

# Generalization, Applications and Inequality Chain of the Idempotent Sum of Three Sides of the Right-angled Triangular

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**Abstract:** In a class of mathematic competition in our school, Mr. Yang explained for us a problem in 2006 Iranian Maths Olympics (Example 1) and the problem of the 176 in Medium Mathematics 2006.4. At the end of which he raised a question that whether we can make up an inequality chain, which interested us very much. So with the instruction of Mr. Yang, we obtained Theorems 1-6 by means of Bottema 2009 which is made by Professor Yang Lu (a researcher of Chinese Academy of Social Sciences), computers and calculators. And in this line, we considered that whether they could be extended to situations of high power. After making great endeavors, we endeavor Theorem 7. Finally, we thought about whether it could be extended to high dimensional situation and obtained the creative Theorem 8.

The objective of this paper is to further study a type of inequalities of the sum of equal powers of right triangle's 3 edges to the and has successfully obtained a series of inequalities to the power of 3 to 6 and some of higher order, among which some inequalities of lower order have been proved true by means of the software of Bottema 2009 that developed by Doctor Yang Lu, who is a researcher of Chinese Academy of Science. And we have obtained the inequalities about  $n$  dimensional simplex. Meanwhile we studied the application of these inequalities in mathematical competitions and teaching. In the last section, we also proposed two conjectures of more generality, among which conjecture 2 is about  $n$  dimensional simplex, for those who are interested in it. The study of this type of problems is beneficial to mathematical competitions and researches of primary and advanced mathematics.

As for the application of these theorems, we can discover their value in geometries like right-angled triangle, rectangle, round, ellipse, hyperbola, cube, hypocycloid, right-angled triangular pyramid, globe, ellipsoid, hyperboloid of two sheet, elliptic cone and so on. We can also study about their value in teaching and competitions.

In the end, we proposed more general conjectures while the second discusses about situations of  $n$  dimensional simplex and both of which are for those readers who are interested in it. This type of problems is beneficial for competitions and study of primary and advanced mathematics.

**Highlight:** We systematically study the inequality of the sum of 3 right-angled triangular sides (Theorems 1-6) and extend them to the right-angled tetrahedron and propose some difficult conjectures.

**Innovation:** We get some inequalities of the sum of 3 right-angled triangular sides of high order (4 and above (Theorem 7)), and extend them to the  $n$  dimensional space (theorem 8), and proposed conjectures in  $n$  dimensional space (conjecture 1,2) with creative methods.

**Key words:** Right-angled Triangle, the Sum of Equal Power, Inequality Chain,  $N$  Dimensional Simplex.