Pythagorean Theorem

1505080

June 19, 2018

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.

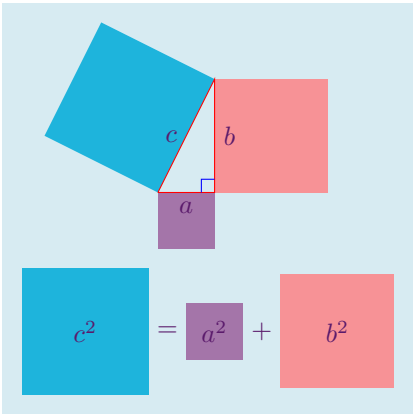

Figure 1: Visual representation of the famous Pythagorean theorem.

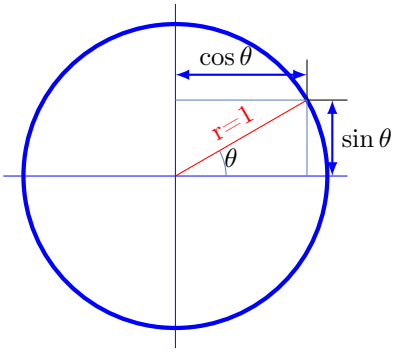

Figure 2: Alternate representation of Pythagorean theorem.

2 Trigonometric Forms

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

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

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

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

2.1 Representing the First

Taking 1, we can show them as shown in Figure2. 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.