Twin Prime Conjecture

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Abstract

I proved the Twin Prime Conjecture.

The probability that (6n -1) is a prime and (6n+1) is also a prime approximately is 4/3 times the square of the probability that a prime will appear in.

I investigated up to 1×10^{12}.

All Twin Primes are executed in hexagonal circulation. It does not change in a huge number (forever huge number).

When the number grows to the limit, the primes occur very rarely, but since Twin Primes are 4/3 times the square of the distribution of primes, the frequency of occurrence of Twin Primes is very equal to 0.

However, it is not 0. Because, primes continue to be generated. Therefore, Twin Primes continue to be generated.

If the Twin Primes is finite, the primes is finite.
This is because 4/3 times the square of the probability of primes is the probability of Twin Primes. This is contradiction. Because there are an infinite of primes.

That is, Twin Primes exist forever.

key words

Hexagonal circulation, Twin Primes, 4/3 times the square of the probability of primes

Introduction

In this paper, it is written in advance that 2 and 3 are omitted from primes.

The prime number is represented as (6n -1) or (6n+1). And, n is positive integer.

All Twin Primes are combination of (6n -1) and (6n+1).

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That is, all Twin Primes are a combination of 5th-angle and 1th-angle.

[n is positive integer]

1th-angle is (6n+1).
5th-angle is (6n -1).

(6n -2), (6n), (6n+2) in are even numbers.
(6n -1), (6n+1), (6n+3) are odd numbers.

Primes are (6n -1) or (6n+1).
The following is a prime number.
There are no primes that are not (6n -1) or (6n+1).
5 ——— 6n -1 (Twin prime)
7 ——— 6n+1
11 ——— 6n -1 (Twin prime)
13 ——— 6n+1
17 ——— 6n -1 (Twin prime)
19 ——— 6n+1
23 ——— 6n -1
29 ——— 6n -1 (Twin prime)
31 ——— 6n+1
.....
.....

Part 1

There are 164 primes from 5 to 1000.
Probability is $\frac{164}{996}$.
In this, there are 34 Twin Primes. Probability is $\frac{34}{996}$ =0.034136546...
and $[\frac{164}{996}]^2 \times \frac{5}{4}$=0.0338905824...
$[\frac{164}{996}]^2 \times \frac{4}{3}$=0.0361499546...

There are 299 primes from 5 to 2000.
Probability is $\frac{299}{1996}$.
In this, there are 60 Twin Primes. Probability is $\frac{60}{1996}$ =0.030060120...
and $[\frac{299}{1996}]^2 \times \frac{4}{3}$=0.0299198932...

There are 426 primes from 5 to 3000.
Probability is $\frac{426}{2996}$.
In this, there are 81 Twin Primes. Probability is $\frac{81}{2996}$ =0.027036048...
and $[\frac{426}{2996}]^2 \times \frac{4}{3}$=0.026957171...

There are 665 primes from 5 to 5000.
Probability is $\frac{665}{9996}$.
In this, there are 125 Twin Primes. Probability is $\frac{125}{4996}$ =0.025020016...
and $[\frac{665}{4996}]^2 \times \frac{4}{3}$=0.023623115...

There are 1227 primes from 5 to 10000.
Probability is $\frac{1227}{29996}$.
In this, there are 204 Twin Primes. Probability is $\frac{204}{9996}$ =0.02040816326...
and $[\frac{1227}{9996}]^2 \times \frac{4}{3}$=0.0200897886...

There are 2258 primes from 5 to 20000.
Probability is $\frac{2258}{29996}$.
In this, there are 340 Twin Primes. Probability is $\frac{340}{19996}$ =0.01700340068...
and $[\frac{2258}{19996}]^2 \times \frac{4}{3}$=0.017002013...

There are 3243 primes from 5 to 30000.
Probability is $\frac{3243}{29996}$.
In this, there are 465 Twin Primes. Probability is $\frac{465}{29996}$ =0.01550206694...
and $[\frac{3243}{29996}]^2 \times \frac{4}{3}$=0.015584969...

There are 6053 primes from 5 to 60000.
Probability is $\frac{6053}{59996}$.
In this, there are 809 Twin Primes. Probability is $\frac{809}{59996}$ =0.01348423228....
and $[\frac{6053}{59996}]^2 \times \frac{4}{3}$=0.013571738...

There are 6931 primes from 5 to 70000.
Probability is $\frac{6931}{69996}$.
In this, there are 904 Twin Primes. Probability is $\frac{904}{69996}$ =0.012915023716...
and $[\frac{6931}{69996}]^2 \times \frac{4}{3}$=0.0130732657...

There are 6933 primes from 5 to 90000.
Probability is $\frac{6933}{89996}$.
In this, there are 903 Twin Primes. Probability is $\frac{903}{69996}$ =0.012900737185...
and $[\frac{6933}{69996}]^2 \times \frac{4}{3}$=0.01308081164...

There are 9590 primes from 5 to 100000.
Probability is $\frac{9590}{99996}$.
In this, there are 1222 Twin Primes. Probability is $\frac{1222}{99996}$=0.0122204888...
and $[\frac{9590}{99996}]^2 \times \frac{4}{3}$=0.0122633943...

There are 17982 primes from 5 to 200000.
Probability is $\frac{17982}{199996}$.
In this, there are 2158 Twin Primes. Probability is $\frac{2158}{199996}$=0.0107902...
and $[\frac{17982}{199996}]^2 \times \frac{4}{3}$=0.01077884...

There are 25995 primes from 5 to 300000.
Probability is $\frac{25995}{299996}$.
In this, there are 2992 Twin Primes. Probability is $\frac{2993}{299996}$=0.00997679969...
and $[\frac{25995}{299996}]^2 \times \frac{4}{3}$=0.01001123...

There are 33858 primes from 5 to 400000.
Probability is $\frac{33858}{399996}$.
In this, there are 3802 Twin Primes. Probability is $\frac{3803}{399996}$=0.009505095...
and $[\frac{33858}{399996}]^2 \times \frac{4}{3}$=0.00955322...

There are 41536 primes from 5 to 500000.
Probability is $\frac{41536}{499996}$.
In this, there are 4564 Twin Primes. Probability is $\frac{4564}{499996}$=0.009128073...
and $[\frac{41536}{499996}]^2 \times \frac{4}{3}$ = 0.009201423...

There are 49096 primes from 5 to 600000.
Probability is $\frac{49096}{599996}$.
In this, there are 4564 Twin Primes. Probability is $\frac{5330}{599996}$=0.00888339255595...
and $[\frac{49096}{599996}]^2 \times \frac{4}{3}$=0.0089275902...

There are 56540 primes from 5 to 700000.
Probability is $\frac{56540}{699996}$.
In this, there are 6060 Twin Primes. Probability is $\frac{6060}{699996}$=0.008657192...
and $[\frac{56540}{699996}]^2 \times \frac{4}{3}$=0.00869879...

There are 63948 primes from 5 to 800000.
Probability is $\frac{63948}{799996}$.
In this, there are 6765 Twin Primes. Probability is $\frac{6765}{799996}$=0.00845629228...
and $[\frac{63948}{799996}]^2 \times \frac{4}{3}$=0.0085195574...

There are 71272 primes from 5 to 900000.
Probability is $\frac{71272}{899996}$.
In this, there are 7471 Twin Primes. Probability is $\frac{7471}{899996}$=0.0083011480051...
and $[\frac{71272}{899996}]^2 \times \frac{4}{3}$ = 0.00836171709...

There are 78496 primes from 5 to 1000000=1×10^6.
Probability is $\frac{78496}{999996}$.
In this, there are 8168 Twin Primes. Probability is $\frac{8168}{999996}$=0.008168032672...
and $[\frac{78496}{999996}]^2 \times \frac{4}{3}$=0.0082155617...

There are 148931 primes from 5 to 2000000=2×10^6.
Probability is $\frac{148931}{1999996}$.
In this, there are 14870 Twin Primes. Probability is $\frac{14870}{1999996}$=0.0074350148...
and $[\frac{148931}{1999996}]^2 \times \frac{4}{3}$=0.00739351...

There are 216814 primes from 5 to 3000000=3×10^6.
Probability is $\frac{216814}{2999996}$.
In this, there are 20931 Twin Primes. Probability is $\frac{20931}{2999996}$=0.0069770093...
and $[\frac{216814}{2999996}]^2 \times \frac{4}{3}$=0.006964212...

There are 283144 primes from 5 to 4000000=4×10^6.
Probability is $\frac{216814}{3999996}$.
In this, there are 26859 Twin Primes. Probability is $\frac{26859}{3999996}$=0.0067147567...
and $[\frac{283144}{3999996}]^2 \times \frac{4}{3}$=0.006680890...

There are 348511 primes from 5 to 5000000=5×10^6.
Probability is $\frac{348511}{4999996}$.
In this, there are 32462 Twin Primes. Probability is $\frac{32462}{4999996}$=0.00649240519...
and $[\frac{348511}{4999996}]^2 \times \frac{4}{3}$=0.006477872...

There are 412847 primes from 5 to 6000000=6×10^6.
Probability is $\frac{412847}{5999996}$.
In this, there are 37915 Twin Primes. Probability is $\frac{37915}{5999996}$=0.00631917087...
and $[\frac{412847}{5999996}]^2 \times \frac{4}{3}$=0.0063126989...

There are 476646 primes from 5 to 7000000=7×10^6.
Probability is $\frac{476646}{6999996}$.
In this, there are 43258 Twin Primes. Probability is $\frac{43258}{6999996}$=0.006179717816...
and $[\frac{476646}{6999996}]^2 \times \frac{4}{3}$=0.0061820862...

There are 539775 primes from 5 to 8000000=8×10^6.
Probability is $\frac{539775}{7999996}$.
In this, there are 48617 Twin Primes. Probability is $\frac{48617}{7999996}$=0.006077128038...

and $[\frac{539775}{7999996}]^2 \times \frac{4}{3}$=0.0060699446...

There are 602487 primes from 5 to 9000000=9×10^6.
Probability is $\frac{602487}{8999996}$.
In this, there are 53866 Twin Primes. Probability is $\frac{53866}{8999996}$=0.00598511377...
and $[\frac{602487}{8999996}]^2 \times \frac{4}{3}$=0.005975158...

There are 664577 primes from 5 to 10000000=1×10^7.
Probability is $\frac{664577}{9999996}$.
In this, there are 58979 Twin Primes. Probability is $\frac{58979}{9999996}$=0.0058979023...
and $[\frac{664577}{19999996}]^2 \times \frac{4}{3}$ = 0.005888839...

There are 1270605 primes from 5 to 20000000=2×10^7.
Probability is $\frac{1270605}{19999996}$.
In this, there are 107406 Twin Primes. Probability is $\frac{107406}{19999996}$=0.005370301...
and $[\frac{1270605}{19999996}]^2 \times \frac{4}{3}$=0.005381459...

There are 2433652 primes from 5 to 40000000=4×10^7.
Probability is $\frac{2433652}{39999996}$.
In this, there are 196752 Twin Primes. Probability is $\frac{196752}{39999996}$=0.00491880049...
and $[\frac{2433652}{39999996}]^2 \times \frac{4}{3}$=0.0049355527...

There are 3562112 primes from 5 to 60000000=6×10^7.
Probability is $\frac{3562112}{59999996}$.
In this, there are 280557 Twin Primes. Probability is $\frac{280557}{59999996}$=0.00478200038...
and $[\frac{3562112}{59999996}]^2 \times \frac{4}{3}$=0.00469949762...

There are 4669380 primes from 5 to 80000000=8×10^7.
Probability is $\frac{4669380}{79999996}$.
In this, there are 361449 Twin Primes. Probability is $\frac{361449}{79999996}$=0.00451811272...
and $[\frac{4669380}{79999996}]^2 \times \frac{4}{3}$=0.00454231495...

There are 5761453 primes from 5 to 10000000=1×10^8.
Probability is $\frac{5761453}{99999996}$.
In this, there are 440311 Twin Primes. Probability is $\frac{440311}{99999996}$=0.004403110176...
and $[\frac{5761453}{99999996}]^2 \times \frac{4}{3}$=0.0044259124...

There are 11078935 primes from 5 to 20000000=2×10^8.
Probability is $\frac{11078935}{199999996}$.

In this, there are 813370 Twin Primes. Probability is $\frac{813370}{199999996}$=0.004066850081...
and $[\frac{11078935}{199999996}]^2 \times \frac{4}{3}$=0.0040914268...

There are 16252323 primes from 5 to 30000000=3×10^8.
Probability is $\frac{16252323}{299999996}$.
In this, there are 1166479 Twin Primes. Probability is $\frac{1166479}{299999996}$=0.00388826338...
and $[\frac{16252323}{299999996}]^2 \times \frac{4}{3}$=0.00391315570...

There are 50847530 primes from 5 to 100000000=1×10^9.
Probability is $\frac{50847530}{999999996}$.
In this, there are 3424505 Twin Primes. Probability is $\frac{3424505}{999999996}$=0.00342450501...
and $[\frac{50847530}{999999996}]^2 \times \frac{4}{3}$=0.00344729510371...

There are 455052507 primes from 5 to 10000000000=1×10^{10}.
Probability is $\frac{455052507}{9999999996}$.
In this, there are 27412678 Twin Primes. Probability is $\frac{27412678}{9999999996}$=0.0027412678...
and $[\frac{455052507}{9999999996}]^2 \times \frac{4}{3}$=0.0027609704572...

There are 4118054809 primes from 5 to 100000000000=1×10^{11}.
Probability is $\frac{4118054811}{99999999996}$.
In this, there are 224376047 Twin Primes. Probability is $\frac{224376047}{99999999996}$=0.002243760...
and $[\frac{4118054811}{99999999996}]^2 \times \frac{4}{3} = 0.0022611167237...$

There are 37607912014 primes from 5 to
1×10^{12}.
Probability is $\frac{37607912014}{99999999996}$.
In this, there are 1870585218 Twin Primes. Probability is $\frac{1870585218}{999999999996} = 0.001870585218007...$
and $[\frac{37607912014}{99999999996}]^2 \times \frac{4}{3} = 0.00188580672808544...$

There are 177291661645 primes from 5 to
5000000000000=5×10^{12}.
Probability is $\frac{177291661645}{4999999999996}$.
In this, there are 8312493001 Twin Primes. Probability is
$\frac{8312493001}{4999999999996} = 0.00166249860020133....$
and
$[\frac{177291661645}{4999999999996}]^2 \times \frac{4}{3} = 0.00167639110874109...$

Part 2

There are 455052507-50847530=404204977 primes from 1×10^9 to $1\times10^{10} = 9 \times 10^9$.

Probability is $\frac{404204977}{9000000000}$=0.04491166411...
In this, there are 27412678-3424505=23988173 Twin Primes. Probability is $\frac{23988173}{9000000000}$=0.00266535255...

$[\frac{404204977}{9000000000}]^2 \times \frac{4}{3}$=0.00268941009764...

There are 4118054809-455052507=3663002302 primes from 1×10^{10} to 1×10^{11}=9×10^{10}.
Probability is $\frac{3663002302}{90000000000}$=0.0407000255777....
In this, there are 224376047-27412678=196963369 Twin Primes. Probability is $\frac{196963369}{90000000000}$=0.0021884818777...

$[\frac{3663002302}{90000000000}]^2 \times \frac{4}{3}$=0.00220865610937....

There are 37607912016-4118054809=33489857207 primes from 1×10^{11} to 1×10^{12}=9×10^{11}.
Probability is $\frac{33489857207}{900000000000}$=0.0372109524522...
In this, there are 1870585219-224376047=1646209172 Twin Primes. Probability is $\frac{1646209172}{90000000000}$=0.0182912130222...

$[\frac{33489857207}{900000000000}]^2 \times \frac{4}{3}$=0.0018462066432020...

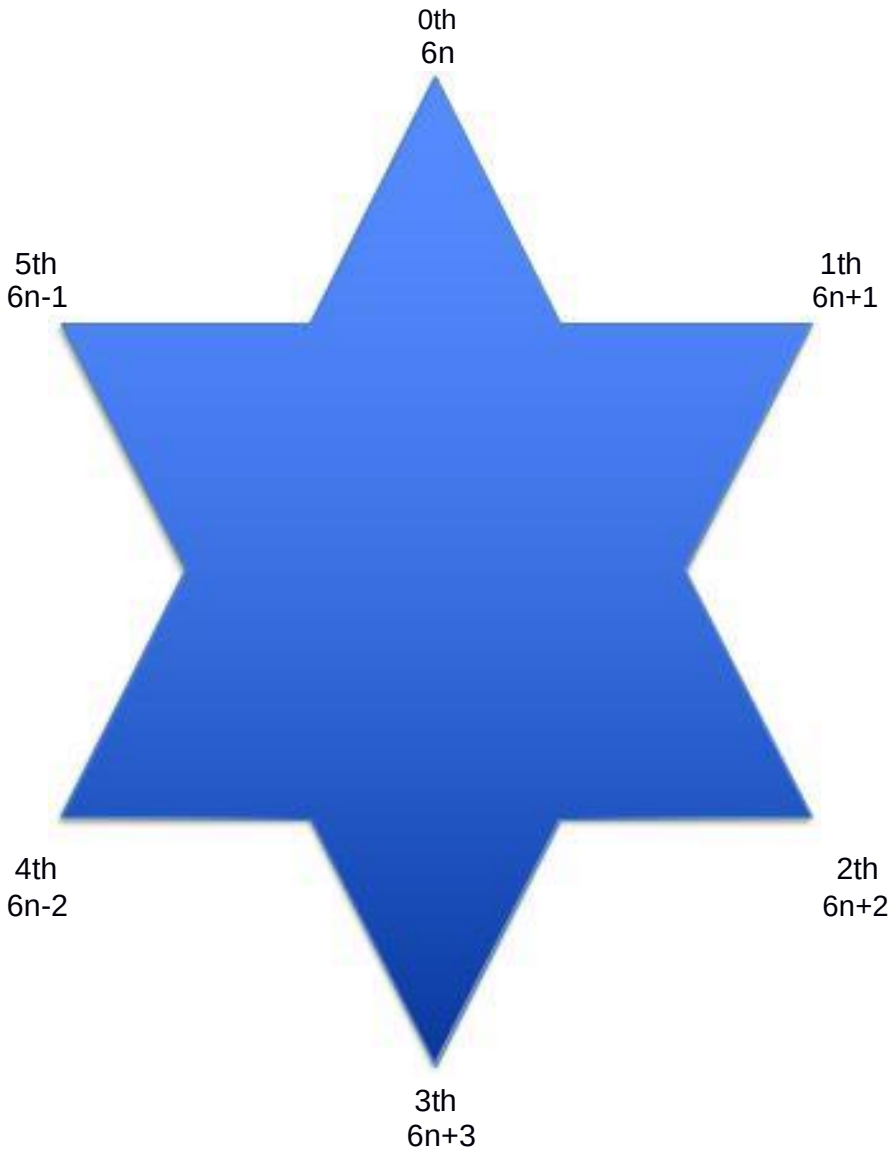
There are 17729166164-3760791201=13968374963 primes from 1×10^{12} to 5×10^{12}=4×10^{12}.
Probability is $\frac{13968374963}{400000000000}$=0.0349209374075
In this, there are 8312493001-1870585219=6441907782 Twin Primes. Probability is $\frac{6441907782}{400000000000}$=0.0016104769455

$[\frac{13968374963}{400000000000}]^2 \times \frac{4}{3}$=0.00162596249255804376140833 3...

At first, the correction value was set to 5/4.
And the correction value is 4/3.

(It was done by hand calculation up to 200,000, but at this time it was [6/5] at first, gradually moved to [5/4], and then moved to [4/3].
At that time, I didn't know that WolframAlpha and Wolfram Cloud could calculate primes and Twin Primes.)

Calculation depends on WolframAlpha and Wolfram Cloud.


0th
6n
1th
6n+1
2th
6n+2
3th
6n+3
4th
6n-2
5th
6n-1

Discussion

There are four possible primes combination: (6n -1)(6n -1), (6n -1)(6n+1), (6n+1)(6n -1), (6n+1)(6n+1), Each with the same probability.
At this time, Twin Prime is only (6n -1)(6n+1).
The probability of (6n -1)(6n+1) is [1/4].
That is, when Primes comes out, the probability that it is Twin Primes is 1/[1-(1/4)=3/4].
This is the reason for the constant [4/3].

I wrote below the distribution of Sexy Primes, Twin primes and Cousin primes.

(number)	(Sexy prime)	(Twin Prime)	(Cousin Primes)
100000	2447	1224	1216
200000	4295	2160	2136
300000	6003	2994	3975
400000	7650	3804	3817
500000	9184	4565	4559
600000	10688	5331	5334
700000	12138	6061	6085
800000	13587	6766	6798
900000	15000	7472	7471
1000000	16386	8169	8144
2000000	29419	14871	14742
3000000	41559	20932	20826
4000000	53224	26860	26629
5000000	64481	32463	32308
6000000	75417	37915	37787
7000000	86165	43258	43125
8000000	96705	48617	48288
9000000	107042	53866	53468
10000000	117207	58980	58622
90000000	801602	401089	401025
100000000=1×10^8	879908	430311	440258

First, say 6n -1 = 6n+5

$(6n-1) \times 5$ =6(5n -1)+1= 1th-angle.
$(6n+1) \times 5$ =6(5n)+5= 5th-angle.
and

$(6n-1)\times 7$ =6(7n -2)+5= 5th-angle.
$(6n+1)\times 7$ =6(7n+1)+1= 1th-angle.
and
$(6n-1)\times 11$ =6(11n -2)+1= 1th-angle.
$(6n+1)\times 11$ =6(11n+1)+5= 5th-angle.
and
$(6n-1)\times 13$ =6(13n -3)+5= 5th-angle.
$(6n+1)\times 13$ =6(13n+2)+1= 1th-angle.
and
$(6n-1)\times 17$ =6(17n -3)+1= 1th-angle.
$(6n+1)\times 17$ =6(17n+2)+1= 5th-angle.
and
$(6n-1)\times 19$ =6(19n -4)+5= 5th-angle.
$(6n+1)\times 19$ =6(19n+3)+1= 1th-angle.
and
$(6n-1)\times(6n-1) = 6(6n^2-2n)+1$= 1th-angle.
(6n -1)$\times(6n+1) = 6(6n^2-1)+5 = 6(6n^2)-1$= 5th-angle.
and
$(6n+1)\times(6n-1) = 6(6n^2-1)+5 = 6(6n^2)-1$= 5th-angle.
(6n+1)$\times(6n+1) = 6(6n^2$+2n)+1= 1th-angle.

In this way, prime multiples of (6n -1) or (6n+1) of primes fill 5th-angle, 1th-angle, and the location of primes becomes little by little narrower.

However, every time the hexagon is rotated once, the number of locations where the prime number exists increases by two.

The probability of a twin prime[(6n -1)(6n+1) combinations] is obtained by multiplying 6/5 times the square of the probability of a prime will occur.

The probability that a twin prime will occur 6/5 times the square of the probability that a prime will occur in a huge number, where the probability that a prime will occur is low from the equation (1).
While a prime number is generated, Twin Primes be generated.

And, as can be seen from the equation below, even if the number becomes large, the degree of occurrence of primes only decreases little by little.

$$\pi(x) \sim \frac{x}{\log x} \quad (x \to \infty) \tag{1}$$

$\log(10^{20}) = 20\log(10) \approx 46.0517018$
$\log(10^{200}) = 200\log(10) \approx 460.517018$
$\log(10^{2000}) = 2000\log(10) \approx 4605.17018$
$\log(10^{20000}) = 20000\ \log(10) \approx 46051.7018$
$\log(10^{200000})$=200000 $\log(10) \approx 460517.018$

(Expected to be larger than $\log(10^{200000})$)

As x in $\log(x)$ grows to the limit, the denominator of the equation also grows extremely large. Even if primes are generated, the frequency of occurrence is extremely low. The generation of Twin Primes is approximately the square of the generation frequency of primes, and the generation frequency is extremely low.

However, as long as primes are generated, Twin Primes are generated with a very low frequency.

When the number grows to the limit, the denominator of the expression becomes very large, and primes occur very rarely, but since twins are the square of the distribution of primes, the frequency of occurrence of twins is very equal to 0.

However, it is not 0. Therefore, Twin Primes continue to be generated.

However, when the number grows to the limit, the probability the twin prime appearing is almost 0 because it is of 4/3 times the square of the probability of the appearance of the primes.
It is a subtle place to say that almost 0 appears.

Use a contradiction method.
If the Twin Primes is finite, the primes is finite.
This is because 4/3 times the square of the probability of primes is the probability of Twin Primes.
This is contradiction. Because there are an infinite of primes.

That is, Twin Primes exist forever.

Proof end.

Appendix

Twin primes are expressed $6m \pm 1$.(m is positive integer)
As you can see from the bottom, primes that satisfy this, that is, certain primes, end with 3 or 7.

For example, 2, 3, 5, 7, 17, 23, 103, 107, 137, 283, 313, 347, 373, 397, 443, 467, 577, 593, 653, 773, 787, 907, 1033, 1117, 1423, 1433, 1613, 1823, 2027, 2063, 2137, 2153, 2203, 2287, 2293, 2333, 2347, 2677 etc.

If write 3 or 7 separately, except 2 and 5, it looks like below.

3, 23, 103, 283, 313, 373, 443, 593, 653, 1033, 1423, 1433, 1613, 1823, 2063, 2153, 2203, 2293, 2333.....

7, 17, 107, 137, 247, 397, 467, 577, 787, 907, 1117, 2027, 2137, 2287, 2347, 2677....

Primes are forever. Therefore, Twin Primes are forever.

$12=6\times2$
$18=6\times3$
$30=6\times5$
$42=6\times7$
$102=6\times17$
$138=6\times23$
$618=6\times103$
$642=6\times107$
$822=6\times137$
$1698=6\times283$
$1878=6\times313$
$2082=6\times347$
$2238=6\times373$
$2382=6\times397$
$2658=6\times443$
$2802=6\times467$
$3462=6\times577$
$3558=6\times593$
$3918=6\times653$
$4638=6\times773$
$4722=6\times787$
$5442=6\times907$
$6198=6\times1033$
$6702=6\times1117$
$8538=6\times1423$
$8598=6\times1433$
$9678=6\times1613$
$10938=6\times1823$
$12162=6\times2027$
$12378=6\times2063$
$12822=6\times2137$
$12918=6\times2153$
$13218=6\times2203$
$13722=6\times2287$
$13758=6\times2293$
$13998=6\times2333$
$14082=6\times2347$
$16062=6\times2677$
$17418=6\times2903$
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The second proof ends.

References

[1] B.Riemann.: Uber die Anzahl der Primzahlen unter einer gegebenen Grosse, Mon. Not. Berlin Akad pp.671-680, 1859

[2] John Derbyshire.: Prime Obsession: Bernhard Riemann and The Greatest Unsolved Problem in Mathematics, Joseph Henry Press, 2003

[3] S.Kurokawa.: Riemann hypothesis, Japan Hyoron Press, 2009

[4] Marcus du Sautoy.: The Music of The Primes, Zahar Press, 2007

[5] S.Saitoh.: Fundamental of Mathematics; Division by Zero Calculus and a New Axiom, vixra:1908.0100

[6] M.Bortolomasi, A.Ortiz-Tapia.: Some remarks on the first Hardy-Littlewood conjecture, arXiv:1904.03017

[7] T.Takami.: Goldbach's Conjecture, viXra:1808.0531

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