# PROOF TO FERMAT'S LAST THEOREM

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**ABSTRACT**

Fermat's last theorem is one of the greatest math problem that exists.In this article, the author tries to prove FLT is true By trying to apply a proof similar to infinite descent by exploiting the properties of Pythagorean triples.

## 1 Introduction

Pythagorean prime triples are the root for all others Pythagorean non-prime triples, We know that two natural numbers a, b that $\sqrt{a^2 + b^2}$ that will lead us to another natural number $c$ but can the same numbers lead us to $a^n + b^n = c^n$? if not, are there any others natural numbers x, y that can satisfy the equation?

## 2 General formula for finding Pythagorean triples

Pythagorean triples $a^2 + b^2 = c^2$ for finding non-primitive Pythagorean triples, we use the constant multiplier m

$$m \cdot (a)^2 + m \cdot (b)^2 = m \cdot (c)^2 \tag{1}$$

### 2.1 Special cases

If we want a special case when we make $a = m$

$$a \cdot (a)^2 + a \cdot (b)^2 = a \cdot (c)^2 \tag{2}$$

Which means

$$a^3 + a \cdot b^2 = a \cdot c^2 \tag{3}$$

likewise for $m = b$ and $m = c$ respectively

$$b \cdot a^2 + b^3 = b \cdot c^2 \tag{4}$$

$$c \cdot a^2 + c \cdot b^2 = c^3 \tag{5}$$

which means the equations (3), (4) and (5) cannot be a solution for the equation

$$a^n + b^n = c^n \tag{6}$$

since $a \neq b \neq c$ and a, b and c are all co-prime.

### 2.2 Proof of Fermat's last theorem

Let's assume that

$$a^n + b^n = c^n \tag{7}$$

As proven by the equations (3), (4) and (5) that a and b cannot satisfy the equation(6) that will lead us to assume that there is two other natural number x, y which they have the property $a \neq b \neq x \neq y \neq c$ that can satisfy

$$x^n + y^n = c^n \tag{8}$$

a rewriting for equation(8) to be equivalent to equation(5)

$$c^{n-2} \cdot (x^2 + y^2) = c^{n-2} \cdot c^2 \tag{9}$$

which leads to by dividing all equation(9) by $c^{n-2}$ as a common multiplier m, from equation(1)

$$x^2 + y^2 = c^2 \tag{10}$$

that will lead us to

$$x^2 + y^2 = a^2 + b^2 = c^2 \tag{11}$$

which eventually lead us to

$$\sqrt{x^2 + y^2} = \sqrt{a^2 + b^2} = c \tag{12}$$

which is

$$\sqrt{x^2 + y^2} = \sqrt{a^2 + b^2} \tag{13}$$

Since a, b, c are natural numbers and co-prime (by dividing them with their multiplier m if they are not primitive Pythagorean triples), Furthermore only the root $\sqrt{a^2 + b^2}$ can lead to a natural number $c$ since $a^2 + b^2 = c^2$ are primitive Pythagorean triples (or any other Pythagorean triple with a multiplier m), and having the property that they can only be divisible by 1 or by themselves and holding the property of being natural numbers we can write and conclude that

$$\frac{a^2 + b^2}{x^2 + y^2} = \frac{c^2}{c^2} = 1 \tag{14}$$

the same equation with multiplier m

$$\frac{m \cdot (a^2 + b^2)}{m \cdot (x^2 + y^2)} = \frac{m \cdot c^2}{m \cdot c^2} = 1 \tag{15}$$

Where x, y cannot be any other natural numbers than either a, b which mean ($a = x$ and $b = y$) or ($a = y$ and $b = x$) with contradiction of $a \neq b \neq x \neq y \neq c$ and as proven by equation(5) it cannot satisfy

$$x^n + y^n = c^n \tag{16}$$

which means

$$x^n + y^n \neq c^n \tag{17}$$

and eventually

$$a^n + b^n \neq c^n \tag{18}$$

## 3 Conclusion

This article is trying to solve Fermat's last theorem by applying a proof with similar approach to Fermat's infinite descent which lead to proof FLT is true.