# Pythagorean Theorem

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### 1 Introduction

In this document, we present the very famous theorem in mathematics: *Pythagorean theorem*, which is stated as follows.

**Theorem 1.1 (Pythagorean theorem)** The square of the hypotenuse (the side opposite the right angle) is equal to the sum of the squares of the other two sides.

Numerous mathematicians proposed various proofs to the theorem. The theorem was long known even before the time of Pythagoras. Pythagoras was the first to provide with a sound proof. The proof that Pythagoras gave was by rearrangement. Even the great Albert Einstein also proved the theorem without *rearrangement*, rather by using dissection. Figure 1 shows the visual representation of the theorem.

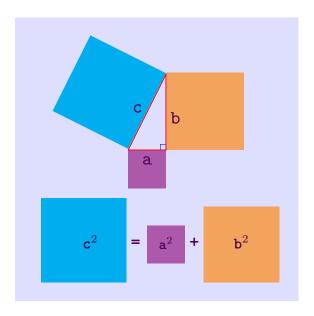


Figure 1: Visual representation of the famous Pythagorean theorem.

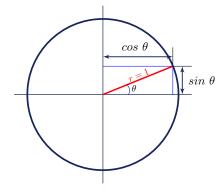


Figure 2: Alternate representation of Pythagorean theorem.

## 2 Trigonometric Forms

Lots of other forms of the same theorem exist. The most useful, perhaps, are expressed in trigonometric terms, as follows:

$$\sin^2\theta + \cos^2\theta = 1 \tag{1}$$

$$sec^2 \theta - tan^2 \theta = 1 (2)$$

$$cosec^2 \theta - cot^2 \theta = 1 (3)$$

### 2.1 Representing the First

Taking 1, we can show them as shown in Figure 2. When we take a point at unit distance from the origin, the y and x co-ordinates become  $\sin \theta$  and  $\cos \theta$  respectively. Therefore, sum of the squares of the two becomes equal to the square of the unit distance, which of course, is 1.