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Solution of topical problems in number theory

Abstract:*it is known that a weak problem Goldbach is finally solved.*

$$p_1 + p_2 + p_3 = 2\mathrm{N} + 1 \qquad (1)$$

where on the left is the sum of three odd primes

more than 7,N>3.

The author provides the proof in this work, being guided by the decision

weak problem of Goldbach that:

$$p_1 + p_2 + p_3 + p_4 = 2\mathrm{N} \qquad (2)$$

where on the right sum of four prime numbers, at the left any even number,

starting from 12 by the method of mathematical induction.

Keywords: *and on this basis decides topical number theory problems.*

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:

$$p_1 + p_2 + p_3 + p_4 = 2\mathrm{N} \qquad (3)$$

We will add to both parts on 1

$$p_1 + p_2 + p_3 + p_4 + 1 = 2\mathrm{N} + 1 \qquad (4)$$

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

$$p_1 + p_2 + p_3 + p_4 + 1 = p_5 + p_6 + p_7 \qquad (5)$$

Having added to both parts still on 1

$$p_1 + p_2 + p_3 + p_4 + 2 = p_5 + p_6 + p_7 + 1 \qquad (6)$$

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:

$$p_1 + p_2 + p_3 + p_4 + 2 = p_5 + p_6 + p_7 + p_8 \qquad (7)$$

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

$$p_1 + p_2 + p_3 + p_4 = 2N \qquad (8)$$

Thus obvious performance of an inductive mathematical method.

As was to be shown.

Now, based on the above theorem, we prove the generalized

Theorem 2:

An even number 2N is represented by the sum of 2K simple odd numbers in this case $2N \geqslant 6K$*, K> 1, where 2K is the number of primes.*

Decision.

If 2K is divisible by 4, then:

$$p_1 + p_2 + ... + p_{(2K-1)} + p_{2K} = 2N \qquad (9)$$

combining the terms into groups of 4, we have the sum of any even numbers more and equal according $2N \geqslant 6K$ *to the proved Theorem 1.*

If 2K is not divisible by 4, combine into groups of 4 and leave at the end

6 primes, which are divided into two groups of 3 primes $2N \geqslant 6K$.

2. From the proved Theorem 2 it follows that the sum of six primes is equal to the sum

four simple.

$$p_1 + p_2 + p_3 + p_4 + p_5 + p_6 = p_7 + p_8 + p_9 + p_{10} \quad (10)$$

$$p_1 + p_2 + p_3 + p_4 + p_5 + p_6 = 2N \quad (11)$$

where $2N \geqslant 18, N \geqslant 9$

$$p_{11} + p_{12} + p_{13} + p_{14} = 2N_1 \quad (12)$$

where $2N_1 \geqslant 12, \quad N_1 \geqslant 6$

$$2N - 2N_1 = p_7 + p_8 \quad (13)$$

Which means the sum of six odd primes is equivalent to

sum, where two primes from the sum of four and :

$$p_{11} + p_{12} + p_{13} + p_{14} = p_9 + p_{10} \quad (14)$$

Thus, from (14) it follows that the sum of four primes is equal to the sum of two simple and make sure that (14) is true from left to right.

Let be :

$$p_{11} + p_{12} + p_{13} + p_{14} \neq p_9 + p_{10} \quad (15)$$

And since the sum of two odd prime numbers is an even number, equal to

Since it is impossible to deny any pair of any two even numbers (13), then

it turns out that the sum of six arbitrary odd primes is not equal to the sum of four arbitrary odd primes (10), which is also impossible. On the other hand, in (10) one can create equality by changing the numeric value $p_7 + p_8$ *and*

then $p_9 + p_{10} = p_{11} + p_{12} + p_{13} + p_{14}$ *, which already reads as equality from right to left.*

And a double contradictory situation arises, which is by no means impossible, so how the equal sign implies equality in both directions simultaneously, the same number 2N cannot be represented simultaneously the sum of six primes, which is not equal to the sum of four and its equivalent equal to the sum of four primes. From what follows inevitability of equality of the sum of four primes to the sum of two primes. Thus, the equality of the sum of six primes and four is equivalent to the equality of the sum of four odd primes and two and is 2N, where $N \geq 18$

An even number greater than or equal to 18, which cannot be summed up to 6 simple odd numbers do not exist.

Representation of even numbers from 6 to 18 (minimum sum of 6 odd prime numbers) we show arithmetically with two odd prime numbers.

Any even number starting with six is the sum of two prime numbers. The Goldbach-Euler conjecture is correct and proven.

3.Thus we proved:

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

$$p_1 + p_2 = 2N \qquad (16)$$

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 . *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.

The prime numbers of twins are infinite.

Any even number, starting from 14, can be represented as a sum

four odd primes, of which two primes are twins.

$$p_1 + p_2 + p_3 + p_4 = 2N \qquad (17)$$

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).

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 (17) $2p_2 + 2p_4$ *:*

$$p_1 - p_2 + p_3 - p_4 = 4 \qquad (18)$$

From (18), 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 (17) the process becomes infinite and the prime numbers are twins -

infinite number

Resources used

1 Weisstein, Eric W. *Landau's Problems (англ.) на сайте Wolfram MathWorld.*

2. *https://lenta.ru/articles/2013/06/17/goldbach/*

3. *https://applied-research.ru/ru/article/view?id=9223*