex numbers, etc.), geometry (plane and solid), number theory, and combinatorics that appear in the high school math curriculum, but with more focus on deeper understanding of concepts and advanced problem solving skills. The questions range from easy to relatively difficult, to challenge students with various levels of mathematical skills in high school and some advanced students in middle school. Part II of the First Round contains two questions that require full solutions. Participants will write complete proofs or solutions with all supporting arguments, and the grading is based on the correctness of the solution as well as the clarity and mathematical rigor. Besides the areas covered in Part I, the questions in Part II can also involve inequalities, functional equations, recurrences, and various other Math Olympiad topics.

The top performers of the First Round are invited to participate in the Final Round. The Top 3 participants of the First Round will be in the Grand Challenge Round, where they are given a series of questions and present their solutions to a panel of judges. Each participant has 15 minutes to present his or her solutions, and then spend 5 minutes to answer questions from the judges. The ranking of the Top 3 shall be decided based on the correctness of the solutions, presentation skills, and response to judges' questions.

Besides the Top 3, the next 40 best participants from the First Round are invited to attend the Team Challenge of the Final Round. The participants shall be divided into 4 teams and given a set of math problems; the team members work together to solve the problems and give answers to the host. The time limit of the Team Challenge is one hour. At the end of one hour, the team that answered the most questions is the team winner.

The Final Round is a fun and entertaining event. It begins with a mathematical talk, then the Team Challenge, the Grand Challenge, and ends with the Award Ceremony.

Sample problems for the Part I of the First Round:

1. A given square and an equilateral triangle have the same area. What is the ratio of the perimeter of the triangle to the perimeter of the square?
2. The product $3^2 \cdot 5^3 \cdot 7^5$ can be written in the form $a^2 \cdot b^3 \cdot c$ with positive integers a, b, and c. What is the greatest possible value of $a \cdot b - c$?
3. Given function $f(x) = \frac{x^2}{1+x^2}$, compute the sum $\sum_{n=1}^{100} \sum_{m=1}^{100} f\left(\frac{m}{n}\right)$.
4. Find the number of ordered triples (a, b, c) of positive odd integers that satisfy $a + b + c = 2009$.

Sample problem for the Part II of the First Round:

- In quadrilateral ABCD, given that $\angle ABD = \angle ACD = 60^\circ$, $\angle ADB = 90^\circ - \frac{1}{2}\angle BDC$. Show that triangle ABC is isosceles.