Nonlinear curve as proof of Fermat's Last Theorem: A graphical method

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Abstract

In this paper we will give an outline of proof of Fermat's Last Theorem using a graphical method. Although an exact proof can be given using differential calculus, we choose to use a more intuitive graphical method.

Introduction

Fermat's Last Theorem is one of the most difficult mathematical problems since more than 200 years ago. It can be rephrased more simply as follows:

"*The Pythagoras Theorem only works for and only for n=2, and does not work for other values of n, where the theorem can be written as* : $a^n + b^n = c^n$."

While more than hundred solutions of FLT have been proposed by eminent mathematicians, including the famous lecture by Andrew Wiles [1][2], but still many people want a simpler but intuitive argument for proving the validity of FLT. This paper is aiming to offer such an intuitive solution using graphical method.

Outline of argument

First we can write down the FLT as follows:

$$a^x + b^x = c^x , \tag{1}$$

Or it can be rewritten as follows:

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

The condition given by FLT is that equation (2) strictly equals 1, but let say we want to check if this condition holds for any value of x, then (2) can be written as follows:

$$\frac{a^x + b^x}{c^x} = y. \quad (3)$$

Now, we have a nonlinear equation in x and y. This equation can be solved at least by two methods, namely:

a. Differential calculus method, by solving dy/dx=0,
b. Graphical method.

Numerical result

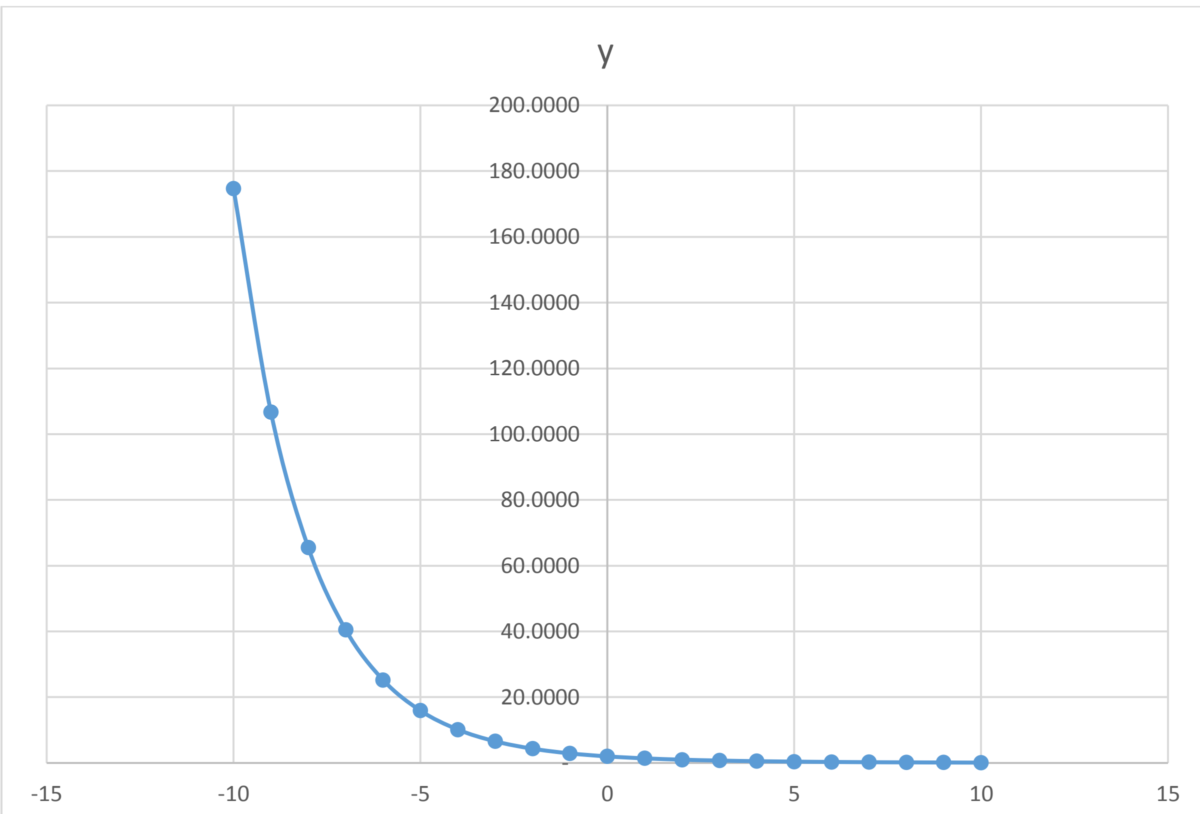
In this paper we will use a simpler and intuitive graphical method, starting with an assumption that a=3, b=4, c=5, and x ranging from -10 to +10. For other values of a,b,c the readers are invited to verify themselves.

Using MS Excel, we got the following result for equation (3):

x	y
-10	174.6949
-9	106.6796
-8	65.4979
-7	40.4908
-6	25.2482
-5	15.9118
-4	10.1575
-3	6.5828
-2	4.3403
-1	2.9167
0	2.0000
1	1.4000
2	1.0000

3	0.7280
4	0.5392
5	0.4054
6	0.3088
7	0.2377
8	0.1846
9	0.1443
10	0.1134

And the graphical plot is as follows:



It should be clear that as x has values below 0, then y increases exponentially, but as x has values greater than 0 then y decreases approaching zero.

The only value where y=1, is where x=2.

This is a graphical method to solve FLT intuitively with equation (3).

Concluding remarks

It is possible to find a proof of validity of Fermat Last Theorem in an intuitive way using a graphical method.

Although an exact proof can be given using differential calculus, we choose to use a more intuitive graphical method.

It is our hope that such a graphical solution can be useful as teaching tool for high school mathematics teachers.

For professors in mathematics, we are aware that this graphical method for solving FLT may sound too naïve, but considering the Occam's razor principle, then the simpler solution may be closer to the truth.

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[2] Andrew John Wiles. Modular elliptic curve and Fermat's Last Theorem. Annals of Mathematics 141, 1995. URL: http://scienzamedia.uniroma2.it/~eal/Wiles-Fermat.pdf

[3] Peter Schorer. Is there a simple proof of Fermat's Last Theorem? Sept. 2016. URL: *www.occampress.com/**fermat.pdf***