A Study on Prime Numbers Between [2n-v2n] and 2n

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Abstract:

This study presents an empirical investigation into Goldbach's Conjecture, which posits that every even integer greater than 2 can be expressed as the sum of two primes. We leverage the structural property of even numbers 2n (n: natural number), noting that 2n, being composite, can be represented as a product of two or more primes. Specifically, if all prime factors of 2n are greater than $\sqrt{(2n)}$, their product would exceed 2n, implying that at least one prime factor must be less than $\sqrt{(2n)}$. Based on this observation, we hypothesize that the existence of a prime between $2n-\sqrt{(2n)}$ and 2n increases the likelihood of constructing 2n through the combination (summation) with a prime less than $\sqrt{(2n)}$. An empirical verification across all even numbers between 7 and 300001 revealed that, with the exception of 902, every even number had at least one prime between $2n-\sqrt{(2n)}$ and 2n. This empirical evidence strongly suggests the potential existence of a prime between $2n-\sqrt{(2n)}$ and 2n for all even numbers greater than 903, offering a novel approach to Goldbach's Conjecture. Future research aims to extend this verification to a wider range of even numbers and conduct theoretical analyses to deepen our understanding of Goldbach's Conjecture.

Keywords:

Goldbach's Conjecture, even number, prime number, composite number, $\sqrt{(2n)}$, empirical evidence.