International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2020): 7.803

Goldbach's Conjecture

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The conjecture states that "every even number more than 2 is a sum of two primes". The conjecture was formulated by Christian Goldbach in 1742.

Abstract: ***The conjecture was formulated by a German Mathematician/Lawyer Christian Goldbach in 1742. The conjecture is in number theory and is one of the seven millennium problems to be awarded US $1 million by publishing house Faber and Faber if proved by any one.***

Keywords: Sum, Triangular, Cardinal, Prime factors, Infinity

1. Proof

Figure 1 below shows the arrangement of natural numbers in cyclic manner that are intersected by ten (10) Cardinals. Half of the Cardinals (i.e. 5 Cardinals) carry even numbers and the other five (5) carry odd numbers as shown below.

The numbers indicated at these intercepts (intersections) of the Cardinals and the circles are as many as infinity.

Figure 1 below shows Boscomplex Web Method (BWM).

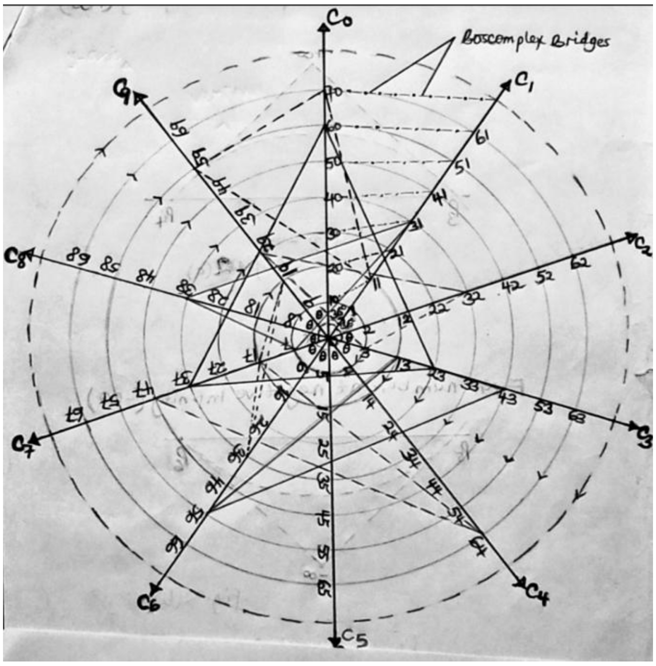

Figure 1: Boscomplex Web Method

In the Figure above, each even number is a sum of two primes that arrange themselves in a triangular manner on each of the five (5) Cardinals of the even numbers that alternate with the five (5) Cardinals of the odd numbers. A total of ten (10) Cardinals are formed, labeled (named) as C_0, C_1, C_2 ...C_8, C_9.They are separated by an angel $\emptyset = 36^{o}$ from each other.

$\emptyset = 360^{o}/n$ (**1**)

$\therefore \emptyset = 360^{o}/10 = 36^{\circ}$, where $\emptyset$ = angle between two Cardinals, n is the total number of the Cardinals.

Each cardinal is intersected by cyclic patterns. The first circle is made up of a set of natural numbers from 1-9 and ends up with 10 as the tenth cardinal which is a combination of 1 and 0.

The 2^{nd}, 3^{rd}, $4^{th}...\infty^{th}$ circles are at an interval of 10 from each other. They carry numbers whose last digits correspond to the Cardinal numbers or digits on the first circle e.g.

(i) 10, 20, 30... Correspond with 0 on c_0
(ii) 11, 21, 31... Correspond with 1 on c_1
(iii) 12, 22, 32... Correspond with 2 on c_2
(iv) 13, 23, 33... Correspond with 3 on c_3.
and so on.

In fact the numbers 0,1,2,3,4,5,6,7,8 and 9 give the cardinal numbers c_0, c_1, c_2...c_8 and c_9.

Zero (**0**) is placed at the center of each circle (reference point) as in the above diagram.

Some of the even numbers are formed by a set of two or more primes as illustrated with triangles in the above diagram except 2, 4, 6 and 8 (single digit even numbers).

Example:

(a) 10 = 3 + 7 or 5 + 5; (b) 8 = 3 + 5; (c) 6 = 3 + 3; (d) 12 = 7 + 5
(e) 4 = 2 + 2; (f) 26 = 3 + 23, 7 + 19, 13 + 13; (g) 36 = 17 + 19, 13 + 23, 5 + 31, 7 + 29
(h) 22 = 3 + 19, 5 + 17,11 + 11; (i) 38 = 19 + 19, 7 + 31; (j) 60 = 23 + 37,19 + 41, 29 + 31, 17 + 43
(k) 100 = 3 + 97 , 11+ 89,17 + 83, 29 + 71, 41 + 59, 47 + 53.

In general, the larger the even number, the more different ways it can split between two primes.

From the above diagram, it's noted that the sum of two primes equals to even number for all even numbers. That's to say;

$p_1 + p_2 = n$ (**2**), where p_1 and p_2 are prime numbers, n = even number.
=> $p_1 = n - p_2$ (**3**)
$p_2 = n - p_1$ (**4**)

Substituting for p_1 and p_2 in (2), i have,
$n - p_2 + n - p_1 = n$
$2n - p_2 - p_1 = n$
$- p_2 - p_1 = -n$
If $p_1 = p_2 = p$, (equal primes),
Then $- p - p = - n$
$- 2p = - n$
$\therefore 2p = n$ (**5**)
$p = 1/2\ n$ (**6**)
$\therefore p_1 = 1/2\ n$ (**7**)
$p_2 = 1/2\ n$ (**8**), since $p_1 = p_2 = p$.

Let $p_1 = 601$, $p_2 = 601$
From $p_1 + p_2 = n$ (equal primes)
=> $2p = n$
Thus $2(601) = n$
$n = 1202$ (a prime number)

A Positive Even Number, n at Positive Infinity (+ ∞)

When an even number is at positive infinity (+ ∞), given two primes p_3 and p_4, the sum of the two prime numbers equals to the positive even number at infinity as illustrated in Figure 2 below.

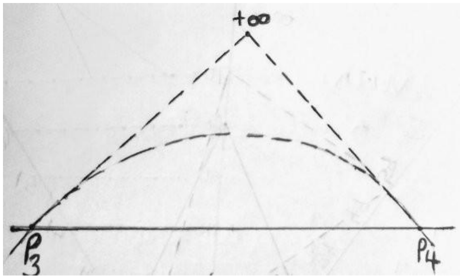

Figure 2 (a)

From Figure 2 (a) above, $p_3 + p_4 = \infty$ **(9)**
$p_3 = \infty - p_4$ **(10)**
Also $p_4 = \infty - p_3$ **(11)**
Substituting for p_3 and p_4 in (9), i have;
$\infty - p_4 + \infty - p_3 = \infty$
$2\infty - p_4 - p_3 = \infty$
$-p_4 - p_3 = -\infty$
If $p_3 = p_4 = p$, (equal primes),
$-p - p = -\infty$
$-2p = -\infty$
$\therefore 2p = \infty$ **(12)**

Comparing (12) with (5), i.e. $2p = \infty$ with $2p = n$ respectively.
$2p: 2p = \infty: n$
Hence $2p/2p = \infty/n$
Thus $1 = \infty/n$
$\therefore n = \infty$ **(13)**

This means that the even number, n which equals to the infinity (∞) is the sum of two equal primes and is the last even number equal to the infinity.

When the infinity, ∞ in (12) is substituted by n, i obtain (4), (5), (6), and (7).

I.e. from $2p = \infty$
$2p = n$ as in (5)
$P = 1/2\ n$ as in (6)
$p_3 = 1/2\ n$ as in (7)

Also $p_4 = 1/2\ n$ as in (8) since $p_3 = p_4 = p$ as shown in (5)

NB: $\infty + 1$ = odd infinity since $n + 1$ = odd number, $\infty + 2$ = even infinity since $n + 2$ = even number. Remember n is an even number and $n = \infty$. For instance $2 + 1 = 3$(odd number), $2 + 2 = (4$ even number).

A Negative Even Number, -n at Negative Infinity ($-\infty$)

When a negative number is at negative infinity ($-\infty$), given two primes p_5 and p_6 are negative, the sum of the two negative primes equals to negative even infinity as illustrated in Figure 2(b) below**.**

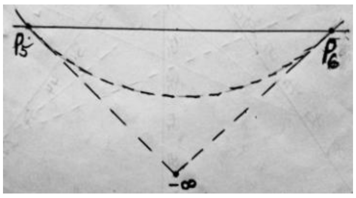

Figure 2 (b)

From Figure 2 (b) above,
$-p_5 + -p_6 = -n$ **(14)**
$-p_5 = -n + p_6$ **(15)**
$-p_6 = -n + p_5$ **(16)**

Substituting for p_5 and p_6 in 14, i have,
$-n + p_6 + -n + p_5 = -n$
$-2n + p_5 + p_6 = -n$
$p_5 + p_6 = n$
If $p_5 = p_6 = p$
$p + p = n$

Hence $2p = n$, it holds.
$\therefore -2p = -n.$

Paper ID: MR21928021925 DOI: 10.21275/MR21928021925

Hence $-2p = -\infty$
$2p = \infty$ (**17**)

This implies that the sum of two negative primes at infinity add up to a negative even number at infinity.

From (17), $p = 1/2(\infty)$ (**18**)
=> $p_5 = 1/2(\infty)$,
$p_6 = 1/2(\infty)$, since $p_5 = p_6 = p$

Comparing (17) with (5), i.e.
$2p: (\infty) = 2p: n$
$2p/2p = \infty/n$

Hence $1 = \infty/n$
$\therefore n = \infty$. It holds as in (13).

Example
Let the prime numbers at infinity be;
$p_1=(6 \times 10^{1000}) +1$
$p_2=(6 \times 10^{1000}) +1$, since 601 is a prime member.
From $2p = n$, (equal primes) where n is a positive even number at infinity.
=> $2(6 \times 10^{1000}) = n$
=> $n = 12 \times 10^{1000} + 2$
Or $n = 1.2 \times 10^{1001} + 2$
Therefore, the even number,n is a sum of two equal primes $p_1=p_2=(6 \times 10^{1000}) +1$.

2. Conclusion

Goldbach's conjecture is true for all even numbers since it holds for any even number as well as a positive even number, n at infinity (i.e. $n = \infty$) and negative even number, - n at negative infinity (i.e. $-n = -\infty$).

3. Future Scope

Although the conjecture is true, it may be restated in future since some even numbers can be obtained from different sets of two prime numbers, notably most of those with more than one digit e.g. 10=3+7, 5+5; 14=3+11, 7+7; 22=3+19, 5+17, 11+11 etc. as illustrated in the given examples above. It may also be restated in future if one is considered as a prime number since 2=1+1. See the conclusion on the Riemann hypothesis by the same author.

Author Profile

Adriko Bosco is a Teregean from Terego District Uganda, an independent researcher in Mathematics more especially the Millennium Mathematics problems and the Hilbert David's 23 Mathematics problems. The career objective of the author is to work for the development of Mathematics in Uganda and the world in general. He completed high school from St. Joseph's college Ombaci and obtained certificate in ICT from Makerere University Uganda. The author taught Physics, Chemistry, Biology and Mathematics in many Secondary schools in Uganda and South Sudan for seventeen years. He was a founding member and the head-teacher of Wulu Secondary school from 2008 to 2010. The author has many manuscripts since May 2020 including;

1. Riemann hypothesis (1859)
2. Goldbach's conjecture (1742)
3. Birch and Swinnerton--Dyer Conjecture 1960s
4. The Beal's conjecture (1993)
5. Twin prime conjecture
6. Fermat's Last Theory
7. Diophantine equations
8. Solvability of a Diophantine equation
9. Arbitrary quadratic forms
10. Reciprocity laws and Algebraic number fields.
11. Deal with Pi (π) and Euler's constant, e
12. The author derived some formulae for solving Arithmetic mean etc. The author is preparing a Mathematics book entitled **"The Book of Wisdom and Giniuseness".** The author is also a song writer.