Discrete hypotenuse on right triangle

KIUMARS GHOWSI
Islamic Azad University Department of Chemistry, Majlesi Branch, Isfahan, Iran

HOSEIN GHOWSI
Payame Noor University Department of Mathematics, Tehran, Iran

ABSTRACT
The hypotenuse on right triangle has been divided from 1 to 2 to 3 to 5 and finally to N parts. The total discrete sections built on hypotenuse were compared within the distance on two sides of the right triangle.

Keywords
Pythagorean Theorem, Discrete hypotenuse, Right triangle

INTRODUCTION
The pythagorean theorem has been around for more than two millennia ago. Discrete mathematics has been around since the past century. We are interested to combine Pythagorean Theorem and discreteness in the mathematics in this article.

THEORY
In the following figure the hypotenuse is divided by 1 and the size of hypotenuse for two right triangles are given as $c'$ and $c$

For this figure it is obvious that $b' + a' = b + a$ and $c = c' = \sqrt{a^2 + b^2} = \sqrt{a'^2 + b'^2}$

In figure 2 it depicts the right triangle hypotenuse is divided into two parts.

We can write:

$a' + b' + c = a + b' + d$ since $d = c'$ and $b + c = a'$, $a + b + c + d = a' + b' + c'$ and according to Pythagorean theorem one can conclude for this figure 2.

$\sqrt{a'^2 + (b' + c')^2} = \sqrt{a^2 + b^2} + \sqrt{c^2 + d^2}$

In figure 3. The hypotenuse is divided into three parts we can write
Fig. 3

\[ a = b', b + c = a', e + f = c', g = e', a + b + c + e + f + g = b' + a' + c' + d' + e' \]
and from Pythagorean theorem

\[ \sqrt{(b' + c' + d')^2 + (a' + e')^2} = \sqrt{a^2 + b^2} + \sqrt{c^2 + e^2} + \sqrt{f^2 + g^2} \]

In figure 4 the hypotenuse has been divided into five divisors we can write with the same logic.

Fig. 4

\[ \sqrt{a^2 + b^2} = \sqrt{a'^2 + b'^2} + \sqrt{c'^2 + d'^2} + \sqrt{e'^2 + f'^2} + \sqrt{g'^2 + h'^2} + \sqrt{i'^2 + f'^2} \]

For the special case if

\[ a' = d' = f' = h' = i' \]

and

\[ b' = c' = e' = g' = i' \]

then

\[ \sqrt{a^2 + b^2} = 5\sqrt{a'^2 + b'^2} \]

and for n steps (n triangles) on hypotenuse we write

Fig. 5

\[ \sqrt{a^2 + b^2} = \sqrt{a'^2 + b'^2} + \sqrt{c'^2 + m'^2} + \sqrt{e'^2 + m'^2} + \sqrt{f'^2 + m'^2} + \sqrt{a'^2 + b'^2} \]
CONCLUSION

The hypotenuse of a right triangle has been discretised from 1 to n sections. The pythagorean theorem is applied to relate the smaller right angles make on hypotenuse to the larger right triangle. These formulas for special case when the smaller right triangles are equal in size are obtained which is the same as Pythagorean theorem.

REFERENCES

[1] Pythagorean theorem- Wikipedia, the free encyclopedi, Google search engine