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Brief Report

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The Truly Marvelous Proof for n=4

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Abstract: The truly marvelous proof of the Fermat's Last Theorem for n = 4. MSC: Primary: 11D41; Secondary:

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Introduction

The Fermat's Last Theorem is the famous theorem. Here we have the truly marvelous proof for n = 4

I. THE TRULY MARVELOUS PROOF OF THE FERMAT'S LAST THEOREM FOR n = 4

Theorem 1 (FLT for $n = 4$). The equation

$A^4 + B^4 = C^4$

has no primitive solutions $[A, B, C]$ in $\{1,2,3,\ldots\}$.

Proof. Suppose that the equation $A^4 + B^4 = C^4$ has primitive solutions $[A, B, C]$ in $\{1,2,3,\ldots\}$.[1],[2]

Then A, B and C are co-prime. Without loss for this proof we can assume that A is odd. Then B is even and C is odd, which is obviously.

For some $C, A \in \{1,3,5,\ldots\}$ and for some $B \in \{4,6,8,\ldots\}$:

$$(C - A + A)^4 - A^4 = B^4 \Rightarrow (C - A)^3 + 4(C - A)^2 A + 6(C - A)A^2 + 4A^3 = \frac{B^4}{C - A}.$$

Notice that

$$(C - A)^3 + 4(C - A)^2 A + 6(C - A)A^2 + 4A^3 = \frac{C^4 - A^4}{C - A} = \frac{(C^2 + A^2)(C + A)(C - A)}{C - A}.$$

Hence - For some $k \in \{1,2,3,\ldots\}$ and for some $e, c, d \in \{1,3,5,\ldots\}$ such that e, c and d are co-prime:

$$\frac{\left(2^k ecd\right)^4}{C - A} = \frac{\left(2^k ecd\right)^4}{2^{4k-2} d^4} = 4(ec)^4 = \frac{B^4}{C - A}.$$

Therefore - For some relatively prime $e, c \in \{1,3,5,\ldots\}$ such that $e > c$:

$$4(ec)^4 = (C^2 + A^2)(C + A) \Rightarrow (C^2 + A^2 = 2e^4 \wedge C + A = 2c^4) \Rightarrow$$

$$\begin{aligned}(C = x + y \wedge A = x - y \wedge C + A = 2x = 2c^4 \wedge x = c^4 \wedge x^2 + y^2 = e^4 \wedge x = c^4 \\ = u^2 - v^2 \wedge y = 2uv \wedge e^2 = u^2 + v^2 \wedge e = p^2 + q^2 \wedge u = p^2 - q^2 \wedge v \\ = 2pq) \\ \Rightarrow \{x^2 = [(p^2 - q^2)^2 - (2pq)^2]^2 = c^8 \equiv \mathbf{0} \wedge y^2 \\ = 4(p^2 - q^2)^2(2pq)^2 \wedge e^4(p^2 + q^2)^4 \wedge [(p^2 - q^2)^2 - (2pq)^2]^2 \\ + 4(p^2 - q^2)^2(2pq)^2 = (p^2 + q^2)^4 \equiv \mathbf{1}\}.\end{aligned}$$

where $(p^2 - q^2)^2 - (2pq)^2 > 4(p^2 - q^2)pq$.

The above last sentence is false inasmuch as on the strength of the Guła's Theorem [1] we have

$$(2pq)^2 = (p^2 - q^2)^2 - (c^2)^2 \Rightarrow p^2 - q^2 = \frac{(2pq)^2 + (2q^2)^2}{2(2q^2)} = p^2 + q^2 \equiv \mathbf{0}.$$

This is the proof.

References

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2. Guła LW (2016) Several Treasures of the Queen of Mathematics. International Journal of Emerging Technology and Advanced Engineering 6: 48-59.