

Successful acquisition of general olympiad problem solving methods in mathematics circles

Laila Zinberga, University of Latvia, Zeļļu 8, Rīga, laila.zinberga@gmail.com
Māris Zinbergs, University of Latvia, Zeļļu 8, Rīga, maris.zinbergs@gmail.com

Math problems are very different. many methods have been developed to solve olympiad problems. Some of the methods are usable to solve only few problems. Although, there are some, that can be used in many branches of mathematics. Scientists have proven that it is not possible to develop one abstract method for solving all math problems. Therefore, to solve new problems, mathematicians are required to find new methods.

In our article we will take a look at three solving/judgement methods, that can be used in many different groups of mathematics (and not only) problems.

One of the most commonly used methods, is invariant method. The basic idea of this method is that there is some value that remains constant apart from changing conditions. Solution of the problem is to find and motivate the constant value.

Dirichlet's principle is method that is best explained with example of rabbits and boxes: if you must put 3 rabbits in 2 boxes, there will be one box with at least 2 rabbits inside. In general, if you must put $n + 1$ rabbits in n boxes, there will be at least 1 box with 2 rabbits inside. To solve the problem, students must find "rabbits", and "boxes".

Third method is extremal element method. Main task is to find and investigate most "extreme" element of the set, for example triangle with largest/smallest area or biggest number of the set.

Invariant method and Dirichlet's principle is commonly used in math branches like geometry, number theory, combinatorics. Similarly extremal element method is used in combinatorics problems.

These methods are usable for solving olympiad problems in all contests for 5.-9. Grades. That is a significant part of all problems, so it is important to contribute to study these methods in math circles in school.

Studying these methods, succession should be noticed. It is important to explain to students the idea of the method and teach how to solve problems, using these methods. When students have acquired these solving methods, it is possible to offer more complex problems in which they need to find the method and use it. There are even more complex problems where they have to make judgements and alterations and the use the methods described earlier.

Special attention should be turned to correct trace of the solution. To make it easier to write solution, teacher should demonstrate easy way how to write solutions. For each method, there is a way to write solution as easy as possible. Most common way is to prove from the opposite.

The authors experience gained organizing mathematics circle in school and examples of using these methods to solve math problems will be examined in the article.