Proof of Goldbach’s Conjecture.

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Abstract –

We had taken a unique and a simple approach and tried to prove Goldbach’s conjecture, the famously known conjecture which mathematician throughout the centuries are trying to solve it but always get failed.

Introduction -

Goldbach conjecture states that – Every even integer greater than 2 is the sum of two primes.

Until now many efforts have been made to prove the above statement to be true or false, but no one has yet come up with the satisfying solutions, but we have 100 % proof that the Goldbach conjecture statement is true. Euler commented "Mathematicians have tried in vain to this day to discover some order in the sequence of prime numbers, and we have reason to believe that it is a mystery into which the mind will never penetrate"

We know that there are additive property of prime and composite numbers that governs all prime numbers including composites numbers (multiple of two prime numbers) and we have highlighted some of those additive property and proved that Goldbach conjecture is true.

This theory states that,

If sum of two prime numbers is not prime or composite or any odd numbers divisible only by 3, then it must be even number.

Explanation & Details -

Arrangement of Numbers -

As we all know that natural number line contains odd and even numbers such as

1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19….

Using the above single number line, we arrange all numbers below in sets of three named as 'triple sets of numbers line'

Arranging of each line is done by assigning name to it as

L1 – Line 1, L2 – Line 2, L3 – Line 3.

L1	L2	L3
1	2	3
4	5	6
7	8	9
10	11	12
13	14	15
16	17	18
19	20	21
22	23	24
25	26	27
28	29	30
31	32	33
34	35	36
37	38	39
40	41	42

43 44 45

46 47 48

49 50 51

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Note – Above ‘triple sets of numbers line’ goes towards infinity.

Notice all the above vertical ‘triple sets of number line’.

L1 - Contains even numbers and numbers such as prime and composites e.g. 1, 4, 7, 10….

L2 – Also contains even numbers and numbers such as prime and composites e.g. 2, 5, 8, 11…

L3 – Contains only even numbers and odd numbers arranged in alternate order e.g. 3,6,9, 12…

By using the above ‘triple sets of numbers’ we derive a following equations. Equations to add primes or composites from all possible ways.

Equations for case of L1 -

pL1 is any prime numbers from L1.

cL1 is any composite numbers (multiple of two primes) from L1.

Where p is prime and $p > 3$ then

pL1 + pL1 = L2

pL1+ cL1 = L2

cL1+ cL1 = L2

Equations for case of L2 –

pL2 is any prime numbers from L2.

cL2 is any composite numbers from L2.

Where p is prime and $p > 3$ then

pL2 + pL2 = L1

pL2+ cL2 = L1

cL2+ cL2 = L1

Equations for case of L1 & L2 -

pL1 is any prime numbers from L1.

cL1 is any composite numbers from L1.

pL2 is any prime numbers from L2.

cL2 is any composite numbers from L2.

Where p is prime and $p > 3$ then

pL1 + pL2 = L3

pL1+ cL2 = L3

cL1+ cL2 = L3

Proving Method Used –

Equation Method -

To prove that $p + p = n$, where p is prime and n is even number.

We need to prove that,

$p + p \neq c$ ………. where c is composite number (multiple of two primes).

$p + p \neq p$

$p + p \neq n$ ………………………….. where n is odd number only divisible by 3.

Pattern in The Series Method –

We find that there are many patterns in the below explained series that is followed by prime and composite numbers, so using this pattern method we had tried to prove Goldbach’s conjecture.

1)Case of $p + p \neq p$, at L2 & L3 –

Notice the ‘triple sets of numbers line’ equation L2 + L3 = L1

Adding the prime numbers,

$2 + 3 = 5$ ……. Where 2 is even number and 3 is odd.

Check L3, there is only one number i.e, number 3. Thereafter there are no prime numbers in this number line.

All prime are odd numbers and falls at L1 & L2.

Therefore, we cannot use equation for L3 any further.

Thus, in case of L3.

All $p > 3$, $p + p \neq p$.

2)Case of Composite Number -

To prove $p + p \neq c$

To prove composite is not sum of two primes first we must find what two numbers are when added makes composites numbers.

We know that composite number (multiple of two primes) in natural number line, starts from number 25.

25, 35, 55, 65, 85, 95…….

Multiplicative property of composites number is,

(5*5 = 25) (5 *7 = 35) (5*11 =55) (5*13 = 65)….

Question is, what is the additive property that makes composites numbers?

To find the answer check below series, it shows additive property of composites numbers by addition of even and prime numbers.

We introduce a new theory – Alfa & Omega Theory.

Theory states that,

Composite numbers (multiple of two prime numbers) are the sum of one specific even number and one specific prime number.

Composite numbers (multiple of two prime numbers) can also be the sum of one specific even number and one specific composite number.

(Note- that to generate Alfa & Omega series, specific even and prime numbers are required. Therefore, one should know what are those specific number's).

In this series we have used (20, 8, 16) (5, 2, 4).

Two prove we must generate Alfa & Omega series.

Generating Alfa series.	Generating Omega series.
20 + 8 = 28	5 + 2 = 7
28 + 16 = 44	7 + 4 = 11
44 + 8 = 52	11 + 2 = 13
52 + 16 = 68	13 + 4 = 17
68 + 8 = 76	17 + 2 = 19

Go on adding 8, 16 to each sum in sequence to generate alfa series.

Go on adding 2, 4 to each sum in sequence to generate omega series.

Consider the left hand side vertical columns of both series.

20, 28, 44, 52, 68…..

5, 7, 11, 13……

Combine both series to generate below Alfa & Omega Series.

20 + 5 = 25

28 + 7 = 35

44 + 11 = 55

52 + 13 = 65

68 + 17 = 85

76 + 19 = 95

92 + 23 = 115

100 + 25 = 125 (n + c = c)

116 + 29 = 145

124 + 31 = 155

As we go on generating and combining alfa and omega series, we get composite numbers (divisible only by 5) this series goes towards infinity.

Notice the sum 25, 35, 55, 65, 85… they are having a pattern i.e. each next sum is the addition of even number 10 & 20 in sequence.

25 + 10 = 35, 35 +20 = 55, 55 + 10 = 65

Notice all even numbers 20, 28, 44, 52, 68…. they are also having a pattern i.e. each next sum is the addition of even number 8 & 16 in sequence.

Also, prime numbers in middle of series has patterns i.e. each next prime number is the addition of even number 2 & 4 in sequence.

Patterns –

Lets consider whole numbers,

2,4,6,8,10….. is the infinite series whose terms are the successive of number 2.

It shows a pattern of number 2. In this case we agree that each and every successive terms must be even numbers just because it follows a of pattern of number 2.

Then, we must also agree that alfa and omega series is infinite series where all terms follow the patterns of 10 & 20, 8 & 16, 2 & 4 and all the sums in the series must be infinitely a **composites numbers** only divisible by 5.

If we agree above conditions, then we must also agree that -

All composite numbers are the sum of even and prime number or composite number.

$n + p = c$ …….where n is even number, p is prime and c is composite.

$n + c = c$ …….where n is even number, p is prime and c is composite.

Therefore, this proves that $p + p \neq c$. …………………………………. 1.1

Case of L2 -

To prove $p + p \neq p$, $p + p \neq c$.

Let's consider the 'triple sets of number line equations'.

Where p is prime, c is composite and $p > 3$ then

$pL2 + pL2 = L1$ …………………………..(Sum L1 must be even number).

$pL2 + cL2 = L1$ …………………………..(Sum L1 must be even number).

$cL2 + cL2 = L1$ …………………………..(Sum L1 must be even number).

Inputting and adding the prime number in sequences from L2 in the $pL2 + pL2 = L1$

equation we can go on generating a series shown below. (Note - further there will be additions of composite & prime numbers where pL2+ cL2 = L1, cL2+ cL2 = L1 will be the equations in series.)

5 + 5 = 10

5 + 11 = 16

5 + 17 = 22, 11 + 11 = 22

11 + 17 = 28

17 + 17 = 34

17 + 23 = 40

23 + 23 = 46

23 + 29 = 52

Go on adding prime or composite numbers in sequence only from L2 and this series goes towards infinity giving same result.

(**Important Note** –

1) If we check - addition of two prime can also be done in random ways, the result sums will always be even numbers.

2) Though, pL2+ cL2 = L1, cL2+ cL2 = L1 is required to generate the series but is not consider in the series. We must consider only pL2+ pL2 = L1 because sum of two primes is what we are finding in this series).

Patterns –

Notice the sums as even numbers 10, 16, 22, 28, 34…. they are having a pattern i.e each next sum is the addition of even number 6 in sequence.

10 + 6 = 16, 16 + 6 = 22, 22 + 6 = 28, 22 + 28 = 34 and so on….

Also notice the left hand side of series, all prime and composites numbers are also having a pattern of number 6 i.e.,

All successive vertically prime numbers 5+ 6 = 11, 11 + 6 = 17, 17 + 6 = 23 and so on…are having a pattern i.e each next prime number is the addition of even number 6 in sequence.

Again, let's consider arithmetic progression of 2,

2,4,6,8,10….. is the infinite series whose terms are the successive of number 2.

It shows a pattern of number 2. In this case we agree that each and every successive terms must be even numbers just because it follows a pattern of number 2.

Then, we must also agree that the above series where all terms follow the patterns of number 6 must be infinitely a sum of two prime numbers having **even numbers as their sums.** (pL2+ pL2 = L1 ……. where sum L1 is even number).

If we agree above conditions, then we must also agree that -

All composite numbers are the sum of even and prime number or composite number.

Therefore, this proves that in case of L2.

Where n is even number, p is prime number & c is composite number.

$p + p \neq p$ but $p + p = n$, $p + c = n$, $c + c = n$ ………………… 1.2

Case of L1 -

To prove $p + p \neq p$

Let's consider the 'triple sets of number line' equations.

Where p is prime, c is composite and $p > 3$ then

pL1+ pL1 = L2 …………………………..(Sum L2 must be even number).

pL1+ cL1 = L2 …………………………..(Sum L2 must be even number).

cL1+ cL1 = L2 …………………………..(Sum L2 must be even number).

Inputting and adding the prime number in sequences from L1 in the equation we get a pattern series shown below.

7 + 7 = 14

7 + 13 = 20

13 + 13 = 26

13 + 19 = 32

19 + 19 = 38

19 + 25 = 44   (Notice here 25 is composite number follows pL1+ cL1 = L2).

Go on adding prime or composite numbers in sequence only from L1 and this series would go towards infinity giving same result.

(**Important Note** –

1) Addition of two prime can also be done in random ways, the result sum will always be even numbers.

2) Though, pL1+ cL1 = L2, cL1+ cL1 = L2 is required to generate the series but is not consider in the series. We must consider only pL1+ pL1 = L2 because sum of two primes is what we are finding in this series).

Patterns –

Here also we find that the sum even numbers 14, 20, 26, 32… are having a pattern i.e each next sum is the addition of even number 6 in sequence.

14 + 6 = 20, 20 + 6 = 26, 26 + 6 = 32 and so on…

Also notice the left hand side of series, all prime and composites numbers are also having a pattern of number 6 i.e.,

All successive vertically prime numbers 7+ 6 = 13, 13 + 6 = 19, 19 + 6 = 25 and so on…are having a pattern i.e each next prime number is the addition of even number 6 in sequence.

Again, let’s consider arithmetic progression of 2, 2,4,6,8,10….. is the infinite series whose terms are the successive of number 2.

It shows a pattern of number 2. In this case we agree that each and every successive terms must be even numbers just because it follows a pattern of number 2.

Then, we must also agree that the above series where all terms follow the patterns of number 6 must be infinitely a sum of two prime numbers having **even numbers as their sums.** (pL1+ pL1 = L2 ……. Where sum L2 is even number).

If we agree above conditions, then we must also agree that -

All composite numbers are the sum of even and prime number or composite number.

Therefore, this proves that in case of L1.

Where n is even number, p is prime number & c is composite number.

$p + p \neq p$ but $p + p = n$, also $p + c = n$, $c + c = n$ ………………… 1.3

Case of L1 & L2 -

To prove $p + p \neq n$, where n is odd number only divisible by 3.

Let's again consider the 'triple sets of number line' equations.

Where p is prime, c is composite and $p > 3$ then

pL1+ pL2 = L3 …………………………..(Sum L3 must be even number).

pL1+ cL2 = L3 …………………………..(Sum L3 must be even number).

cL1+ cL2 = L3 …………………………..(Sum L3 must be even number).

Inputting and adding the prime number in sequences from L1 & L2 in the equation we get a pattern series shown below.

5 + 7 = 12

7 + 11 = 18

11 + 13 = 24

13 + 17 = 30

19 + 19 = 38

This series goes towards infinity.

Go on adding prime or composite number in sequence from L1 & L2 as shown above.

(**Important Note** –

1) Addition of two prime can also be done in random ways, the result sums will always be even numbers.

2) Though pL2+ cL2 = L3, cL2+ cL2 = L3 is required to generate the series but is not consider in the series. We must consider only pL1+ pL2 = L3 because sum of two primes is what we are finding in this series).

Patterns –

Notice the sum 12, 18, 24, 30 …. they are having a pattern i.e each next sum is the addition of even number 6 in sequence.

12 + 6 = 18, 18 + 6 = 24, 24 + 6 = 30 and so on…

Also all the prime and composites numbers on left hand side are also having a pattern of number 6 i.e.,

All successive vertically prime numbers 7+ 4 = 11, 11 + 2 = 13, 13 + 4 = 17 so on… each next prime number is the addition of even numbers 4, 2 in sequence.

Again, let's consider arithmetic progression of 2,

2,4,6,8,10….. is the infinite series whose terms are the successive of number 2.

It shows a pattern of number 2. In this case we agree that each and every successive terms must be even numbers just because it follows a pattern of number 2.

Then, we must also agree that the above series where all terms follow the patterns of number 2, 4 must be infinitely a sum of two prime numbers having **even numbers as their sums.** (pL1+ pL2 = L3 ……. Where sum L3 is even number).

This proves that in case of L1 & L2.

Where n is even number, p is prime number & c is composite number.

$p + p \neq p$ but $p + p = n$, also $p + c = n$, $c + c = n$ ………………… 1.4

So from 1.1, 1.2 & 1.3, Case of $p + p \neq p$, at L2 & L3.

$p + p \neq c$. ………………. 1.1

$p + p \neq p$ but $p + p = n$, $p + c = n$, $c + c = n$ ………………… 1.2

$p + p \neq p$ but $p + p = n$, $p + c = n$, $c + c = n$ ………………… 1.3

Thus, we proved that

$p + p = n$, where n is even number, p is prime number.

Therefore, Goldbach's conjecture statement is absolutely true.

Conclusion -

About the theory, series and its explanation, one must ask question why number 6 & 2, 4 pattern arises in all three cases of series and pattern of (8, 16) (2,4) at alfa & omega series. It is because all prime and composites numbers (multiple of two primes) at natural number line are govern by,

Additive property – Addition in patterns.
Multiplicative property - Adding equal groups.

So, by knowing how the pattern works in case of additive terms of prime and composite numbers we are able to prove Goldbach's conjecture to be true.

Reference –

https://mathworld.wolfram.com/GoldbachConjecture

Weisstein, Eric W. "Goldbach Conjecture". MathWorld.

Silva, Tomás Oliveira e. "Goldbach conjecture verification". www.ieeta.pt

Sinisalo, Matti K. (Oct 1993). "Checking the Goldbach Conjecture up to 4 1011" (PDF). Mathematics of Computation. American Mathematical Society https://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.364.3111

https://www.nature.com/news/mathematicians-come-closer-to-solving-goldbach-s-weak-conjecture-1.10636