THE SHORT PROOF

LESZEK W. GUŁA

Dedicated to my Parents and my Brother

ABSTRACT. The short proof of the Fermat's Last Theorem.

I. INTRODUCTION

It is known that for each $u,\, v \in \mathbb{R}_+$, such that $u > v$:

$$\left\{u^2 - v^2 = x \wedge 2uv = y \wedge u^2 + v^2 = z \wedge \right. \tag{1}$$
$$\left. x^2 + y^2 = z^2 \wedge (x+y)^2 + [\pm(x-y)]^2 = 2z^2 \right\}.$$

II. THE FERMAT'S LAST THEOREM

Theorem 1 (FLT)**.** *For all* $n \in \{3, 4, 5, ...\}$ *the equation*

$$X^n + Y^n = Z^n$$

has no primitive solutions in $\mathbb{N}_1$.

Proof of the Main Theorem. Suppose that for some $n \in \{3, 4, 5, ...\}$ the equation

$$X^n + Y^n = Z^n$$

has primitive solutions $[X, Y, Z]$ in $\mathbb{N}_1$.

We assume that for some $u,\, v \in \mathbb{R}_+$, with $u > v$:

$$\left[u^2 - v^2 = \left(X^{\frac{n}{4}}\right)^2 \wedge 2uv = Y^{\frac{n}{2}} \wedge u^2 + v^2 = \left(Z^{\frac{n}{4}}\right)^2\right].$$

Thus on the strength of (1):

$$\left[2u^2 = \left(X^{\frac{n}{4}}\right)^2 + \left(Z^{\frac{n}{4}}\right)^2 \wedge \pm X^{\frac{n}{4}} = X^{\frac{n}{4}} - v \wedge X^{\frac{n}{4}} + v = Z^{\frac{n}{4}}\right] \Rightarrow$$
$$\left(X^{\frac{n}{4}} = Z^{\frac{n}{4}} \vee 3X^{\frac{n}{4}} = Z^{\frac{n}{4}}\right) \Rightarrow \left(X^n = Z^n \vee 3^4 X^n = Z^n\right) \Rightarrow \gcd(X, Z) > 1,$$

which is inconsistent with $\gcd(X, Z) = 1$. This is the proof. □

LUBLIN-POLAND
E-mail address: lwgula@wp.pl

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