

INEQUALITIES IN MATHEMATICAL OLYMPIADS

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The inequality problems rarely appear in different mathematical contests. In this report the author will discuss problems related to inequalities in School level Olympiad, Regional Mathematical Olympiad and Open Mathematical Olympiad for secondary (also including grade 9) school students.

The inequality problems in Olympiads are very different from the school tasks and the methods are not familiar to the ordinary student. So it is very important for teachers to know how to prepare student for competition and show most typical problems and solutions.

The main methods and facts that are used to prove inequalities and solve various problems where valuation is needed are

- division into multipliers;
- decreasing or increasing value of expression;
- modifying the value of fraction by changing denominator or numerator;
- using the common evaluation $a^2 \geq 0$ and equality $(a \pm b)^2 = a^2 \pm 2ab + b^2$;
- connection between the mean value and the geometric mean $A \geq G$ where

$$A = \frac{x_1 + x_2 + \dots + x_n}{n} \text{ and } G = \sqrt[n]{x_1 \cdot x_2 \cdot \dots \cdot x_n}, x_i > 0 \text{ for } i = 1, 2, \dots, n;$$

- Cauchy-Bunjakovski inequality

$$(x_1^2 + x_2^2 + \dots + x_n^2)(y_1^2 + y_2^2 + \dots + y_n^2) \geq (x_1 y_1 + x_2 y_2 + \dots + x_n y_n)^2.$$

Inequalities are widely used for solving problems where student needs to find the minimum or maximum value of some expression.

The analysis of some inequality problem sets, the examples of the extended solutions and the most characteristic students' mistakes will be considered in the report. Statistics on the results of solving inequalities problems in Open Mathematical Olympiad for secondary school students will be given.

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