Research Article
Volume 11:11, 2022

Journal of Applied & Computational Mathematics

ISSN: 2168-9679 Open Access

Pierre De Fermat's Last Theorem: Some Historical Evidences, Facts and Inference

Khurshid Ahmad Bhat*

Department of State Education, Indian Institute of Integrative Medicine, Jammu and Kashmir, India

Abstract

Around 1637 Fermat wrote few lines in the margin of Arithmetica, an Ancient Greek text on mathematics written by Diophantus of Alexandria, an Alexandrian mathematician in 3rd century AD. Fermat wrote that "it is impossible to separate a cube into two cubes, or a fourth power into two fourth powers, or in general, any power higher than the second, into two like powers. I have discovered a marvelous proof of this, which this margin is too narrow to contain". After 358 years, in 1995. Published a successful proof that $X^n+Y^n \neq Z^n$, for 'n' >2, as Pierre de Fermat was talking about some marvelous demonstration of this theorem, since than no clue was found about the marvelous demonstration. In this paper some historical evidences and facts are highlighted and some anticipated demonstration related to Fermat's Last Theorem is devised, may be it will contribute and facilitate the mathematicians to search out some facts associated to Fermat's Last Theorem and the demonstration.

Keywords: Fermat last theorem • Error percentage • Arithmetica • Narrowness • Mathematical programming • Regular pattern

Introduction

Historical background and facts

Pierre de Fermat was a French mathematician born in Beaumont-de-Lomagne, his father Dominique Fermat, a wealthy leather merchant from Gascony, a province of southwestern France. Fermat receives a Bachelor's degree in civil law from University of Orleans. He was a trained lawyer and working with mathematics as a hobby, he communicated maximum portion of his work through letters to his friends with some modest proof or no proof. He had contributed analytical geometry, number theory and maxima and minima. After the death of Fermat his son Clement Samuel found a book of Arithmtica and inform the world regarding the note of the Fermat called Fermat Last Theorem. "It is impossible to separate a cube into two cubes, or a fourth power into two fourth powers, or in general, any power higher than the second, into two like powers. I have discovered a truly marvelous proof of this, which this margin is too narrow to contain". When this note was published it challenges the mathematicians and after 350 years of efforts first successful proof was released by Andrew Wiles which was formally published in 1995. This conjecture was considered as most difficult problem in mathematical history and it was make a place in Guinness Book of World records having largest number of unsuccessful proofs. In 1995 Andrew Wiles proves that the conjectur is true i,e $X^n+Y^n \neq Z^n$, for 'n'>2, but the mystery remains unanswered that there is a marvelous demonstration for this problem. As far as the second part of theorem is concerned, no researcher has talked about this till date. To provide some prediction/anticipation, let us intensely look the statement of Fermat's last theorem. The statements seems some mystery, may be some puzzle. In these statements some bizarre words are used like narrowness, appetizer, incompleteness, too wide, white space etc.

***Address for Correspondence:** Khurshid Ahmad Bhat, Department of State Education, Indian Institute of Integrative Medicine, Jammu and Kashmir, India, Email: jkstatuk@yahoo.co.in*

Date of Submission: 02 November 2022, Manuscript No. jacm-22-78147; **Editor assigned:** 03 November, 2022, PreQC No. P-78147; **Reviewed:** 16 November 2022, QC No. Q-78147; **Revised:** 17 November 2022, Manuscript No. R-78147; **Published:** 24 November, 2022, DOI: 10.37421/2168-9679.2022.11.500

Statement I: "I have discovered a truly marvelous proof of this, which this margin is too narrow to contain.

Statement II: "I have a truly marvelous proofs of this facts, but these margins are frankly too wide to contain it. I mean it's too much white space, you know? It is be like a huge dinner plate with a tiny appetizer on it. Now I do have proof, obviously. But let's be real. People know how great I am at math and there's something they don't know how great I am at drawing cats. To that end, I have a truly marvelous cut picture and this margin is just big enough for it".

Some possible inferential demonstrations

In the history of mathematics large number of conjecture are found, a good number of challenging conjecture are in number theory, some of them have been solved and some of them are still exigent. Some of the famous Conjectures in number theory are:

- Gold Bach's conjecture. (Unsolved till date)
- Twin Prime Conjecture. (Unsolved till date)
- The P verses NP problem. (Unsolved till date)
- The Riemann Hypothesis. (Unsolved till date)
- Collatz Conjecture. (Recently solved) and more …

Fermat's conjecture in one of the oldest conjecture in number theory, Andrew Wiles has proved that this conjecture is true i,e, no value of X, Y and Z satisfies for 'n'> 2. Many researchers worked on this conjecture and presented their views and modus operandi for different values of 'n'. Some of them are [1-10].

Three possible inferential demonstrations are discussed at this juncture:

- Regular Pattern of Numbers
- Fermat's Possible Series.
- Mathematical Programming Approach.

Regular pattern of numbers: Analyzing Fermat's conjecture carefully, a beautiful pattern of numbers are envisage, after using different integers values of X, Y, and Z in, $X^n+Y^n \neq Z^n$, the pattern is regular [11]. But the difference is there, which is not more than 5% or in higher cases it is not more than the quantity of appetizer used in big plates of dinner. The pattern can be understood by the following relation:

$O^n+(O+1)^n \sim (O+2)^n$

O = All odd values > 3

n≥3

Starting from 'O'=3, and 'n'= 3 (in order), a marvelous continuous pattern is found which provides the some lower differences in specific groups. By this pattern we can find any higher combinations having least difference in any specific power.

Fermat's possible series: In Fermat's Last theorem equality doesn't hold ($X^n+Y^n \neq Z^n$), but in this demonstration equality holds under modified condition: In the margin of copy of the Arithmetica next to Diophantus's sum of squares problem, Fermat write his theorem that " It is impossible to separate a cubes, or a fourth power into two three power or fourth powers, or in general, any power higher than the second, into two like powers, I have discovered a truly marvelous proof of this, which this margin is too narrow to contain [12].

Equality holds in fermat's theorem under following conditions: "It is possible to separate a cube or a fourth power into sum of three cubes or sum of four fourths powers or in general any power higher (n),into 'n' like powers, the number of terms may be less then 'n' or more than 'n'".

Let y_1, y_2, y_3,..... y_m be 'm' finite numbers such that:

$y_1 \leq y_2 \leq y_3 \leq \ldots y_{m-1} \leq y_m$

$(y_1)^n \leq (y_2)^n \leq (y_3)^n \leq \ldots (y_{m-1})^n \leq (y_m)^n$

$(y_1)^n+(y_2)^{n+}(y_3)^n+\ldots (y_{m-1})^n+(y_m)^n= Z^n$

n>2 and m>2

Mathematical programming approach: Andrew Wiles submitted two manuscripts on 24th November 1994 "Modular elliptic curves and Fermat's last theorem" [13,14]. and " Ring theoretic properties of certain Hecke algebra [13]. with co-author with Taylor and proved that some conditions were met that were needed to justify the corrected steps in the main paper.

These papers established the modularity theorem for semi stable elliptic curves, the last step in proving Fermat's last theorem.

Now it is true that

$X^n+Y^n \neq Z^n$

We can write this as:

$X^n+Y^n+e = Z^n$ e – any natural number (error)

` $E = (e/Z) = 1 - (X/Z)^n +(Y/Z)^n$

In order to recognize the closed values for different powers of 'n' the concept of mathematical programming is used, a mathematical programming problems is framed which helps to find the values of the variables when the 'E' is minimum.

Minimize $E = 1 - (X/Z)^n +(Y/Z)^n$

Subject to

$1 - (X/Z)^n +(Y/Z)^n \geq 0$

X, Y, Z (Natural Number)

X, Y, Z > 1

X, Y, Z < L

(L is any upper limit so that number of iterations and run time remains limited)

Solution of this mathematical programming problem for some values of 'n' (for demonstration purpose) such that the value of 'E' is least is as:

Discussion

The statements of the Fermat are the main clues to find the links regarding the marvelous demonstration of Fermat. Keeping in view these statements three possible inferential demonstration are introduced to find the flanking values of the variables. Out of the three techniques first introduced the beautiful pattern of the numbers, second provides the equality possibility in Fermat's Last Theorem and the third helps to find the contiguous values with least percentage of differences (error).

References

1. Wiles, Andrew. "Modular forms, elliptic curves, and Fermat's Last Theorem." In Proceedings of the International Congress of Mathematicians, Birkhäuser, Basel, (1995): 243-245.
2. Tafelmacher, A. "Sobre la ecuacion x4+y4= z4." In Anales de la Universidad de Chile (1893): 307.
3. Barbara, Roy. "91.33 Fermat's Last Theorem in the case n=4." *Math Gaz* 91 2007): 260-262.
4. Barlow P. "An elementary Investigation of Theory of Numbers". St. Paul's Church-Yard, London: J. Johnson. Pp. (1811): 144 -145.
5. Betrand, Joseph and Louis François. "Traité élémentaire d'algèbre." (1851).
6. Carmichael, R. D. "On the impossibility of certain Diophantine equations and systems of equations." *Amer Math Monthly* 20 (1913): 213-221.
7. Dolan, Stan. "95.24 Fermat's method of "Descente infinie". *Math Gaz* 95 (2011): 269-271.
8. Euler, Leonhard, Artur Diener and Alexander Aycock. "Theorematum quorundam arithmeticorum demonstrationes." arXiv preprint arXiv: (2012): 1202-3808.
9. Gambioli, Dionisio. Memoria bibliografica sull'ultimo teorema di Fermat. (1901): 145 -192.
10. Hilbert, D. "Die Theorie der algebraischen Zahlkörper. Jahresber. der D." Math. Ver 4 (1897): 349-357.
11. Khurshid, A Peeping into the Collatz Conjecture. Journal of Applied & computational Mathematics. 10 (2021).
12. Khurshid, A. "Some Remarkable Evidence of Pierre de Fermat Last theorem". *Eur j appl sci* 10 (2022). 242-245.
13. Heath, T. L. "Diophantus of alexandria: a study in the history of greek algebra." Chicago: Powell's Bookstore, Martino Publishing, Mansfield Center, (2003).
14. Taylor, Richard and Andrew Wiles. "Ring-theoretic properties of certain Hecke algebras." *Ann Math* 141 (1995): 553-572.

How to cite this article: Bhat, Khurshid Ahmad. "Pierre De Fermat's Last Theorem: Some Historical Evidences, Facts and Inference." *J Appl Computat Math* 11 (2022): 500.