Proof of Fermat's Last Theorem

Zengyong Liang

Preface

Fermat is a French justice and amateur mathematician .In 1637, Fermat was inadvertently attracted by the Pythagorean work described in the ancient Greek mathematician Diophantine's arithmetic. He had a whim about whether he could find a solution to the indefinite equation of the Pythagorean equation.

The original Pythagorean equation can be expressed as the search equation:

$$x^n + y^n = z^n$$

integer solution of.

Fermat then annotated in the book "arithmetic": it is impossible to divide a cubic number into two cubic numbers, a fourth power into two fourth powers, or generally divide a power higher than the second power into two powers of the same power. On this, I am sure I have found a wonderful proof. Unfortunately, the blank space here is too small to write down." This problem is then called "Fermat's Last Theorem".

For more than three centuries, the best mathematicians in history have tried to prove it, but got nothing. In 1994, Wiles indirectly proved Fermat's theorem by using modern mathematical methods such as modular form, Gushan Zhicun conjecture and the properties of elliptic curves of Galois group. But his proof is 130 pages long and quite esoteric, which is obviously not the short proof Fermat said. People are still seeking a concise Fermat's theorem as Fermat said

If *x, y* and *z* have common factor, we can eliminate them. Is that the equation becomes

$$A^n + B^n = C^n .$$

First proof

Zengyong Liang

Fermat's lasr theorem: If equation

$$A^n + B^n = C^n \qquad (1)$$

there is no positive integer solution.

Proof. If $B^n=0$，$A^n=C^n$ is ture . But $B\neq 0$, then $A^n \neq C^n$. Let $C=A+c$, then

$$C^n = (A+c)^n$$

$$C^n == A^n + n A^{n-1}c + \ldots + nAc^{n-1} + c^n \quad (2)$$

（1）+（2）:

$$A^n + B^n == A^n + n A^{n-1}c + \ldots + nAc^{n-1} + c^n$$

$$B^n = n A^{n-1}c + \ldots + nAc^{n-1} + c^n \quad （3）$$

Let $B=A+x$,

$$B^n = (A+x)^n$$

$$B^n = A^n + n A^{n-1}x + \ldots + nAx^{n-1} + x^n \quad (4)$$

By（3）and（4）get

$$n A^{n-1}c + \ldots + nAc^{n-1} + c^n = A^n + n A^{n-1}x + \ldots + nAx^{n-1} + x^n \quad （5）$$

If（5）is ture，then（4）is also ture .

Sorting (5) can obtain:

$$A^n + n A^{n-1}（x - c） + \ldots + nA(x - c)^{n-1} + x^n - c^n = 0 \quad (6)$$

From the theorem, when

$x - c = q = A$,

$x^2 - c^2 = q^2 = A^2$

…

$x^n - c^n = q^n = A^n$

in order to establish (6).

Obviously, the equations contradict each other. It cannot be established at the same time. Then (6) cannot be established.

Then (5),…, (2) and (1) are not tenable.

Second proof

Zengyong Liang

Fermat's lasr theorem: If equation

$$A^n + B^n = C^n \quad (1)$$

there is no positive integer solution.

Proof . If $B^n=0$，$A^n=C^n$, equation (1) is ture .

Then gradually reduce A^n from equal to C^n, plus the reduced part is still equal to C^n.

let the reduced part is y^n , i.e.

$$(A - x)^n + y^n = C^n$$

$$(A - x)^n = A^n - n A^{n-1} x + \ldots\ldots + (-1)^{n-1} n A x^{n-1} + (-1)^n x^n \quad (2)$$

In (2), $n A^{n-1} x - \ldots\ldots + (-1)^n n A x^{n-1} + (-1)^{n+1} x^n$ is the reduced part, which should be equal to

$$n A^{n-1} x - \ldots\ldots + (-1)^n n A x^{n-1} + (-1)^{n+1} x^n = y^n$$

$$x(n A^{n-1} - \ldots\ldots + (-1)^n n A x^{n-21} + (-1)^{n+1} x^{n-1}) = y^n$$

then $x \mid y$.

1）If $y^n = q^n p^n$, $x = pq$, then

$$pq\,(n A^{n-1} \quad -\ldots\ldots+(-1)^{n}\, n A\, x^{n-21}+(-1)^{n+1}\, x^{n-1}) = q^n p^n$$

$$n A^{n-1} \quad -\ldots\ldots+(-1)^{n}\, n A\, x^{n-21}+(-1)^{n+1}\, x^{n-1} = q^{n-1} p^{n-1}$$

There is a common factor between A and $q^{n-1}p^{n-1}$,

That is, there is a common factor between A and y (also B), which is impossible.

2）If $y^n = q^n p^n$, $x = p^n$, （p,q）=1, then

$$p^{n}\,(n A^{n-1} \quad -\ldots\ldots+(-1)^{n}\, n A\, x^{n-21}+(-1)^{n+1}\, x^{n-1}) = q^n p^n$$

$$n A^{n-1} \quad -\ldots\ldots+(-1)^{n}\, n A\, x^{n-21}+(-1)^{n+1}\, x^{n-1} \ = q^n$$

There is a common factor between A and q^n,

That is, there is a common factor between A and y (also B), which is impossible .

(20170706)

Third proof

Zengyong Liang

Fermat's lasr theorem: If equation

$$A^n + B^n = C^n \qquad (1)$$

there is no positive integer solution.

Proof. Let $C=A+c$,

$$A^n + B^n = (A+c)^n$$

$$A^n + B^n \ = A^n + n A^{n-1} c + \ldots\ldots + n A\, c^{n-1} + c^{n}$$

$$B^n \ = n A^{n-1} c + \ldots\ldots + n A\, c^{n-1} + c^{n}$$

$$B^n \ = c\,(n A^{n-1} + \ldots\ldots + n A\, c^{n-2} + c^{n-1}) \qquad (2)$$

Then B contains c, $c|B$.

Let $B = c\,k$,

$$c^{n} k^n \ = c\,(n A^{n-1} + \ldots\ldots + n A\, c^{n-2} + c^{n-1})$$

$$c^{n-1} k^n \ = n A^{n-1} + \ldots\ldots + n A\, c^{n-2} + c^{n-1}$$

$$c^{n-1} k^n - c^{n-1} = n A^{n-1} + \ldots\ldots + n A\, c^{n-2}$$

$$c^{n-1}(k^n - 1) = nA(A^{n-2} + \ldots\ldots + c^{n-2})$$

1) There is can’t be that there is c and nA contains common factor, because $C=A+c$.

2) Then there is c^{n-1} and ($A^{n-2} + \ldots\ldots + c^{n-2}$) contains common factor；but lead to c and A contains common factor.

So, in any case, it will lead to C and A contains common factor. It is impossible.

(20181108)

Tips: for more communication, please link:
http://www.mathchina.com/bbs/forum.php?mod=viewthread&tid=2051239