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EXPLORING STATEMENTS INVOLVING PRIMES OF THE FORM (K+1)(K+2)(K+3)+-1

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ABSTRACT: The approximate number of prime numbers that follow a given integer is x/log x, according to Carl Gauss' Prime Number Theorem.

$$\pi(x) \sim \int_2 \frac{1}{\log t}$$

The prime counting function, denoted by the symbol (x), computes the number of prime numbers less than a given value. The prime number theorem is a very important theorem because it provides essential insights into the nature of prime numbers. The prime number theorem states that the probability of a randomly chosen number being prime is approximately equal to 1 divided by the logarithm of n. We use this concept, together with other ideas, to show the existence of an infinite number of prime numbers of the type (k-1)(k)(k+1)+-1 (A293861) using a heuristic argument is the user input. Furthermore, we present empirical evidence to support the assumption that there are an infinite number of prime numbers and outline a systematic method for determining the number of these primes that are less than a given integer. In addition, we use a heuristic approach to determine the amount of prime integers that exist inside the range from a given value x to twice that value, 2x.
Keywords: Prime Numbers, Number Theory, Diophantine Equations, Primality Testing, Factorization.

INTRODUCTION

First, examine the table that shows the number of primes that are fewer than specific powers of ten.(The series number has a value of 10,000.)

10^k	Number of our primes
1	2
2	5
3	10
4	21
5	39
6	66
7	118
8	213
9	419
10	770

A large proportion of our primes appear at or around powers of ten, and their frequency does not decrease significantly. Having said that, the list of primes of our form might go on indefinitely in this scenario. This is only a concept supported by evidence, not proof, so we can proceed. Right now, look at the graph of A293861(n) versus n.

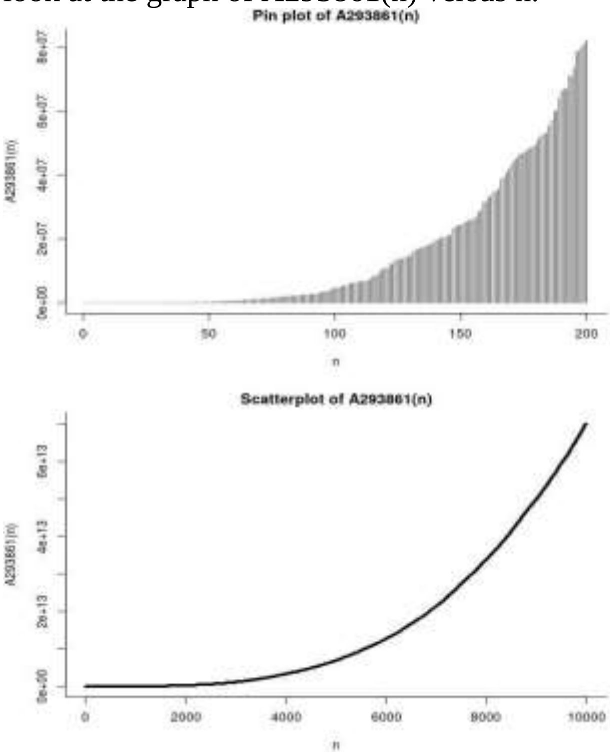

Figure 1. Pin plot and Scatter plot of A293861

This is just a reference for future readers to get some ideas over this.

HEURISTIC PROOF

According to the Prime Number Theorem, the likelihood that a given "random number" is prime and less than n approaches 1 divided by the logarithm of n. There is no text entered by the user.

The likelihood that the equation (k-1)(k)(k+1) +-1 represents a prime number is around 0.

$$\frac{1}{\log((k-1)(k)(k+1))}$$

Without a doubt, the amount indicated above exceeds

$$\frac{1}{\log(k^3)}$$

A criterion for calculating the number of prime numbers that are less than a certain value has been developed.

$$\sum_{k=2}^{n} \frac{1}{\log((k-1)(k)(k+1))}$$

The cumulative sum of every digit from 2 to infinity must be calculated to determine the endless nature of prime numbers in our form.

Currently, at this time,

$$\sum_{\infty} \frac{1}{log(k^3)} \to \infty$$

As a result of this, $\sum \frac{1}{log(k)} \to \infty)$ Following on from the preceding assertion,

$$\sum_{k=2} \frac{1}{\log((k-1)(k)(k+1))}$$

This outperforms $\sum \frac{1}{\log(k^3)}$

As a result, in essence,

$$\sum_{k=2}^{\infty} \frac{1}{\log((k-1)(k)(k+1))} \to \infty$$

This approach, by virtue of its lack of constraints, serves as a quick tool for demonstrating the presence of an infinite number of prime integers that are less than a specified integer.

NUMBER OF OUR PRIMES BELOW A FIXED NUMBER

The above explanation demonstrates that the following method can be used to approximate the number of prime integers less than a given integer:

$$\sum_{k=2}^{n} \frac{1}{\log((k-1)(k)(k+1))}$$

Because the terms are ambiguous, the effort necessary to verify the estimated assumption must be substituted with a constant denoted as a2.

To increase estimation precision, we conclude the inquiry by defining a2 as a "dependence constant" that is most likely related with Merten's theorem [4] or another such theorem:

$$\mu(n) \sim \sum_{k=2}^{n} \frac{a2}{\log((k-1)(k)(k+1))}$$

The solution to this integral can be found as follows:

$$\mu(n) \sim \int_{2}^{n} \frac{a2}{\log((k-1)(k)(k+1))}$$

NUMBER OF OUR PRIMES BETWEEN N AND 2 N

The procedure for calculating the number of prime numbers less than x and less than 2x is the same. The difference between the two values thus represents the number of prime numbers less than x and less than 2x. This is straightforward.

$$\mu(2n) - \mu(n) \sim \sum_{k=2}^{2n} \frac{a2}{\log((k-1)(k)(k+1))} -$$

$$\sum_{k=2}^{n} \frac{a2}{\log((k-1)(k)(k+1))} \text{ or } \int_{2}^{2n} \frac{a2}{\log((k-1)(k)(k+1))} - \int_{2}^{n} \frac{a2}{\log((k-1)(k)(k+1))}$$

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