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The Truly Marvellous Proof for $n=4$

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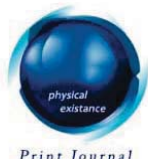
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The Truly Marvellous Proof for $n=4$

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I. INTRODUCTION

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

II. THE TRULY MARVELLOUS 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* $\{1, 2, 3, \dots\}$.

Proof. Suppose that the $A^4 + B^4 = C^4$ equation has primitive solutions $[A, B, C]$ in $\{1, 2, 3, \dots\}$. [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 $C, A \in \{1, 3, 5, \dots\}$ and for some $B \in \{4, 6, 8, \dots\}$:

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

Notice that

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

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

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

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

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

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.

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