PHYSICAL AND MATHEMATICAL SCIENCES

REPRESENTATION OF EVEN NUMBER IN THE FORM OF THE SUM OF FOUR SIMPLE

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It is known that a weak problem Goldbach is finally solved.

$$p_1 + p_2 + p_3 = 2N + 1 \quad [1]$$

where on the left is the sum of three odd primes more than 7.

The author provides the proof in this work, being guided by the decision weak problem of Goldbach that:

$$p_1 + p_2 + p_3 + p_4 = 2N \quad [2]$$

where on the right sum of four prime numbers, at the left any even number, since 12, by method of mathematical induction.

Theorem1. Any even number starting from 12 is representable as a sum four odd prime numbers.

1. For the first even number 12 = 3+3+3+3.

We allow justice for the previous N> 5:

$$p_1 + p_2 + p_3 + p_4 = 2N \quad [3]$$

We will add to both parts on 1

$$p_1 + p_2 + p_3 + p_4 + 1 = 2N + 1 \quad [4]$$

where on the right the odd number also agrees [1].

$$p_1 + p_2 + p_3 + p_4 + 1 = p_5 + p_6 + p_7 \quad [5]$$

Having added to both parts still on 1

$$p_1 + p_2 + p_3 + p_4 + 2 = p_5 + p_6 + p_7 + 1 \quad [6]$$

We will unite $p_6 + p_7 + 1$

again we have some odd number, which according to [1] we replace with the sum of three simple and as a result we receive:

$$p_1 + p_2 + p_3 + p_4 + 2 = p_5 + p_6 + p_7 + p_8 \quad [7]$$

at the left the following even number is relative [3], and on the right the sum four prime numbers.

$$p_1 + p_2 + p_3 + p_4 = 2N \quad [8]$$

Thus obvious performance of an inductive mathematical method.

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As was to be shown.

2. Any even number starting with six is representable in the form of the sum of two prime numbers. Goldbach-Euler's hypothesi. Consider a sequence of even numbers starting from 6:

6, 8, 10... to infinity. The sum of two adjacent even numbers will be twice the previous number plus 2. Thus [8] has the appearance:

$$p_1 + p_2 + p_3 + p_4 = 2(p_1 + p_2) + 2 \qquad [9]$$

where $p_1 + p_2 -$ the previous even number, $p_3 + p_4 -$ the next.

$$p_1 + p_2 + 2 = p_3 + p_4 \qquad [10]$$

[10] – mathematical induction for the sum of two simple.

[10] – shows the inevitability of the next number to be equal to the sum two prime numbers. And since the subsequent even number then becomes previous, then the entire sequence of even numbers can be represented as sums of two odd primes. In [10], instead of the previous set the first 6, already 8 should be the sum of two simple ones, further in [10] instead of we set the previous 8, we get 10 inevitably the sum of two simple, etc.

The process is continuous and endless. Case of an even number not equal to the sum of two odd primes categorically excluded since this completely contradicts [8-10].

3. Thus we proved:

Any even number since 6 is representable in the form of a bag of two odd the simple.

$$p_1 + p_2 = 2N \qquad [11]$$

Any even number is representable in the form of the sum of two simple. In total even numbers, without exception, since 6 are the sum of two prime numbers. Goldbakha-Euler's problem is true and proved! Theorem the four simple and the Goldbach Euler conjecture have a series of corollary. One of which is relevant problem in number theory.

Corollary 1. If one of the sum of three primes for any odd number, starting 9, arbitrarily set in the open interval [3, 2N-6], then two simple variables in the sum give the required even number. Which is evident from the proven Goldbach-Euler hypothesis.

Corollary 2. If one of the sum of four simple for even $2N$, starting with 12, arbitrarily set in the open interval [3, 2N-9], then three simple variables in total give the necessary odd number. Which, obviously, is from the proven Goldbach hypothesis.

Corollary 3. An even number, starting at 14, can be represented by a sum of four where a prime is the sum of three primes.

$$p_1 + p_2 + p_3 + p_4 = p_5 + p_6 = 2N \qquad [12]$$

Suppose $p_4 = p_5$ it is always possible (Corollary 2), the sum of the other three prime number p_6 .

Theorem.

Any even number starting from 10 can be represented by a sum not fewer than two pairs of two odd primes, 12– exception. Let us show that the sum of four primes for all even numbers starting from 16 can be simultaneously the sum of two pairs of odd prime numbers.

$$3 + 3 + 5 + 5 = 16 = 3 + 13 = 5 + 11$$

We prove this for all even numbers greater than 16. From the proven hypothesis of Goldbach-Euler:

$$p_1 + p_2 = 2N$$

It follows that even numbers can have several pairs of prime numbers, in the sum of 2N. N is the arithmetic average, where to the left and to the right of the same distance is a pair of prime numbers.

Suppose one pair p_1, p_2 , $p_1 \square p_2$

According to the Goldbach theorem, the sum of three simple ones can be represent any odd number, starting with 9, including prime numbers and they are represented by this sum and start with 11.

$$p_4 + p_5 + p_6 = p_1 \quad [15]$$

$$p_4 + p_5 + p_6 + p_2 = 2N \quad [16]$$

We prove that in [16] there is another pair of prime numbers.

Consider all possible options.

Option 1. $(p_4 \neq p_2 , \ p_5 \neq p_2 , \ p_6 \neq p_2)$

Then the opposite way we have the system:

$$2N - p_4 \neq p_7 \quad [17]$$

$$2N - p_5 = s_1 \quad [18]$$

$$2N - p_6 = s_2 \quad [19]$$

where s_1, s_2 composite odd numbers and in [17] the difference is not equal to the simple odd number- p_7 .

Subtract the left and right sides [18-17], respectively.

$$p_4 - p_5 \neq s_1 - p_7 \quad [20]$$

$$p_4 + p_5 + p_7 \neq s_1 + 2p_5 \quad [21]$$

On the right [21] is an odd number, on the left is the sum of three odd primes, which, according to Goldbach's hypothesis, since 9, is any odd number.

Is [21] inequality? Set one of three simple values. (Corollary 1) p_7 . The sum of the other two is denoted as 2K equal to the difference:

$$2K = s_1 + 2p_5 - 2N + p_4 = p_4 + p_5 \quad [22]$$

$$p_4 + p_7 = 2N \quad [23]$$

Thus we get equality. Assumption that in the system [17-19]. All odd composite numbers are not true. At least one simple a number that creates a pair of prime numbers– p_4, p_7 . Thus it is shown that with $p_1 \square 11$, there are three simple $p_4, \ p_5, \ p_6$

numerical values, for which [17-19], although they can take on the values of three composite numbers, however, there are necessarily three such values at which at least one prime number.

But $p_4 = p_2$ a new couple is missing. If $p_1 - p_2 = 0; 2; 4$ then $p_4 = p_2$ does not fit p_1 and there are at least two pairs sums of prime numbers.

Lemma: If $2N = 2p$, where p is a prime number except 3, is an even number we represent several pairs of sums of primes.

For $p \square 11$ according to the above in [16] $p = p_1, p = p_2$. For smaller:

6 = 3 + 3, 10 = 5 + 5 = 7 + 3, 14 = 11 + 3 = 7 +7.

Option2. $(p_4 = p_2)$

And similarly to option 1;

$$2p_4 + p_5 + p_6 = 2N \quad [24]$$

$$2p_4 + p_5 \neq p_8 \quad [25]$$

$$2p_4 + p_6 = s_3 \quad [26]$$

$$p_6 - p_5 \neq s_3 - p_8 \quad [27]$$

$$p_5 + p_6 + p_8 \neq s_3 + 2p_5 \quad [28]$$

$$2K_1 = 2p_4 + p_6 + 2p_5 - 2p_4 - p_5 = p_5 + p_6 \quad [29]$$

$$2p_4 + p_5 = p_8 \quad [30]$$

$$p_8 + p_5 = 2N \quad [31]$$

Again possible $p_5 = p_2$.

Option2. $p_4 = p_5 = p_2$

In this case, for $2p_2$ we use the lemma and double the sum prime numbers will be displayed as the sum of two prime numbers, without p_2 .

Option 3 becomes option 1.

However, this does not happen for $p_2 = 3$. In this case again apply corollary 1 replace with a lower value p_6 . Then p_4 or p_5 not equal to 3. And option 3 goes to option 1 or 2.

Exception 14 = 3 + 3 + 5 + 3, where p_6 it is impossible to replace.

Changing p_4, p_5, p_6 we find the third, fourth, etc., (if they have) a pair -sum of two simple odd numbers.

And even to 16:

6 = 3 + 3, 8 = 5 + 3, 10 = 7 + 3 = 5 + 5, 12 = 5 + 7, 14 = 11 + 3 = 7 +7

It can be seen that only three even 6,8,12 is the sum of only one pair primes, all other sums of two or more pairs of primes odd numbers.

Corollary 4. If the sum of two simple of the sum of four for even $2N$, starting at 12, arbitrarily set to open interval [6, 2N – 6], then the sum of the remaining two simple variables there is a necessary even number.

What can be seen from the proven Goldbach-Euler hypothesis.

Corollary 5. The prime numbers of twins are infinite.

Any even number starting from 14 can be represented as a sum of four odd primes of which two are prime twins.

$$p_1 + p_2 + p_3 + p_4 = 2N \quad [13]$$

Let $p_{3,} p_{4.}$ prime numbers be twins, then the difference is any even, starting at 14, and the sum of the primes of the twins is also an even number, which, according to the proved Goldbach-Euler hypothesis, is equal to the sum of two prime numbers (Corollary 4).

Next, we place the prime numbers from left to right in descending order.

And if the even number $2N = 2p_2 + 2p_4 + 4$, then p_1, p_2 inevitably also twins.

Subtract the sum from both parts [13] $2p_2 + 2p_4$:

$$p_1 - p_2 + p_3 - p_4 = 4 \quad [14]$$

From [14], it is obvious – inevitably twins.

Let their finite number and the last prime numbers be twins $p_{3,} p_{4.}$.

Denote two primes greater than $p_{3,} p_{4.}$ how p_1, p_2.

Sum up all four primes and then according to the sum theorem four simple there is an even number 2 N at which inevitably large p_1, p_2 – twins. And then substituting $p_{3,} p_{4.}$ numeric values instead p_1, p_2 in [13] the process becomes infinite and the prime numbers are twins – infinite number.

References:

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