Proof of Goldbach's Conjecture

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(see note 01/27/2019)

$$L = (p_1)^2 + (p_2)^2 = 2(p_1)(p_2) = 2N$$

Goldbach's conjecture ("Every (positive) even number is the sum of two primes.")

Update (4/9/22)

Goldbach's Conjecture is False

By defining prime numbers via the interaction equation, I proved that the sum of two prime numbers is even. However, the sum of two even numbers is also even so that Goldbach's conjecture ("**Every even number is the sum of two primes**" is false.

Asa consequence, prime numbers (as per the fundamental theorem of arithmetic) are insufficient to characterize syntactically any system described by Gödel numbers (that is, the system is incomplete). This is because that characterization does not include the group operation of arithmetic. If such a system is complete (includes negative numbers), then it is inconsistent, because negative numbers (except as differences of positive numbers) render it inconsistent.

In my previous expression $L = \left[p_1{}^2 + p_2{}^2 \right] = \{2N\}$ I invoked the fundamental theorem of arithmetic to arrive at $L = 2N$ via $\{o_p\} + \{o_p\} \in \{e\}$, but that expression excludes the expression

$$\{e\}\left[(o_p)^2 + (o_p)^2 \right] = \{e\}\{2N\} \in \{e\}$$

That is, "**Not every even number is the sum of two primes.**", and thus Goldbach's conjecture is false.

Thus the following analyses attempting to show that "Goldbach's Conjecture is true" are incomplete for the above reasons.

Clarification 3/11/2021 (Very Short Proof)

$$\text{Let } (c\tau') = (c\tau) - (v\tau'),\ (c\tau) \ge (v\tau')$$

$$(c\tau')^2 = \left[(c\tau) - (v\tau') \right]^2 = (c\tau)^2 + (v\tau')^2 - 2(c\tau)(v\tau')$$

$$(c\tau')^2 = 0 \Leftrightarrow (c\tau)^2 + (v\tau')^2 = 2(c\tau)(v\tau')$$

Setting $(c\tau')^2 = 0$ does not mean that $(c\tau') = 0$ unless $(c\tau) - (v\tau') = 0$; that is, $(c\tau) = (v\tau')$

Then $p \triangleq (c\tau) = (v\tau')$ (first order) and $p^2 \triangleq (c\tau)^2 = (v\tau')^2$ (second order), so that

Then $L \triangleq p^2 + p^2 = \left[(c\tau)^2 + (v\tau')^2\right] = 2(p)(p) = 2p^2 = 2N$

Since $\{p\}$ represents the set of all prime numbers, $p^2 \in \{p\}$ and is also prime. Therefore, $L \triangleq p^2 + p^2$ is the sum of two primes, $2N$ is an even number and consists of the product of two primes, and they both have a common unique representation under the Fundamental Theorem of Arithmetic. Since the expression exhausts $\{p\}$, Goldbach's conjecture is proven.

Then $L = 2N \equiv \{e\}$, the complete set of even numbers $\{e\}$

Then $\left\{(c\tau')^2\right\} - \{e\} = \{o\}$ so that $\left\{(c\tau')^2\right\}$ is the complete set of odd and even integers $\{\mathrm{Z}\}$ to the unit base, so that $\{\mathrm{Z}\} = \{o\} + \{e\}$ and the system is complete, since every integer has a unique representation in sums of units $N = \sum_1^n (1_n)$.

Note that:

$$4(1^2) = (1+1)^2 = 1^2 + 1^2 + 2(1^2)$$
$$4(p^2) = (p+p)^2 = p^2 + p^2 + 2(p^2)$$

(This proof is fundamental to the numerical representation of existing physical systems in one and two dimensions (Including those represented by multinomials), where existence is represented by the sum of positive entities, and interaction is represented by the products of entities. If negative elements are not allowed, then neither is the square root of negative elements, so imaginary numbers must be excluded from physics.)

(Some clarifications probably needed in discussion below, but don't have time right now to revisit it)

Discussion/example

05/04/2018 Added note clarifying role of metric L/L=1

05/05/2018 Added clarifying comments regarding nomials, added examples

05/09/2018 Added clarifying comment on nomials

01/18/2019 Added clarification why proof is valid for all positive real numbers, not just integers

Update (02/05/2019)

Thoughts on Goldbach (additional points of proof) 10/10/2019

Goldbach and Vectors

Basic Proof

This proof rests on the concept that for "nomials" (as in the Binomial expansion), the arithmetic laws of multiplicative association to not apply, which preserves nomial identity under parametrizationa; that is,

$(c\tau)(v\tau') \neq (c\tau')(v\tau)$ (Nomials – no multiplicative laws association or distribution) Proof of Fermat's Last Theorem) (and the mathematical foundation of Theory of Relativity)

Furthermore, in defining prime numbers, the following condition also holds:

$(c\tau)(v\tau') \neq (c\tau')(v\tau) = 0$ (Goldbach Proof) (Definition of prime numbers) (This discussion)

Consider the relation $(c\tau') = (c\tau) - (v\tau') = (c\tau, v\tau')$ where $c\tau \in \mathbb{R}_1$ and $v\tau' \in \mathbb{R}_2$ have no common factors $\mathbb{R}_1 \bigcup \mathbb{R}_2 = \{0\}$, and so are prime numbers relative to each other, and the product $(c\tau')$ is a multiplicative relation between $\mathbb{R}_1$ and $\mathbb{R}_2$. (Or one can say that $x = (c\tau)$ and $x' = (v\tau')$ are independent variables in the same set where $\{x, x'\} \in \mathbb{R}$). These factors are nomials in the Binomial expansion for $n = 2$.

Then $(c\tau')^2 = (c\tau)^2 + (v\tau')^2 - 2(c\tau)(v\tau)$

Setting $(c\tau')^2 = 0$ eliminates the multiplicative factor having common elements from each nomial, so that in

$$(c\tau)^2 + (v\tau')^2 = 2(c\tau)(v\tau')$$

the nomials are relatively prime numbers except for common multiplicative factors on each side of the equation.

Clarification (added 01/18/2019)

Setting ct' = 0 in the initial analysis does not mean c=0 or t' = 0; it means that c and t' are independent ("orthogonal") variables; c "dot" t' = 0 and c "x" t' = ct. By change of variable, it means that v is also independent of t, which means the elements (ct) and (vt') are independent, which is true for all real numbers involving scalar multiplication in a single dimension.

By employing unit logarithms for t and t', one can show why the integer examples work, but the relation is true for all real numbers, and Goldbach's conjecture is proven...

(Note that if the $(c\tau)^2 + (v\tau')^2$ and $2(c\tau)(v\tau')$ have common factors (e.g. $v = c$ and $\tau' = \tau$), the factor $k = c\tau = v\tau'$ can be divided out, so that the nomials on both sides of the equation will be relatively prime:

$k\left[(c\tau)^2 + (v\tau')^2\right] = k\left[2(c\tau)(v\tau')\right] \Leftrightarrow (c\tau)^2 + (v\tau')^2 = \left[2(c\tau)(v\tau')\right]$, where $(c\tau)^2 + (v\tau')^2$ is an expression of prime numbers under addition, and $2(c\tau)(v\tau)$ is an expression of an even product of prime numbers and so must be different, since $a + b = 2ab \Leftrightarrow a = b = 1$ for a and b prime numbers where $a + b = 1^1 = 1^1 = 2$ is a sum, but $2(ab) = 2(1^2)$ is a product of different powers of 1. (1 is not a prime number if it applies to all variables).

Note that $1_\tau = \log_\tau(\tau),\ \tau \neq 1$, so that $p_1 = c\tau_c$, $p_2 = v\tau_v$, $p_1 = c\tau_c$, $p_2 = v\tau_v$ are also prime numbers with no common factors.

Then the expression $(c\tau_c)^2 + (v\tau_v)^2 = 2(c\tau_c)(v\tau_v)$ can be represented by the expression

$(p_1)^2 + (p_2)^2 = 2(p_1)(p_2) = L$ for some common number L (a "length" or "metric" in the prime space defined by the operations of addition and multiplication).

$(p_1)^2$ and $(p_2)^2$ are prime numbers and $2(p_1 p_2) = L$ is an even number.

Then any number $m = nL$ will also be an even number.

Therefore, every even number is equal to the sum of two primes.

QED

Note: The length $L(p_1, p_2, p_1, p_2)$ is a general relation characterizing addition and subtraction in terms of a specific set of prime numbers. This is a metric for the set of real numbers, since $1_{(p_1,p_2,p_1,p_2)} = \frac{L(p_1, p_2, p_1, p_2)}{L(p_1, p_2, p_1, p_2)}$ becomes the unit basis for $r = r * 1_{(p_1,p_2,p_1,p_2)}$ for any real number system; that is, it is basis for the Relativistic Unit Circle as the foundation for the complete system of real numbers in one dimension in terms of the power of 2 and the addition and multiplication operators, and is the foundation of mathematics (which can then be extended to $n > 2$ to prove Fermat's Last Theorem.

Examples

Example 1

$$\left(c\tau_c\right)^2 + \left(v\tau_v\right)^2 = 2\left(c\tau_c\right)\left(v\tau_v\right) = 30$$
$$c = \sqrt{23},\ v = \sqrt{7},\ c = \sqrt{5},\ v = \sqrt{3}$$
$$\left(c\tau_c\right) = \left(\sqrt{23\tau_c}\right),\ \left(v\tau_v\right) = \left(\sqrt{7\tau_v}\right),\ \left(c\tau_c\right) = \left(5\right)\tau_c,\ \left(v\tau_v\right) = \left(3\right)\tau_v$$
$$\left(c\tau_c\right)^2 = 23,\ \left(v\tau_v\right)^2 = 7,\ \left(c\tau_c\right) = 5, \left(v\tau_v\right) = 3$$
$$23 + 7 = 2\left(3 * 5\right) = 30$$

Example 2

There can be more than one partition of $L = p_1 + p_2$, the set of additive primes is not unique, and this is not a requirement of Goldbach's conjecture. Similarly, the multiplicative nomials need not be distinct, since the only requirement is that $L = 2\left(p_1 p_2\right) = 2\left(p^2\right)$ be an even number.

For example, in the expression $L = 16 = \left(8 + 8\right) = 2\left(4 * 4\right)$, 8 is not a prime number, but $L = 16 = \left(2^3 + 2^3\right) = 2\left(2^2\right)\left(2^2\right) = \left(8 + 8\right) = \left(11 + 5\right) = \left(13 + 3\right) = (3^2 + 7)$ where the sums consist of prime numbers. Since 2 is a prime number, then so is $2^2 = 4$ but the Goldbach conjecture does not say that the nomials in the product $\left(4 * 4\right)$ have to be distinct; the only requirement is that $L = 2\left(p_1 p_2\right) = 2\left(p^2\right)$ be an even number.

Note that $L = 16 = \left[15\left(1_{15}\right) + 1\left(1_1\right)\right] = 2\left(4 * 4\right),\ \left(1_{15}\right) = \log_{15}(15),\ \left(1_1\right) = \log_1(1)$, and

$15\left(1_1\right) = 15 * \log_1(1) = 15$.

Therefore $15\left(1_{15}\right)$ and $1\left(1_1\right)$ are not relatively prime since $\left(1_{15}\right)$ can be divided by $\left(1_1\right)$ so 1_τ to any base τ is not a prime number.