# About Prime Numbers

Bolesław Tabor

## Abstract

Prime numbers are numbers that are expressions an of eight arithmetic sequences with the following terms: a1=1; a1=7; a1=11; a1=13; a1=17; a1=19; a1=23; a1=29 and progress r = 30, which are not powers of prime numbers, and numbers 1, 2, 3, 5.

1. Introduction

The interest in prime numbers dates back to antiquity. Euclides proved that there are infinitely many primes, and Eratosthenes developed a method for finding primes (the so-called The Sieve of Eratosthenes).

2. Definition

**Prime number** - a natural number greater than 1 that has exactly two natural divisors: one and itself.

The set of all primes is marked with the symbol **P**.

> **Note**: The numbers 0 and 1 are neither prime nor complex numbers.

However, the number 1 meets the basic criteria of the definition of prime numbers because it is divisible by one and by itself. Therefore, the conditions for considering the number 1 as a prime are met.

The definition of prime numbers is not exactly precise because one of the criteria for identifying a prime number is divisibility by 1. However, each number is divisible by 1, so the criterion used does not contribute any information distinguishing the prime numbers.

3. A power number

A power (prime) number - is formed by raising a prime number to the power of n, n>1. Power numbers are complex numbers.

4. Set of prime numbers.

The set of all "**P**" primes is contained in eight monotonic, increasing arithmetic sequences, which are bounded from the bottom: $\exists m \forall n \in \mathbb{N}(a_n \geq m)$; and the numbers 2, 3, 5. Exclude from the arithmetic sequences numbers that are the powers of prime numbers, which are corresponding to the term $a_n$ of one of the eight arithmetic sequences that are not prime numbers.

The numbers 3 and 5 are used to exclude numbers from among odd numbers that are not prime numbers.

For each of the eight arithmetic sequences that group prime numbers, $m = a_1$ ; $a_n = a_1 + (n-1)r$ ; $r = 30$.

The prime numbers 2, 3, and 5 are not included inm.

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|---|---|---|---|---|---|
| **I.** | $m_1=1$; | $a_n = a_1 + (n-1)r$ ; | $r = 30$; | $m_1$ | $\{y1\} = 0,03(3)$ |
| **II.** | $m_2=7$; | $a_n = a_1 + (n-1)r$ ; | $r = 30$; | $m_2=m_1+6$ | $\{y2\} = 0,23(3)$ |
| **III.** | $m_3=11$; | $a_n = a_1 + (n-1)r$ | $r = 30$; | $m_3=m_2+4$ | $\{y3\} =0,36(6)$ |
| **IV.** | $m_4=13$; | $a_n = a_1 + (n-1)r$ ; | $r = 30$; | $m_4=m_3+2$ | $\{y4\} = 0,43(3)$ |
| **V.** | $m_5=17$; | $a_n = a_1 + (n-1)r$ ; | $r = 30$; | $m_5=m_4+4$ | $\{y5\} = 0,56(6)$ |
| **VI.** | $m_6=19$; | $a_n = a_1 + (n-1)r$ ; | $r = 30$; | $m_6=m_5+2$ | $\{y6\} = 0,63(3)$ |
| **VII.** | $m_7=23$; | $a_n = a_1 + (n-1)r$ ; | $r = 30$; | $m_7=m_6+4$ | $\{y7\} = 0,76(6)$ |
| **VIII.** | $m_8=29$; | $a_n = a_1 + (n-1)r$ ; | $r = 30$; | $m_8=m_7+6$ | $\{y8\} = 0,96(6)$ |

$$n = [x] \iff a_n/r = [x],\{y\}$$

5. Search for prime numbers.
5.1. The state to date.

At this time, the most effective method of searching for prime numbers is to use The Sieve of Eratosthenes.

5.2. Checking the ranges of numbers.

The answer to whether the given numbers are prime numbers is to check that:
a) The numbers are not even numbers (the last digit is not divisible by 2)
b) The last digit of numbers is not 5;
c) The sum of the digits of each of the remaining numbers is not divisible by 3.

A number that meets the above criteria is either a prime or a power prime. These numbers form eight arithmetic sequences that have been defined in note #4 of this publication.
d) Elimination the powers of prime numbers in the analyzed range.

**Note**: The ratio of the above numerical criteria 2 * 5 * 3 = 30 is equal to r the difference of each of the eight arithmetic sequences in which all prime numbers are grouped.

5.3. Checking any number.

The given number should be divided by r = 30. The quotient consists of the integer [x] and the fractional part {x}. The fractional part {x} should be compared with the fractional parts of the quotients $a_1$/ 30 = [x],{y} of eight arithmetic sequences containing prime numbers. This is described in note #4 of this publication. In case of compliance, the number checked might be a prime number. Than check if that number is the result of the exponentiation of one of the primes and if confirmed, the number is not prime.

6. Conclusion

Prime numbers are numbers that are expressions an of eight arithmetic sequences with the following terms: $a_1$=1; $a_1$=7; $a_1$=11; $a_1$=13; $a_1$=17; $a_1$=19; $a_1$=23; $a_1$=29 and progress r = 30, which are not powers of prime numbers, and numbers 1, 2, 3, 5.

List of publications:

[1] Poznański Portal Matematyczny.https://matematyka.poznan.pl/
[2]https://matematyka.poznan.pl/artykul/w-poszukiwaniu-liczb-pierwszych/
[3] http://www.math.edu.pl/

Bolesław Tabor
ul. Powstańców 9/9
41-500 Chorzów
POLAND