EasyChair Preprint

№ 8686

A New Sequence of Prime Numbers

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August 16, 2022

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Abstract. In this paper, we discovered a new sequence of prime numbers, every term of this sequence is either a prime number or equal to 1.

Keywords. Prime numbers, sequence.

1. Introduction

A number is said to be a prime number if the number is divisible by 1 and itself; otherwise it's composite. In this paper, we present two new sequences related with the continued fraction.

2. The sequence of $b(n)$

The sequence $b(n)$ satisfy the following recursive formula

$$b(n) = (n-1)b(n-1) - nb(n-2)$$

With the starting conditions $b(3) = 1$, and $b(4) = 7$

Table 1. The first few values of $b(n)$

n	3	4	5	6	7	8	9	10	11
$b(n)$	1	7	23	73	277	1355	8347	61573	523913

Theorem 2.1 For $n \geq 3$.

$i)$
$$\frac{b(n)}{n^2-n-1} = \cfrac{1}{2-\cfrac{3}{3-\cfrac{4}{4-5}}} \ddots \cfrac{}{(n-1)-\cfrac{n}{n-(n+1)}}$$

For $n \geq 5$.

$ii)$ $b(n) = (2n^2-6n+3).A051403(n-5) - (2n^2-5n+2).A051403(n-6)$

Proof. By using some simplification of the denominator of the continued fraction.

3. The sequence of $\boldsymbol{a(n)}$

In this section, we present our sequence of prime numbers defined in the conjecture as follows

Conjecture 3.1. The sequence $a(n)$ of the prime numbers satisfy the following formula

$$a(n) = \frac{n^2 - n - 1}{gcd(b(n),\ n^2 - n - 1)}$$

Table 2. The first few values of $\boldsymbol{a(n)}$

n	3	4	5	6	7	8	9	10	11
$\boldsymbol{a(n)}$	5	11	19	29	41	11	71	89	109

Also we have

$$a(37) = a(43) = a(48) = a(53) = 1$$

Conjecture 3.2. every term of this sequence is either a prime number or equal to 1.

References

[**1**] Richard Guy, Unsolved Problems in Number Theory, Springer science (2004).

[**2**] N. J. A. Sloane et al., The On−line Encyclopedia of integers sequences, https://oeis.org

(Concerned with the sequence $A051403$)