Pythagoras of Samos

The Pythagorean Theorem

TESE DE DOUTORADO

DEPARTAMENTO DE MATEMÁTICA

Postgraduate Program in Matemática

Rio de Janeiro
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PONTIFÍCIA UNIVERSIDADE CATÓLICA
DO RIO DE JANEIRO

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Thesis presented to the Postgraduate Program in Matemática of the Departamento de Matemática do Centro Técnico Científico da PUC–Rio, as partial fulfillment of the requirements for the degree of Doutor em Matemática.

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Rio de Janeiro — August 30, 1984

Pythagoras of Samos

Pythagoras of Samos was an Ionian Greek philosopher, mathematician, and founder of the religious movement called Pythagoreanism.

To all who were inspired by my ideas.

Acknowledgments

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Abstract

Samos, Pythagoras of; Miletus, Thales of. **The Pythagorean Theorem**. Rio de Janeiro, 1984. 15p. Tese de Doutorado — Departamento de Matemática, Pontifícia Universidade Católica do Rio de Janeiro.

This work presents a famous theorem about areas of similar figures on the three sides of a right triangle.

Keywords

Resumo

Samos, Pythagoras of; Miletus, Thales of. **O Teorema de Pitágoras**. Rio de Janeiro, 1984. 15p. Tese de Doutorado — Departamento de Matemática, Pontifícia Universidade Católica do Rio de Janeiro.

Este trabalho apresenta um famoso teorema sobre áreas de figuras planas semelhantes nos lados de um triângulo retângulo.

Palavras–chave

matemática.   geometria.   triângulo retângulo.

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Nomenclature

a	lengths of one cathetus
b	lengths of one cathetus
c	length of the hypotenuse

*Number is the ruler of forms and ideas, and
the cause of gods and daemons.*

Pythagoras of Samos, *Life of Pythagoras.*

1
A Famous Theorem

The Pythagorean Theorem, is possibly the most famous theorem of history. Its was already included in the elements of Euclid [1] and can be stated as follows

Theorem 1 (Pythagoras) *In any right triangle, the area of the square whose side is the hypotenuse (the side opposite the right angle) is equal to the sum of the areas of the squares whose sides are the two legs (the two sides that meet at a right angle).*

Proof: To see 367 different proofs of this theorem the reader is encouraged to see reference [2].

The theorem can be written as an equation relating the lengths of the sides a, b and c, often called the Pythagorean equation:

$$a^2 + b^2 = c^2, \tag{1.1}$$

where c represents the length of the hypotenuse, and a and b represent the lengths of the other two sides (the cathetus).
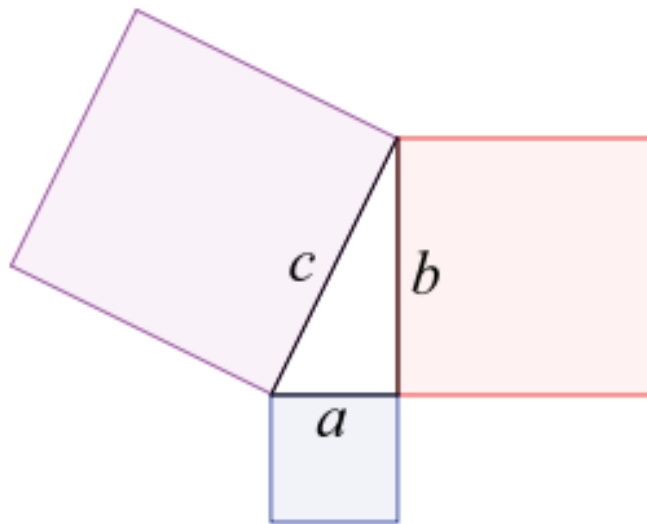

Figure 1.1: Illustration of the Pythagorean theorem. The sum of two sqares whose sides are the two legs (blue and red) is equal to the area of the square whose side is the hypotenuse (purple).

A generalization of this theorem is as follows

Theorem 2 *If one erects similar figures with corresponding sides on the sides of a right triangle, then the sum of the areas of the ones on the two smaller sides equals the area of the one on the larger side.*
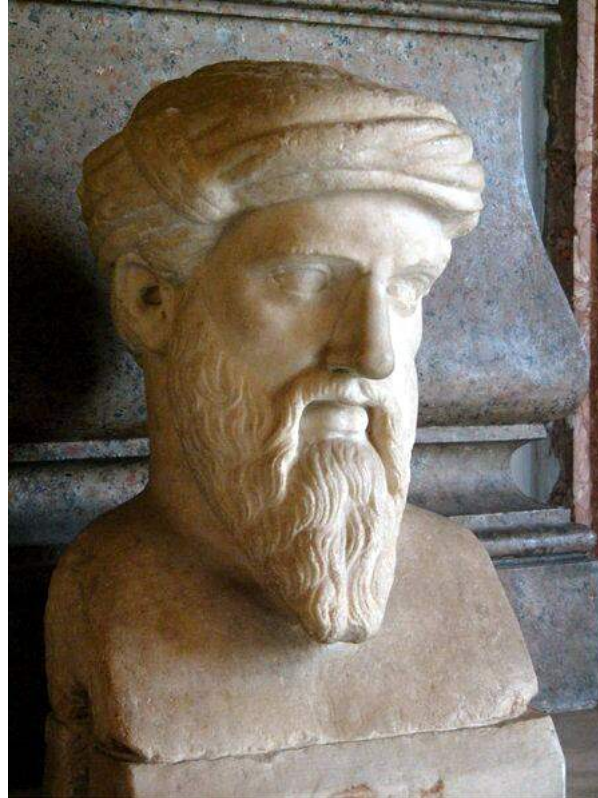

Figure 1.2: Bust of Pythagoras of Samos in the Capitoline Museums, Rome.

Bibliography

[1] EUCLID; HEATH, T. L. **The Thirteen Books of the Elements**. New York: Dover Publications, 1956.

[2] LOOMIS, E. S. **The Pythagorean Proposition**. Natl Council of Teachers, 1968.