



The magic of numbers in mathematics

What is the secret behind prime numbers?

Sumaia Saad Eddin

Enter the mysterious universe of prime numbers, superheroes of mathematics! At first glance, they seem very simple and inconspicuous. So who would have thought that they are THE building blocks for every number? Join us on a magical journey of discovery to unravel the mystery of prime numbers.

What are prime numbers?

A prime number is a special kind of number that can only be divided by 1 and itself.

Imagine you have a box full of colorful building blocks, and you decide to build towers with these blocks. The rule for building is that each tower must be the same height, and you must use all the blocks without any blocks left over. It's helpful to explain our idea with an example:

- If you have 7 blocks, you can either build one big tower using all 7 blocks, or 7 tiny towers where each has just 1 block. There's no other way to evenly divide them into towers without having blocks left over. This is because 7 is a prime number and can only be divided by 1 and 7.



- If you have 8 blocks, your options increase. You could build one big tower with all 8 blocks, 4 towers with 2 blocks each, or 2 towers with 4 blocks each. This is possible because 8 can be divided evenly in several ways (1x8, 2x4, and 4x2). You can take a look at the diagram below.



Understanding this about prime numbers helps you discover some of these amazing numbers. For example, between 1 and 20, the prime numbers are **2, 3, 5, 7, 11, 13, 17** and **19**.

How are Numbers made from Primes?

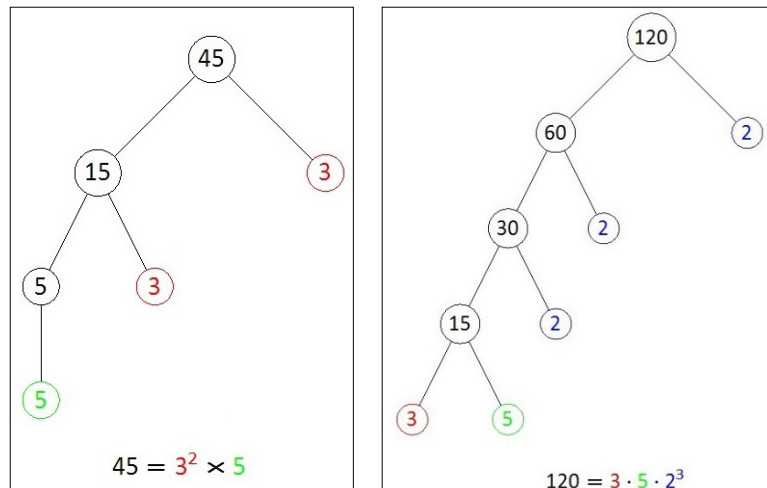
Did you know that every number is like a secret recipe made up of special ingredients called prime numbers? Just like how ingredients like flour, sugar, and butter come together to bake a delicious cake, numbers work the same way with primes!

Let's uncover the secret recipe of some numbers:

- Take the number **6**. Did you know 6 is actually a team-up of the primes **2** and **3**? When you multiply 2 and 3 together, you get 6 (**2 x 3 = 6**). It's like they're the secret ingredients to make 6!
- Now, what about **12**? This number is made up of **two times 2** and **one 3** (**2 x 2 x 3 = 12**). You can see we used the 2 ingredient twice because some recipes call for more of one ingredient!

This magical way of breaking down numbers into their prime ingredients is called in the world of mathematics "**Prime Factorization**". It's like solving a puzzle where each number is made of primes in a unique way.

Question: What about the prime factorization of 45 and 120?



How many primes are there?

Now, you are maybe wondering just how many prime numbers are out there? It's like looking up at the stars and trying to count them all. Finding out exactly how many primes exist is one of the trickiest puzzles in the world of mathematics! Over 2,300 years ago **Euclid**, an ancient Greek mathematician, proved that "the number of primes is infinite". Just like the endless expanse of the universe, the list of primes goes on forever. But don't let that number infinity scare you, it's just a way of saying that no matter how high we count, there will always be another prime number waiting to be discovered.

Why are prime numbers magical?

As we have seen, prime numbers are the building blocks of all numbers, similar to how Lego bricks can be assembled in various ways to create different shapes. They are not only crucial in mathematics but also play a key role in keeping our online secrets safe. When you send a secret message, like a password, or make an online purchase, prime numbers help encrypt the information so that only the intended recipient can decrypt it. This method of protecting information and communications with codes, is known as a "Cryptographic System", which relies heavily on prime numbers.

In conclusion, while prime numbers might seem simple at first, the more you learn about them, the more fascinating they become. Prime numbers are shrouded in many mysteries and adventures. By asking questions and exploring, just as we are now, we can uncover the magic of prime numbers and see how they make our world more interesting.

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