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Discovery of a property in 3-orthoschemes using computer

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Abstract. By using a cad modeling software a property of 3-orthoschemes has been discovered.

Keywords. 3-orthoscheme, birectangular , quadrirectangular, tetrahedron, property, discovery.

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1. Introduction

A 3-orthoscheme is a tetrahedron where all four faces are right triangles. The 3-orthoscheme is a tetrahedron having two right angles at each of two vertices, so another name for it is birectangular tetrahedron. It is also called a quadrirectangular tetrahedron because it contains four right angles[1]. (See figure 1)

2. Preliminaries

2.1. Discovery of a property in 3-orthoschemes.

Definition 2.1. *it seems sum of the square of the area of the largest triangle and the smallest one in a 3-orthoscheme is equal to the sum of squares of the areas of the other two triangles. This discovery has been made by the use of CAD modeling softwares and later investigated with a numerous examples and it seems this property is not mentioned in [2]. If this property is not reported yet, the author wishes to claim it as the theorem with his name.*

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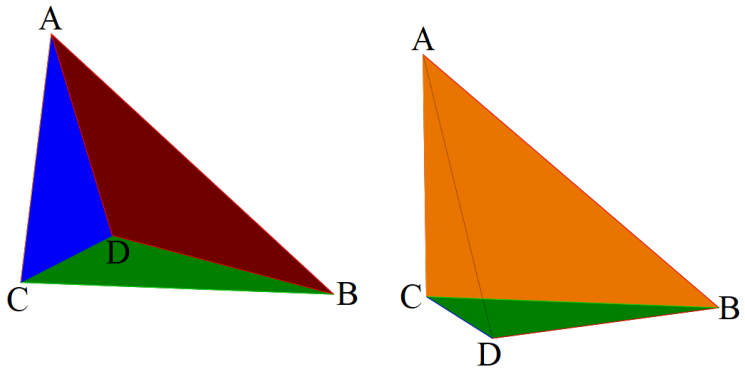

FIGURE 1. shows different views of a quadrirectangular tetrahedron; all triangles are right-angle triangles; the largest triangle is shown with the red color (ΔABD) and the smallest triangle is shown with green color (ΔBCD)

Theorem 2.1. *in any quadrirectangular tetrahedron the sum of square of the area of the largest triangle and the smallest one equals to the sum of squares of the area of the other two triangles. In other words: Square of largest Area + Square of smallest area= Sum of squares of two other areas*

Proof. The Author cannot provide an analytic proof of the theorem as of yet. however, there are numerous numerical proofs to the above mentioned theorem.One numerical example is provided in Figure-2. □

Triangle name	Side a	Side b	Side c (Hypotenuse)	Area (Unit^2)	Square of area (Unit^4)	Sum of squares of areas (largest and smallest) and sum of squares of the two other areas (Unit^4)
1	4.9	2.4	5.456189	5.88	34.5744	
2	5.456189	1.8	5.745433	4.91057	24.1137	58.6881
3	2.4	1.8	3	2.16	4.6656	
4	4.9	3	5.745433	7.35	54.0225	58.6881

FIGURE 2. shows a numerical proof as an example. Triangles 1 to 4 are all right triangles with which one can make a 3-orthoscheme

Remark. *It seems the theorem could be extended to higher dimensions as well.*

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