Concise Proof of Goldbach's Conjecture

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Updates (refresh/reload your browser for the latest version):

04/02/2018 (Clarification setting $x(c,\tau)=x(c\tau)$ and $y(v,\tau')=y(v\tau')$

04/03/2018 Added proposal of Thermal Potential as relation of entropies

04/05/2018 Inserted link to sub-document Important Updates (will be shortly incorporated into this doc)

04/07/2018 Added discussion of preserving countability between additive and multiplicative sets. Expanded to include general case of Binomial Expansion for positive numbers. Squashed bugs.

04/22/2018 Added summary comments

04/22/2018 11:56 PST **Final Proof** and clarification

04/22/2018 16:04 PST Added **Corollary**

05/-4/2018 added link to Very Short Proof of Goldbach's Connecture

Links

Very Short Proof of Goldbach's Conjecture (Short Summary)

Proof of Fermat's Last Theorem and relation to Theory of Relativity

Goldbach's conjecture relation to proof of Fermat's Last Theorem and Binomial Expansion

The Derivative (in this context)

Discussion of Russell's Paradox (in this context)

Discussion Forums (Join in!)

Fermat's Last Theorem (and other topics)

Goldbach's Conjecture

Goldbach's conjecture: "Every even number is the sum of two primes"

I believe this expression must be modified to read

"**Every even number can be expressed as twice the product of two prime numbers equal to the sum of two prime numbers**"

E.g. $23+7=30=2(3)(5)=L$ where red indicates a partition under addition and blue indicates a partition under multiplication.

since division, multiplicative distribution, and association are not permitted in the domain of prime numbers (and thus rational, irrational, and transcendental numbers are not included) if countability is preserved between the sets under addition and multiplication of prime numbers.

Summary – This proof uses the observation that operations under the Binomial Expansion preserve the widget count in its constituent elements, and so are different from those that characterize those of arithmetic or vectors. This perspective is then applied to a parametrized form of the Binomial Expansion for n=2 in terms of an underlying field to show its relation to prime numbers and the subsequent proof of Fermat's Last Theorem (n>=2) and Goldbach's conjecture, as well as its consequences to the Theory of Relativity.

Define x , y and z as numbers with internal parameters belonging to the set $\{\{c,\tau\},\{v,\tau'\}\}$ so that

$$
\begin{aligned}
x &\triangleq x(c\tau) = x(c,\tau) \\
y &\triangleq y(v\tau') = y(v,\tau') \\
z &= c\tau' = z(x,y) = x(c\tau) - y(v\tau') = x(c,\tau) - y(v,\tau')
\end{aligned}
$$

Prime Number condition

The Binomial Expansion for positive numbers is

$$(c\tau')^n = \left[(c\tau)+(v\tau')\right]^n = (c\tau)^n + (v\tau')^n + rem(c\tau, v\tau', n)$$

Consider the expression $(c\tau')^n = 0 = (c\tau)^n + (v\tau')^n - rem(c\tau, v\tau', n)$

$\left\{(c\tau)^n + (v\tau')^n\right\} = \left\{rem(c\tau, v\tau', n)\right\}$ preserves the number of positive elements on the l.h and r.h sides of the equation for all powers of n .

The condition $(c\tau')^2 = 0$ defines the expression in terms of prime numbers; that is, division is not allowed in the expression on the right, since z^2 contains elements of both which are independent; that is, $c \in \{x\}, c \notin \{y\}$ and $\tau' \in \{y\}, \tau' \notin \{y\}$; that is,

$$\frac{x}{y} = \frac{c\tau}{v\tau'} = \frac{c}{\tau'}\frac{\tau}{v}\left(\frac{\tau'}{\tau'}\right) = \frac{c\tau'}{(\tau')^2}\frac{\tau}{v} = \frac{(0)\tau}{(\tau')^2 v} = \frac{0}{(\tau')^2 v}$$

$$\frac{x}{y} = \frac{c\tau}{v\tau'} = \frac{c}{\tau'}\frac{\tau}{v}\left(\frac{c}{c}\right) = \frac{c^2}{(c\tau')^2}\frac{\tau}{v} = \frac{c^2\tau}{(0)v} = \frac{c^2\tau}{(0)}$$

Then

$$\frac{y}{x} = \frac{(\tau')^2 v}{0} \text{ and } \frac{x}{y} = \frac{c^2\tau}{(0)}$$

imply division by zero.

Note that setting $z=0$ in the expression $z = x - y$ means that the number of elements in $\{x\}$ is equal to the number of elements in $\{y\}$ so that the countable elements in both are equal (none are "lost"), so that $N\{x\} = N\{y\}$.

Then

$$z^2 = (c\tau')^2 = (c\tau)^2 - (v\tau')^2 = \left(x(c\tau) + y(v\tau')\right)^2 = x(c\tau)^2 + y(v\tau')^2 - 2x(c\tau)y(v\tau')$$

Setting $z^2 = 0^2 = (c\tau)^2$ results in the expression $0^2 = x(c\tau)^2 + y(v\tau')^2 - 2x(c\tau)y(v\tau')$ which is interpreted as $\left\{x(c\tau)^2 + y(v\tau')^2\right\} = \left\{2x(c\tau)y(v\tau')\right\}$ which expresses that the number of elements in the set under the operation of addition is equal to the number of elements under the operation of multiplication.

A detailed analysis is given in: Concise Proof of Goldbach's conjecture

Final Proof

Let $\sqrt{r} = c\tau$ and $\sqrt{r} = v\tau'$ so that $r = |c\tau| = |v\tau'|$

Assume p_1 and p_2 are prime numbers and r is a real number, and thus $\sqrt{r}$ is a real number.

Then $2\left(\sqrt{r}\,p_1\right)\left(\sqrt{r}\,p_2\right) = 2r\left(p_1\right)\left(p_2\right)$

Let $\sqrt{r} = c\tau$ and $\sqrt{r} = v\tau'$ so that $r = |c\tau| = |v\tau'|$

Then $rp_1 + rp_2 = r\left(p_1 + p_2\right)$

Let $r\left(p_1 + p_2\right) = 2r\left(p_1\right)\left(p_2\right) = L$, where L is a real number.

Then $\frac{L}{r} = \frac{L}{r}$ is a real number, so that $\left(p_1 + p_2\right) = \frac{L}{r} = R$, where R is a real number

Then every real number R can be expressed as the sum of two primes.

QED

Corollary: every real number R can be expressed as the product of two primes.

(follows immediately, since $\left(p_1\right)\left(p_2\right) = \frac{L}{2r}$ since $\left(\frac{L}{2r}\right) = \left(\frac{4}{4}\right)\left(\frac{L}{2r}\right) = 2\left(\frac{L}{4r}\right)$ is an even real number.

Note that

$\left\{x(c\tau)^2 + y(v\tau')^2\right\} = \left\{\left|x(c\tau)\right|^2 + \left|y(v\tau')\right|^2\right\}$ so that absolute values preserve the count under addition, and

$$
\begin{aligned}
&2\left\{x(c\tau)\,y(v\tau')\right\} = 2\left\{\left(-x(c\tau)\right)\left(-y(v\tau')\right)\right\} \\
&= 2\left\{\left(+x(c\tau)\right)\left(+y(v\tau')\right)\right\} \\
&= \left\{\left(+x(c\tau)\right)\left(+y(v\tau')\right)\right\} + \left\{\left(-x(c\tau)\right)\left(-y(v\tau')\right)\right\} \\
&= 2\left\{\left|x(c\tau)\right|\left|y(v\tau')\right|\right\}
\end{aligned}
$$

so that the absolute values preserve the count under multiplication.

Since x and y do not divide each other, they satisfy the definition of prime numbers. Therefore, the expression $x^2 + y^2 - 2xy = 0$ must be a relation among prime numbers, where $\{x\} \cap \{y\} = 0$ so that $\{x\} = x(c,\tau) = x(c\tau)$ and $\{y\} = y(v,\tau') = y(v\tau')$. Then x as a prime number is located in its dimension (axis) by the parameters $(c\tau)$ and y by the parameters $(v\tau')$, where the number system does not admit functions of both variables (all numbers reside on one or the other of the $x \perp y$ axes.

For example, the expression $x^2 + y^2 - 2xy = 0$ is equivalent to $x^2 + y^2 = 2xy$ which means the number of unit elements in the set $\left\{\left\{x^2\right\} + \left\{y^2\right\}\right\}$ is the same as the number of unit elements in the set $\{2xy\}$; the sets are just partitioned differently in terms of prime numbers.

This relation can be re-written as

$x(c\tau)^2 + y(c\tau)^2 = 2x(c\tau)\,y(v\tau')$; where both the red and black sets are countable and complete.

If a prime number is taken to a power, the number remains prime; that is if x is a prime number, then so is x^n , and similarly for y . Then $x^2 + y^2$ is the sum of prime numbers, and so is $x + y$, where each prime number is located on the real number axis by the parameters $(c\tau)$ and $(v\tau')$ respectively in the expression. $2x(c\tau)\,y(v\tau') = 2r$ where $2r = 2xy = 2(c\tau)(v\tau')$ is an even real number.

For $\left\{(c\tau)^n + (v\tau')^n\right\} = \left\{rem(c\tau, v\tau', n)\right\}$, the elements $(c\tau)^k (v\tau')^{n-k}$ in $\left\{rem(c\tau, v\tau', n)\right\}$ must be products of prime numbers.

The prime numbers on each side of the equation form the bases of the two dimensions in terms of their radixes. A detailed analysis is given in:

Prime Numbers and Logarithms

Since it is always possible to locate the prime number on each axis through these parameters for any real number, then Goldbach's conjecture is proved.

QED

1. Setting $\tau = \tau' = 0$ yields $0^2 + 0^2 = 2x(0)y(0)$ so the prime numbers are referenced to the origins of their respective dimensions.
2. Of course, you can imagine $x(c\tau)$ and $y(v\tau')$ to be on the same axis (dimension); i.e. $x(c\tau)$ and $x'(v\tau')$, so that different bases apply to different radixes on the same axis, the only criteria being that they are independent variables where division is not defined for $c\tau$ and $v\tau'$.

The expression $x^2 + y^2 = 2x(0)y(0)$ (like that of Fermat's; $c^2 \neq a^2 + b^2$) is an example of an undecidable proposition within the context of positive integers) because they can be expressed in the syntax of arithmetic and are true, but require a metalanguage for proof (in Goldbach's case the set $\{c, \tau, v, \tau'\}$ and in the Fermat case imaginary numbers.

This perspective has consequences both for physics (since prime numbers are "quantized") (especially in symmetries) and mathematics by extending the analysis to the Binomial (Multi-nomial) Expansion for $n > 2$

See The Relativistic Unit Circle

Proposal: Thermal Potential as the difference in entropies

$$\left(\frac{kT}{q}\right)=(c\tau')^3-(c\tau')^2$$

$$\varphi_3=N_3\left[1-\frac{N_d}{N_a}\right]\exp\left(\frac{kT}{q}\right)=N_3\left[1-\frac{N_a}{N_d}\right]\exp\left[(c\tau')^3-(c\tau')^2\right]$$

Where N_3 is the total number of potential donors and accepters in a Black Hole at $T=0$, where T is the absolute temperature, k is Boltzmann's constant, q is the charge per unit mass and from the Binomial Expansion as a single valued function; in three "dimensions" (three degrees of freedom, and $(c\tau')$, $(c\tau)$, and $(v\tau')$ are interpreted as photon-equivalent masses:

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

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

$$(c\tau')^3=\left[(c\tau)+(v\tau')\right]^3=(c\tau)^3+(v\tau')^3+rem(c\tau,v\tau',3)$$

In general,

$$(c\tau')^n=\left[(c\tau)+(v\tau')\right]^n=(c\tau)^n+(v\tau')^n+rem(c\tau,v\tau',n)$$

$$\left(\frac{kT}{q}\right)=(c\tau')^{n+1}-(c\tau')^n$$

$$\varphi_{n+1}=N_{(n+1)}\left[1-\frac{N_d}{N_a}\right]\exp\left(\frac{kT}{q}\right)=N_{(n+1)}\left[1-\frac{N_a}{N_d}\right]\exp\left[(c\tau')^{n+1}-(c\tau')^n\right]$$

Note: There may be more than one type of particle/field. The general case for n particles where each particle is counted n times is

$$\varphi_n=(ct')_n=\sum_{i=0}^{n}(v\tau')_i$$

where $(v\tau')_0=c\tau$ is the basis particle (the "Higgs boson"). This model can then be expanded using the Multinomial Expansion, with all other particles referenced to the basis particle. The energy of this basis particle is the lowest that can be observed optically (corresponding to the zero-point energy, or local "black").

If there is no resultant $\left[(ct')_n\right]^n=0$ then there is no bound on the number of prime ("quantized") interactions, where n represents the concept that each particle is counted n times.

The (almost) most general case is where each particle of type n is counted m times

$$\varphi_{m,n} = (ct')^{m}_{n} = \sum_{i=0}^{n,m} (v\tau')^{m}_{n}$$

Of course, one can then model $\varphi_{i,m,n,j} = f_j\,(ct')^{m}_{n} = \sum_{i,m,n,j=0}^{n,m,j} f_j\,(v\tau')^{m}_{n}$ and so on

(Little fleas on littler fleas upon their backs so bite ‘em

And littler fleas on littler fleas, and so ad infiinitem….)