

Twin prime numbers, Goldbach's proof  
of conjecture

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abstract

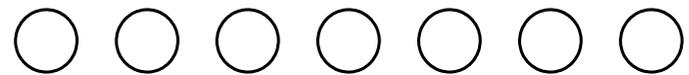
Twin prime numbers, Goldbach's proof  
of conjecture

Twin prime numbers are infinitely large.

All even numbers greater than 2 may be  
expressed as the sum of two prime  
numbers.

5 10 15 20 25 30 ...

Except for the case where synthetic water is included,



Consider that there is an N-length equivalent sequence as above.

For example

○ ○ ○ ○ ○ ○ ○

If there is a 7-length equivalent  
sequence as above,

Teeth

× × ○ × × ○ × × ○ × × ○

You can think of it as filling in the  
blank X here

○ ○ ○ ○ ○ ○ ○ ○ ○ × ○

As above, there is a multiple of 3 every third time (red circle)

Let's say this pushes the black circle to the right

The  $N$  th black circle here is the

$\frac{p+1}{p-1} \cdot N$  th circle or to the left

About  $p$  who is satisfied with  $p \leq N$

$\frac{p+1}{p-1} \cdot N$  continuous series of

equivalent series is minimum

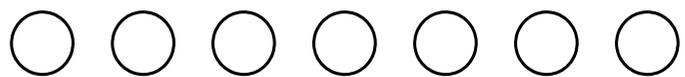
Include more than  $N$  terms that are  
not divided by  $p$

as to  $p_1, p_2$  satisfying  $p_1, p_2 \leq N$

$\frac{p_1 + 1}{p_1 - 1} \cdot \frac{p_2 + 1}{p_2 - 1} \cdot N$  series of equivalent

sequences are

It includes at least  $N$  terms that are not divided into  $p_1, p_2$



$N$ -length equivalent series

× × ○ × × ○ × × ○ × × ○

For each  $p_1$ , fill in × that cannot be filled with ○

○ ○ ○ ○ ○ ○ ○ ○ ○ ×

Let's do this again

× × × × ○ × × × × ○ × × × × ○

You can think of it as filling ○ with ×

that cannot be filled for each  $p_2$ .

In the same way, when there are two equivalent sequences,

○ ○ ○ ○ ○ ○ ○

If there is a 7-length equivalent sequence as above,

× × ○ × × ○ × × ○ × × ○

For each  $p_1$  in the first order of magnitude,  $\times$  cannot be filled

$\times \bigcirc \times \times \bigcirc \times \times \bigcirc \times \times \bigcirc \times$

For each  $p_1$  in the second order,  $\times$  cannot be filled

If you think about filling in  $\bigcirc$ ,

$\times \bigcirc \bigcirc \times \bigcirc \bigcirc \times \bigcirc \bigcirc \times \bigcirc \bigcirc \times \bigcirc \bigcirc$

It is the same as filling  $\times$  in  $\bigcirc$ ,  
where 2 spaces are empty for each  
 $p_1$ . therefore

About  $p$  who is satisfied with  $p \leq N$

$\frac{p+2}{p-2} \cdot N$  series of two equal order

sequences are at least

contains terms that are not divided

into  $N$  or more,

as to  $p_1, p_2$  satisfying  $p_1, p_2 \leq N$

The two consecutive series of

$\frac{p_1 + 2}{p_1 - 2} \cdot \frac{p_2 + 2}{p_2 - 2} \cdot N$  contain at least  $N$

terms that are not divided by  $p_1, p_2$ .

Thus, the two consecutive

$$\prod_{p < x} \left( \frac{x+2}{x-2} \right) \cdot x\text{-sequence sequences}$$

both contain at least  $x$  terms that are not divided by a decimal fraction of  $x$  or less.

$$\text{For } 3 \leq x, \quad \frac{x+2}{x-2} < \left( \frac{x}{x-1} \right)^4$$

For  $x \geq 10^4$ ,

$$\prod_{p \leq x} \frac{p}{p-1} \leq e^{\gamma} \ln x \left(1 + \frac{1}{2 \ln^2 x}\right)$$

(Kevin Broughan, *Equivalents of the Riemann hypothesis*(2017), 188)

$\left(e^{\gamma} \ln x \left(1 + \frac{1}{2 \ln^2 x}\right)\right)^4 x$  series of two consecutive

equivalent sequences are:

Include at least  $x$  terms that are not divided into decimal places below  $x$ .

Therefore, it has a value of  $x^2$  or less

When there are two consecutive equal

sequences of  $\left( e^{\gamma} \ln x \left( 1 + \frac{1}{2 \ln^2 x} \right) \right)^4 x$ ,

If you do not include any arguments

below  $x$ , they are prime,

Two consecutive  $\left( e^{\gamma} \ln x \left( 1 + \frac{1}{2 \ln^2 x} \right) \right)^4 x$

–sequence sequences with values equal to or less than  $x^2$  contain terms that are prime on at least both sides.

1. Proof of twin prime conjecture

1 2 3 4 5  $\cdots n$

3 4 5 6 7  $\cdots n + 2$

As shown above, it can be shown that there are cases where two equal order sequences are prime numbers at the same time.

For the maximum prime  $p$  below  $n$ ,

$p^2 < n$  is satisfied, and the length of

the above equivalent sequence pair is

$n$

Since when  $10^4 < p$  satisfies

$\left(e^{\gamma} \ln p \left(1 + \frac{1}{2 \ln^2 p}\right)\right)^4 p < p^2$ , at least  $p$  pairs

of equivalent sequences are prime at the same time.

## 2. Proof of Goldbach's conjecture

$$1 \ 2 \ 3 \ 4 \ 5 \ \cdots \ (n-1)$$

$$(n-1) \ (n-2) \ (n-3) \ \cdots \ 1$$

As shown above, it can be shown that there are cases where two equal order sequences are prime numbers at the same time.

For the maximum prime  $p$  below  $n-1$ ,

$p^2 < n - 1$  is satisfied, and the length of the above equivalent sequence pair is  $n - 1$

Since when  $10^4 < p$  satisfies

$\left( e^{\gamma} \ln p \left( 1 + \frac{1}{2 \ln^2 p} \right) \right)^4 p < p^2$ , at least  $p$  pairs

of equivalent sequences are prime at

the same time.