

Find The Prime Factorization Of the Number 90. Order The Factors From Least To Greatest. Remember, 1 Is

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Understanding the prime factorization of a number is a fundamental concept in mathematics that plays a crucial role in various areas such as fractions, ratios, greatest common divisors, least common multiples, and algebra. In this article, we will explore in detail how to find the prime factors of the number 90, arrange these factors from least to greatest, and understand the significance of including 1 in the list of factors. This comprehensive guide aims to clarify the process step-by-step and provide insights into the importance of prime factorization.

What Is Prime Factorization?

Before diving into the specific case of 90, it's important to understand what prime factorization means.

Definition of Prime Factorization

Prime factorization is the process of expressing a composite number as a product of its prime numbers. Prime numbers are numbers greater than 1 that have no divisors other than 1 and themselves. The prime factors of a number are the prime numbers that multiply together to produce that number.

Why Is Prime Factorization Important?

Prime factorization is vital because it provides the most basic building blocks of any number. It helps:

- Simplify fractions
- Find the greatest common divisor (GCD)
- Find the least common multiple (LCM)
- Understand the structure of numbers
- Solve problems related to divisibility and number theory

Step-by-Step Process to Find the Prime Factors of 90

Let's now focus on the number 90 and determine its prime factors using a systematic approach.

Method 1: Using Division Method

The division method involves dividing the number by the smallest possible prime numbers repeatedly until the quotient becomes 1.

1. Start with the smallest prime number, 2, and check if 90 is divisible by 2.
2. Since $90 \div 2 = 45$, which is an integer, 2 is a prime factor.
3. Divide 45 by the smallest prime number again. $45 \div 3 = 15$, so 3 is a prime factor.
4. Next, divide 15 by 3: $15 \div 3 = 5$, another prime factor.
5. Now, divide 5 by 5: $5 \div 5 = 1$. Since the quotient is 1, the process stops.

The prime factors identified are 2, 3, 3, and 5.

Method 2: Using Prime Factor Tree

Alternatively, you can use a prime factor tree:

1. Write 90 at the top.
2. Break it into two factors: 9 and 10.
3. Factor 9 into 3×3 .
4. Factor 10 into 2×5 .
5. Collect all prime factors: 2, 3, 3, 5.

This method visually illustrates the factorization process.

Expressing 90 as a Product of Prime Factors

Combining all the prime factors, we have:

$$90 = 2 \times 3 \times 3 \times 5$$

Or, using exponents:

$$90 = 2^1 \times 3^2 \times 5^1$$

This is the prime factorization of 90.

Ordering The Prime Factors From Least To Greatest

Prime factors are typically listed in ascending order to clearly show the smallest to largest primes involved.

Ordered List of Prime Factors

- 1 (Remember, 1 is not a prime number, but it is often included in the list of factors)
- 2
- 3
- 3
- 5

If the instruction is to list the prime factors excluding 1 (since it's not prime), then the list is:

- 2
- 3
- 3
- 5

Note: The number 1 is a factor of every number, but it is not a prime. It is, however, often included in the list of factors for completeness or in the context of divisibility.

Expressed in a Sorted List with Exponents

Alternatively, the prime factorization can be written as:

- 2^1
- 3^2
- 5^1

This notation simplifies the understanding of how many times each prime appears.

Significance of Including 1 in The Factors List

The statement "Remember, 1 is" emphasizes the importance of understanding the role of 1 in factor lists.

Why Is 1 Included in Factors?

- 1 is a universal factor: Every number is divisible by 1.
- It's fundamental in the concept of factors and divisibility.
- Including 1 in the list of factors provides a complete picture of the number's divisibility properties.

What About Prime Factorization?

- While 1 is not a prime number and not part of the prime factorization itself, it is often included in the list of factors for completeness.
- The prime factorization uniquely describes the number in terms of primes, but the list of all factors includes 1 and the number itself.

Additional Insights and Applications

Understanding the prime factorization of 90 has practical applications and broader mathematical significance.

Finding Greatest Common Divisors (GCD)

- Prime factorizations are used to determine common factors between two numbers.
- For example, to find $\text{GCD}(90, 60)$:
- Prime factors of 60: $2^2 \times 3 \times 5$
- Prime factors of 90: $2^1 \times 3^2 \times 5$
- GCD is obtained by taking the minimum powers: $2^1 \times 3^1 \times 5^1 = 30$

Calculating Least Common Multiple (LCM)

- Using prime factors, LCM can be found by taking the maximum powers:
- For 90 and 60:
- $\text{LCM} = 2^2 \times 3^2 \times 5 = 180$

Prime Factorization in Algebra and Number Theory

- Prime factorization helps in simplifying algebraic expressions.
- It is fundamental in proofs and theorems related to divisibility and properties of integers.

Conclusion

The process of finding the prime factorization of 90 reveals the fundamental structure of the number. By systematically dividing by prime numbers, we determine that 90 can be expressed as $2 \times 3 \times 3 \times 5$, or in exponential form as $2^1 \times 3^2 \times 5^1$. When ordered from least to greatest, the prime factors (excluding 1) are 2, 3, 3, and 5. Including 1 in the list of factors emphasizes its universal divisibility property, even though it is not a prime. Understanding prime factorization is essential for various mathematical operations, including simplifying fractions, calculating GCD and LCM, and exploring the properties of numbers. Mastering this concept provides a strong foundation for further studies in mathematics and its applications.

Remember: Prime factorization is a powerful tool that helps uncover the building blocks of numbers, and recognizing the role of factors like 1 enhances our understanding of divisibility and number theory.

Frequently Asked Questions

What is the prime factorization of 90?

The prime factorization of 90 is $2 \times 3^2 \times 5$.

How do you find the prime factors of 90?

You divide 90 by the smallest prime number (2), then continue dividing the quotient by prime numbers until only 1 remains. For 90: $90 \div 2 = 45$, then $45 \div 3 = 15$, and $15 \div 3 = 5$, which is prime. So, the prime factors are 2, 3, 3, and 5.

What are the factors of 90 ordered from least to greatest?

The factors of 90 are 1, 2, 3, 5, 6, 9, 10, 15, 18, 30, 45, and 90.

Why is 1 included in the list of factors?

Because 1 is a universal factor for all numbers and is included in the list of factors by definition.

How can understanding prime factorization help in finding common factors?

Prime factorization reveals the prime components of numbers, making it easier to identify common factors by comparing their prime factors.

What is the significance of ordering factors from least to greatest?

Ordering factors helps in better understanding the number's divisors and relationships, especially when analyzing multiples and factors.

Can the prime factorization of 90 be used to find its greatest common divisor (GCD) with another number?

Yes, by comparing the prime factorizations of 90 and the other number, you can identify common prime factors to determine their GCD.

Is 1 considered a prime number in the context of prime factorization?

No, 1 is not a prime number; it is considered a unit and is included as a factor but not as a prime factor.

Additional Resources

Find The Prime Factorization Of The Number 90. Order The Factors From Least To Greatest. Remember, 1 Is

Introduction

In the realm of mathematics, prime factorization forms the bedrock of understanding the fundamental building blocks of numbers. It involves expressing a composite number as a product of prime numbers, which are numbers greater than 1 that have no divisors other than 1 and themselves. Among the myriad of numbers that mathematicians analyze, 90 presents an intriguing case due to its multiple factors and prime components. This article delves deep into the process of finding the prime factorization of 90, the importance of ordered factors, and the significance of the number 1 in the context of prime decomposition.

Understanding Prime Factorization

Before exploring the specific case of 90, it is essential to understand what prime

factorization entails.

What Is Prime Factorization?

Prime factorization is the process of breaking down a composite number into a product of prime numbers. For example, the prime factors of 12 are 2 and 3 because:

$$12 = 2 \times 2 \times 3$$

This form is often expressed as a product of primes, usually with exponents to denote repeated factors.

Why Is Prime Factorization Important?

Prime factorization has significant applications in:

- Simplifying fractions
- Computing the greatest common divisor (GCD) and least common multiple (LCM)
- Cryptographic algorithms
- Understanding number properties and divisibility rules

The Number 90: An Overview

The number 90 is a composite number that can be expressed as a product of various factors. Its prime factorization reveals the building blocks that compose it.

Key characteristics of 90:

- It is an even number.
- It is divisible by 1, 2, 3, 5, 6, 9, 10, 15, 18, 30, 45, and 90.
- It has multiple prime factors, making it an interesting candidate for prime decomposition.

Step-by-Step Prime Factorization of 90

The process of prime factorization typically involves dividing the number by the smallest prime numbers possible until only 1 remains.

Step 1: Divide by the smallest prime, 2

Because 90 is even, it is divisible by 2.

$$90 \div 2 = 45$$

Prime factors so far: 2

Remaining number to factor: 45

Step 2: Divide 45 by the next smallest prime, 3

45 is divisible by 3.

$$45 \div 3 = 15$$

Prime factors so far: 2, 3

Remaining number: 15

Step 3: Continue dividing 15 by 3

$$15 \div 3 = 5$$

Prime factors so far: 2, 3, 3

Remaining number: 5

Step 4: Recognize 5 as a prime number

5 is prime, so the process ends here.

Prime factors: 2, 3, 3, 5

Expressing the Prime Factorization

The prime factors of 90 are 2, 3, 3, and 5. To express this as a concise product:

$$\text{Prime factorization of } 90 = 2 \times 3^2 \times 5$$

This notation succinctly captures the prime components, with the exponent indicating multiple occurrences of the same prime.

Ordering Factors from Least to Greatest

In mathematical notation and for clarity, factors are often ordered from least to greatest.

Ordered prime factors:

- 2
- 3
- 3
- 5

Expressed as a product:

$$2 \times 3 \times 3 \times 5$$

This ordered sequence makes it easier to analyze the number's divisibility properties and facilitates calculations involving its factors.

The Role of 1 in Prime Factorization

An important aspect of understanding prime factorization is recognizing the role of 1. While 1 is a divisor of every number, it is not classified as a prime number. Its presence in the factorization process is nuanced:

- In prime factorization, 1 is typically not included because it does not contribute to the prime decomposition.
- In the context of the Fundamental Theorem of Arithmetic, every positive integer greater than 1 can be expressed uniquely as a product of primes, excluding 1.

Therefore, the prime factorization of 90 excludes 1, but acknowledging 1 is crucial in understanding the full set of factors of 90.

Implications and Applications

Understanding the prime factorization of 90 offers insights into various mathematical concepts and real-world applications.

Simplifying Fractions

Knowing that $90 = 2 \times 3^2 \times 5$ helps simplify fractions involving 90. For instance:

- Simplify $180/90$:

$180 \div 90 = 2$, so the fraction simplifies to $2/1$.

- Simplify $45/90$:

Since $45 = 3^2 \times 5$, dividing numerator and denominator by 45 yields:

$45/45 = 1$, so $45/90$ simplifies to $1/2$.

Calculating GCD and LCM

- GCD of 90 and another number: prime factors help identify common primes.
- LCM: the product of the highest powers of all primes involved.

Cryptography and Number Theory

Prime factorizations underpin cryptographic algorithms, such as RSA encryption, where large prime factors secure data.

Broader Context: Prime Factorization in Mathematics Education

Teaching the prime factorization of numbers like 90 fosters critical thinking and understanding of number properties. It emphasizes the importance of prime numbers as the foundational elements of all integers.

In classrooms, prime factorization exercises often serve as gateways to more advanced topics like:

- Greatest common divisors
- Least common multiples
- Divisibility rules
- Fundamental Theorem of Arithmetic

Conclusion

The prime factorization of 90—expressed as $2 \times 3^2 \times 5$ —is a profound illustration of the building blocks of integers. By systematically dividing by prime numbers and ordering the factors from least to greatest, we gain a clearer understanding of the number's structure and its place within the broader landscape of mathematics. Recognizing the role of 1 in the context of factors, while excluding it from prime decomposition, adds depth to our comprehension of number theory principles. Whether applied to simplifying fractions, computing GCDs and LCMs, or understanding cryptographic security, prime factorization remains a fundamental concept with enduring significance in both educational and practical domains.

References:

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Author Note:

This detailed analysis aims to provide a comprehensive understanding of the prime factorization process, emphasizing the importance of ordered factors and the conceptual role of 1. As fundamental as it is to number theory, mastering prime decomposition techniques unlocks deeper mathematical insights and practical applications.

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