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Proof of Beal's Conjecture

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Commentary

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ABSTRACT

Beal's hypothesis states if $A^x + B^y = C^z$, where A, B, C, x, y, and z are positive integers and x, y, and z are greater than 2, then A, B, and C must share a prime component. The most crucial justification for conjecture proof is that the conjecture itself contains the answer to Beal's conjecture. The largest common integer factor between A, B, C attendants us in the simplest forms of Equation $A^x + B^y = C^z$.

INTRODUCTION

The most crucial justification for conjecture proof is that the conjecture itself contains the answer to Beal's conjecture. The largest common integer factor between A, B, C attendants us in the simplest forms of Equation (1).

$$A^x + B^y = C^z \,\text{.....Equation}\,(1)$$

The powers of positive integer numbers are displayed in Table 1.

Table 1. The powers of positive integer numbers.

1^0	1^1	1^2	1^3	1^4	1^5	1^6	1^7	1^8	1^9	1^{10}	→
2^0	2^1	2^2	2^3	2^4	2^5	2^6	2^7	2^8	2^9	2^{10}	
3^0	3^1	3^2	3^3	3^4	3^5	3^6	3^7	3^8	3^9	3^{10}	
4^0	4^1	4^2	4^3	4^4	4^5	4^6	4^7	4^8	4^9	4^{10}	
5^0	5^1	5^2	5^3	5^4	5^5	5^6	5^7	5^8	5^9	5^{10}	
6^0	6^1	6^2	6^3	6^4	6^5	6^6	6^7	6^8	6^9	6^{10}	
7^0	7^1	7^2	7^3	7^4	7^5	7^6	7^7	7^8	7^9	7^{10}	
8^0	8^1	8^2	8^3	8^4	8^5	8^6	8^7	8^8	8^9	8^{10}	
9^0	9^1	9^2	9^3	9^4	9^5	9^6	9^7	9^8	9^9	9^{10}	
10^0	10^1	10^2	10^3	10^4	10^5	10^6	10^7	10^8	10^9	10^{10}	
↓											

First of all, we gain the possible simplest form of three - elements equations with the numbers in Table 1. These equations have simplest forms as Equations (2) to (5)

The following equations have the simplest forms for Equation (1):

$$K + F^m = G^m \text{.....Equation}\,(2)$$
$$E^m + F^m = K \text{.....Equation}\,(3)$$
$$1 + F^m = K \text{.....Equation}\,(4)$$
$$1 + K = G^m \text{.....Equation}\,(5)$$

K is a positive integer number, and Equations (2) to (5) have not common factor between any of the equations.

By proving these four cases and proving the absence of the fifth case, Beal's conjecture is also proved.

In other words, Beal's conjecture is true if and only if the simplest form of the Equation

(1) is one of the Equations (2) to (5).

The substantiation should look like this:

- Let the Equation (2) to (5) are the simplest form of the Equation (1) therefore have a largest common factor and it will be explained in Chapter 2
- Let $A^x + B^y = C^z$ have a greatest common factor; therefore, Equations (2) to (5) are the simplest form of the Equation (1), and it will be explained in Chapter 3.

EQUATION (2) TO EQUATION (5) IS THE SIMPLEST FORM OF EQUATION (1)

Equations (2) and (3)

Equation (1) can be formed by multiplying Km in the sides of Equations (2) and (3). Therefore, Equations (2) and (3) are the most basic of Equations (1).

$$K + F^m = G^m \Rightarrow K^{m+1} + (FK)^m = (GK)^m \Rightarrow \text{Equation (2) is a simplest form of Equation (1).}$$

$$\text{e.g., } 19 + 2^3 = 3^3 \Rightarrow 19^{3+1} + (2*19)^3 = (3*19)^3 \Rightarrow 19^3 + 38^4 = 57^3$$

$$E^m + F^m = K \Rightarrow (EK)^m + (FK)^m = K^{m+1} \Rightarrow$$ Equation (3) is a simplest form of Equation (1).

e.g., $3^3 + 2^3 = 35 \Rightarrow (3*35)^3 + (2*35)^3 = (35)^{3+1} \Rightarrow 105^3 + 70^3 = 35^4$

Equations (4) and (5)

Equation (1) can be formed by multiplying Km in the sides of Equations (4) and (5). We come to the conclusion that Equation (4) and (5) are the most basic version of Equation (1).

$$1 + F^m = K \Rightarrow K^m + (FK)^m = K^{m+1} \Rightarrow$$ Equation (4) is the simplest form of Equation (1).

$$1 + K = G^m \Rightarrow K^m + K^{m+1} = (GK)^m \Rightarrow$$ Equation (5) is the simplest form of Equation (1).

e.g., $1 + 7 = 2^3 \Rightarrow (7)^3 + (7)^{3+1} = (2*7)^3 \Rightarrow 7^3 + 7^4 = 14^3$

THE SIMPLEST FORM OF THE EQUATION $A^x + B^y = C^z$ IS REPRESENTED BY EQUATIONS (2) TO (5).

P is assumed to be the most frequent component of the equation $A^x + B^y = C^z$.

$$\frac{A^x}{P} + \frac{B^y}{P} = \frac{C^z}{p} \Rightarrow \frac{a*P}{P} + \frac{b*P}{P} = \frac{c*P}{P} \Rightarrow a + b = c$$ ......Equation (6)

a, b, and c are numbers from Table 1. and they must possess some prerequisite in order to be expressed in Equation (1) in their simplest form.

These are the prerequisites:

If a=1, then the numbers b and c have different exponents.

Proof:

We suppose that $b = i^1$ and $c = j^1$ with power 1>2 in Equation (6).

Equation (6) $\Rightarrow 1 + i^1 = j^1$, because j is always greater than i this equation has no solution for any i and j.

The power inequality for b and c in Equation (6) shows that Equation (4) and (5) are the simplest forms for Equation (1), in this case $K = G^n$ in Equation (4) and F^n in Equation (5) for $n \geq 1$ and $n \neq m$

e.g., $9^3 + 18^3 = 9^4 \Rightarrow (9)^3 + (2*9)^3 = (9)^{3+1} \Rightarrow 1 + 2^3 = 3^2 \Rightarrow K = 3^2$

$P = 9^3, a = 1, b = 2^3, c = 9 = 3^2$

b, c are to numbers from Table 1. With different exponents 3 and 2.

e.g., $7^3 + 7^4 = 14^3 \Rightarrow (7)^3 + (7)^4 = (2*7)^3 \Rightarrow 1 + 7 = 2^3 \Rightarrow K = 7^1$

$$P = 7^3, a = 1, b = 7^1, c = 8 = 2^3$$

b, c are to numbers from Table 1. With different exponents 1 and 3.

If $c = 1$

In Equation (6) the lowest value of a and b is 1 and c can therefore never be assigned one.

$1+1 \neq 1$

If $a = K$ > 1, then ***b*** and ***c*** are two numbers with the same exponents.

If $a = 1$, b and c are two numbers with different exponents therefore if

$a = K$ > 1, then b and c are two numbers with the same exponents. The only thing that needs to be proven is that K does not have an exponent greater than one as shown in Equation (7).

$$K + i^1 = j^1 \text{.....Equation (7)}$$

This is demonstrated by the following contraposition: Equation (7) is a simplest form of Equation (1) and if K is a number with exponent greater than one, no common factor leads us to Equation (1) therefore K is not a number with an exponent greater than one.

e.g., $$19^4 + 38^3 = 57^3 \Rightarrow (19)^4 + (2*19)^3 = (3*19)^3 \Rightarrow 19 + 2^3 = 3^3 \Rightarrow K = 19$$

$$P = 19^3, \mathrm{a} = 19, \mathrm{b} = 2^3, c = 9 = 3^3$$

b, c are to numbers from Table 1. With the same exponents 3.

If $c = K$ > 1, then a and b are two numbers with the same exponents, if c = 1, b and a are two numbers with different exponents therefor if c=K > 1, b and a are two numbers with the same exponents.

The only thing that needs to be proven is that K does not have an exponent greater than one, as shown in Equation (8).

$$i^1 + j^1 = K \text{.....Equation (8)}$$

This is demonstrated by the following contraposition:

Equation (8) is the simplest form of Equation (1), and if K is a number with an exponent greater than one, no common factor leads us to Equation (1), therefore K is not a number with an exponent greater than one.

e.g., $$760^3 + 456^3 = 152^4 \Rightarrow (5*152)^3 + (3*152)^4 \Rightarrow 5^3 + 3^3 = 152 \Rightarrow K = 152$$

$$p = 152^3, a = 5^3, \mathrm{b} = 3^3, c = 152$$

a, b are to numbers in Table 1. with the same exponents 3.

Finally, we conclude that Beal's conjecture is correct if and only if Equation (1)'s simplest form is one of the following equations:

$$K + F^m = G^m \text{.....Equation}(2)$$
$$E^m + F^m = K \text{.....Equation}(3)$$
$$1 + F^m = K \text{.....Equation}(4)$$
$$1 + K = G^m \text{.....Equation}(5)$$

CONCLUSION

Fermat's Last Theorem is generalized in Beal's conjecture. It states that if $A^X + B^Y = C^Z$, where $A, \mathrm{B}, \mathrm{C}, \mathrm{x}, \mathrm{y}$, and z are all positive integers and all greater than 2, then A, B, and C must have a common prime factor.

The solution to Beal's conjecture lies in the conjecture itself, and it is the most important reason for conjecture proof.

The simplest forms of Equation (1) are guided by the largest common integer factor between A, B, and C.

$$A^x + B^y = C^z \text{.....Equation}(1)$$

One of the following equations is the simplest form of Equation (1):

$$K + F^m = G^m \text{.....Equation}(2)$$

$$E^m + F^m = K \text{.....Equation}(3)$$

$$1 + F^m = K \text{.....Equation}(4)$$

$$1 + K = G^m \text{.....Equation}(5)$$

We can prove Fermat's conjecture much more easily with proof of Beal's conjecture. To reach the Beal's conjecture, the sides of Equations (2) to (5) must be multiplied by Km.

This leads us to an important conclusion that follows the proof of Fermat's theorem in a more direct way.

Multiplying Km by the sides of Equations (2) to (5) never yields the same exponent in the equations.

APPRECIATION

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