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A Natural Number is the Number and Sum of Natural Divisors

Yuldoshev Mansur Najmiddin ugli
mansuryuldoshev212901@mail.ru
Academic Lyceum of Tashkent State University of
Economics lead math science teacher

Abstract. This article describes the sum and sum of natural divisors and explains them with examples.

Key words: numbers, natural numbers, divisions, mathematical properties and operations, etc.

Explanation. A natural number with only two different divisors is called a prime number, and a natural number with more than two different natural divisors is called a complex number. Explanation. p is a prime number different from 1 and is divisible only by 1 vap. *A complex number m has at least one divisor other than 1 and m divisors. The number 1 is neither a prime nor a complex number.* Let's look at some properties of prime and complex numbers.

1. *If a > 1 is the smallest natural divisor of a complex number different from 1, then p is a prime number.*

Indeed, otherwise p is some q (1 < q < p)having a divisor, and

q < p would be. This contradicts that p is the smallest divisor.

2. Any natural prime number a and p is either mutually prime or a is divisible by p.

3. If the product ab is divisible by some prime number p, then at least one of the factors is divisible by p, i.e.

$$(\forall a, b \epsilon N) \left(\frac{ab}{p}\right) \Rightarrow \left(\frac{a}{p} \vee \frac{b}{p}\right).$$

An example. 2,3,5,7,11,13 are prime numbers, 4,6,8,9,10,12 are complex numbers. Theorem. The smallest prime divisor of a natural number is not greater than Va.

Proof. Let p1 be the smallest divisor of a. Then a = p1^ a1 and a>p1. From this a = p1a1 > p\ or p1<Va

Theorem. The sum of prime numbers is infinite. Proof. Let us assume that the number of prime numbers is finite, and they consist of prime numbers of the form Vi> P2, ■■■ >Vn in ascending order.

Qn = Pi P2 ■■■Pn + 1

we get the number. If we call the smallest divisor of this number pm, it is definitely a prime number (1st property of prime numbers) and it is not equal to any of the pt laming. The number pm Pi (i = 1,

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n) cannot be equal to any of the prime numbers, otherwise the division of Qn and Pi p2 ■■■ Pn by pm would result in the division of 1 by pm. This is not possible. So, our hypothesis is wrong.

If Qn is a prime number, then Qn > pt(i = 1 , n) and a new prime number is formed. In this case, our assumption is wrong. Therefore, the number of prime numbers is infinite, that is, the sum of prime numbers is infinite.

Explanation. Two natural numbers that do not have a common divisor other than 1

are called prime numbers. Explanation. If for non-zero integers a and b there exists an integer q that satisfies the equality a=bq, then the number a is divided by the number b without a remainder, or the number b is said to divide the number a, and b | is written as a. The number a in the equation a=bq is called a divisor or multiple of b, b is a divisor of a, and q is a divisor.

Obviously, if two numbers have a common divisor, then their sum, difference, and multiples also have this divisor.

.If x, y and z are integers, then the following simple properties hold:

(a) x | x (REFLEXIVITY PROPERTY);

(b) If x | y and y | if z , then x | z (transitivity property);

(c) If x | If y vay F 0, then ^

(d) If x | y and x | if z , then for all integers x | &y + pz;

(e) If x | y and x | If y ± z , then x | z;

(f) If x | y wow | if x , then ^^yl'

(g) x |y ^ |x| | M;

Explanation. It should be noted that the last property (g) makes it possible to carry out considerations related to division not for integers, but for natural numbers.

And1+1-1 And2+1-1 V^{an}+1-1

a(a) = El ------- ^{1}^---------- ^{1}... Bn --------- ^{1}.

P1-1 R2-1 Pn-1

Theorem. a = p^1 p%2 ... r%p is not greater than the number and the number of prime numbers <p(a) is determined by the following formula:

<Ka) = a(i-^)(i-^)-...-(i-^) .

Example 1. Determine whether the given number 1321 is prime or complex. Solving. To determine whether a given natural number is prime or complex, it is determined whether the given number is divisible by prime numbers up to And. If the given number a is not divisible by any prime number up to And, then a is a prime number. So, we find V1321 « 36. Let's check if the prime numbers up to 36

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are divisible by 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31.

2 is not divisible by because 1321 is an odd number;

3 is not divisible by because 1+3+2+1=7/3;

It is not divisible by 5 because the last digit of 1321 is 1;

1321:7^188;

1321:11^120;

1321:13^101;

1321:17^77;

1321:19^69;

1321:23^54;

1321:29^45;

1321:31^42

Therefore, 1321 is not divisible by prime numbers up to 36. It is a prime number.

2- example 23! find the canonical distribution of

Solving. Given n! to find the expansion of a number into prime multipliers, we find with what degree prime numbers not larger than n participate in the canonical expansion.

Prime numbers less than 23 are 2, 3, 5, 7, 11, 13, 17, 19, 23

2 of 23! we find the degree in the canonical distribution of 23 for this

2 to our child. We continue this process until the divisor is less than 2:

23=2-
11+1
11=2-5+1
5=2-2+1
2=2-1+0

So, the degree of 2 from the canonical distribution is 11+5+2+1=19.

3 we find the degree of:

23=3-7+27=3 2+1, power of 3 is 7+2=9.

We find the power of 5:

23=5 4+3, power of 5 is 4.

Power of 7 is 3 23=7 3+2.

Power of 11 is 2 23=11-2+1.

Power of 13 is 1 23=13-1+10.

Similarly, the levels of 17, 19, 23 in the spread are equal to 1. So 23! = 219 -39-54-73- 112 -13 -17 -19 - 23.

Integers that are multiples of 2 (ie 2 *k , k e Z, visible numbers) are even, and integers that are not multiples of 2 (that is, 2 k + 1 , k e Z, visible numbers) are called odd numbers.*

The following are relevant:

a) The sum and difference of two odd numbers is even, and their product is odd.

b) The sum, difference, and product of two even numbers is an even number.

Theorem. If a = p^1 p%2 ... r%p, then the number of all natural divisors of a number z(a) is determined by the following formula:

r(a) = (ai + 1) (a2 + 1) ... (an + 1) .

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