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.

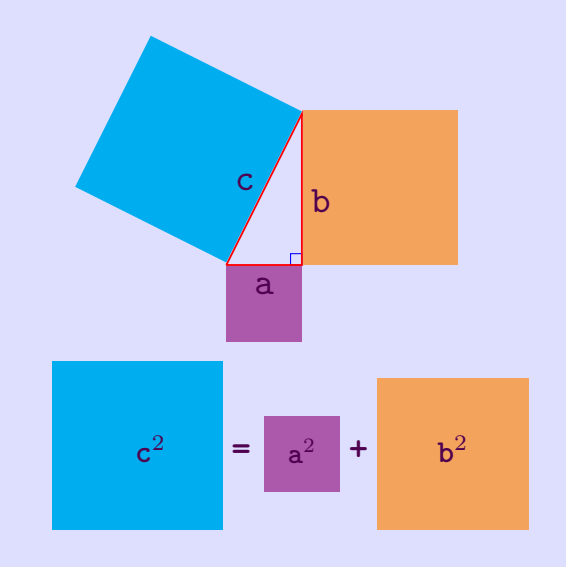

Figure 1: Visual representation of the famous Pythagorean theorem.

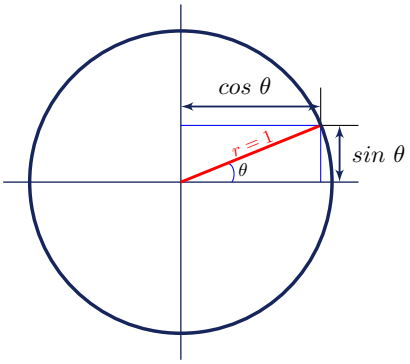

Figure 2: Alternate representation of Pythagorean theorem.

2 Trigonometric Forms

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

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

$$sec^2\ \theta\ -\ tan^2\ \theta\ =\ 1 \tag{2}$$

$$cosec^2\ \theta\ -\ cot^2\ \theta\ =\ 1 \tag{3}$$

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.