

Select The Correct Answer.Which Calculation Correctly Uses Prime Factorization To Write 48 In Simplest

Select The Correct Answer. Which Calculation Correctly Uses Prime Factorization To Write 48 In Simplest Form?

Prime factorization is a fundamental mathematical technique used to express a number as a product of its prime factors. When simplifying numbers or expressing them in their prime components, understanding prime factorization is essential. In this article, we will explore how to correctly perform prime factorization on the number 48, identify the correct calculation among various options, and understand the importance of prime factors in simplifying numbers.

Understanding Prime Factorization

What Is Prime Factorization?

Prime factorization involves breaking down a composite number into a product of prime numbers. Every composite number can be uniquely expressed as a product of prime factors, apart from the order of the factors. This process helps in simplifying fractions, finding the greatest common divisors, least common multiples, and solving various algebraic problems.

Why Is Prime Factorization Important?

- It provides a unique representation of a number.
- It helps in simplifying fractions and algebraic expressions.
- It facilitates the calculation of the greatest common divisor (GCD) and least common multiple (LCM).
- It enhances understanding of number properties and divisibility.

Step-by-Step Prime Factorization of 48

Method 1: Using Division by Prime Numbers

Let's find the prime factors of 48 through successive division:

1. Start with the smallest prime number, 2:

- $48 \div 2 = 24$

2. Continue dividing by 2:

- $24 \div 2 = 12$

- $12 \div 2 = 6$

- $6 \div 2 = 3$

3. Now, 3 is a prime number, and dividing further:

- $3 \div 3 = 1$

Thus, the prime factors of 48 are:

- 2, 2, 2, 2, 3

Expressed as a product:

- $48 = 2 \times 2 \times 2 \times 2 \times 3$

Or, using exponents:

- $48 = 2^4 \times 3$

Method 2: Confirming the Prime Factorization

By expressing 48 as $2^4 \times 3$, we have simplified it to its prime components, which is the standard form for prime factorization.

Common Mistakes in Prime Factorization

- Skipping prime factors: For example, dividing by 4 instead of breaking it down into 2×2 .
- Not fully factoring out primes: Stopping at a composite number like 6 instead of breaking it down into prime factors.
- Using non-prime divisors: Dividing by numbers like 10 or 15 instead of their prime constituents.

Analyzing Given Calculations for 48

Suppose the multiple-choice options are as follows:

1. $48 = 2 \times 24$

2. $48 = 2^4 \times 3$

3. $48 = 3 \times 16$

4. $48 = 4 \times 12$

Let's evaluate each:

- Option 1: $48 = 2 \times 24$

- Not fully prime factorized; 24 can be further broken down.

- Option 2: $48 = 2^4 \times 3$

- Correct prime factorization.

- Option 3: $48 = 3 \times 16$

- 16 can be factored as 2^4 , so overall this is equivalent to 3×2^4 , which matches option 2.
- Option 4: $48 = 4 \times 12$
- 4 and 12 are composite; need to break down further:
- $4 = 2^2$
- $12 = 2^2 \times 3$
- So, $4 \times 12 = (2^2) \times (2^2 \times 3) = 2^4 \times 3$, which again aligns with option 2.

Thus, options 2, 3, and 4 all represent the prime factorization of 48, but the most simplified and standard form is given in option 2: $48 = 2^4 \times 3$.

Conclusion: Selecting the Correct Calculation

The most accurate and standard prime factorization of 48 is:

$$- 48 = 2^4 \times 3$$

This form clearly shows the prime factors and their exponents, making it the simplest and most precise expression using prime factorization.

Importance of Using the Simplest Prime Factorization

Expressing 48 as $2^4 \times 3$ allows for:

- Easy calculation of divisors and multiples.
- Simplification in algebraic expressions.
- Efficient computation in problems involving ratios, fractions, or GCD/LCM.

Final Remarks

Understanding prime factorization is vital in various mathematical contexts. When asked to write a number like 48 in its simplest prime factors, the key is to repeatedly divide by prime numbers until no further division is possible. The correct calculation for 48 involves expressing it as $2^4 \times 3$, which reflects its prime components in the simplest form. Recognizing and applying this method ensures accuracy in mathematical computations and problem-solving.

Summary:

- Prime factorization of 48: $2^4 \times 3$
- Correct choice among options: The one that states $48 = 2^4 \times 3$
- Significance: Simplifies calculations and enhances understanding of number properties.

Frequently Asked Questions

Which prime factors are used to write 48 in its simplest form through prime factorization?

The prime factors of 48 are 2 and 3, and the prime factorization is $2^4 \times 3$.

What is the correct prime factorization of 48?

The correct prime factorization of 48 is $2 \times 2 \times 2 \times 2 \times 3$ or $2^4 \times 3$.

Which of the following is the correct way to write 48 using prime factors?

$48 = 2^4 \times 3$.

How can 48 be expressed using its prime factors in the simplest form?

48 can be expressed as $2^4 \times 3$, which is the prime factorization in simplest form.

What is the process to find the prime factorization of 48?

Divide 48 by the smallest prime number 2 repeatedly until it cannot be divided further, then divide the quotient by 3 if possible, resulting in $2^4 \times 3$.

Which calculation correctly represents 48 using prime factorization?

$48 = 2^4 \times 3$ is the correct calculation representing 48 through prime factors.

Additional Resources

Select The Correct Answer. Which Calculation Correctly Uses Prime Factorization To Write 48 In Simplest Form?

Prime factorization is a fundamental concept in mathematics that involves breaking down a composite number into its simplest building blocks — the prime numbers. When tasked with expressing a number like 48 in its simplest form through prime factorization, it's essential to understand how to decompose the number accurately and then present it in the most simplified manner. This process not only aids in simplifying complex calculations but also enhances comprehension of the number's intrinsic properties. In this guide, we will explore the correct way to use prime factorization to write 48 in its simplest form, analyze common methods, and help you select the correct calculation among multiple options.

Understanding Prime Factorization

Before diving into the specific calculation, it's crucial to grasp what prime factorization entails.

What is Prime Factorization?

Prime factorization is the process of expressing a composite number as a product of prime numbers. Every composite number can be uniquely written as a product of primes, which are numbers greater than 1 that have no divisors other than 1 and themselves.

Example:

48 can be broken down into prime factors as follows:

$$\backslash 48 = 2 \times 24 \backslash$$

But since 24 is composite, we continue:

$$\backslash 24 = 2 \times 12 \backslash$$

Again, 12 is composite:

$$\backslash 12 = 2 \times 6 \backslash$$

And 6 is composite:

$$\backslash 6 = 2 \times 3 \backslash$$

Now, 3 is prime.

Putting it all together:

$$\backslash 48 = 2 \times 2 \times 2 \times 2 \times 3 \backslash$$

Or, using exponents:

$$\backslash 48 = 2^4 \times 3^1 \backslash$$

Significance of Prime Factorization

- Simplifies the process of finding least common multiples (LCM) and greatest common divisors (GCD).
- Aids in simplifying fractions.
- Helps in solving algebraic problems involving factors and multiples.

How to Prime Factorize 48 Step-by-Step

Let's walk through the process of prime factorizing 48 clearly and systematically.

Step 1: Divide by the smallest prime (2)

Since 48 is even, start with 2:

$$\backslash 48 \div 2 = 24 \backslash$$

Step 2: Continue dividing by 2

24 is also even:

$$\backslash 24 \div 2 = 12 \backslash$$

12 is even:

$$\lfloor 12 \div 2 = 6 \rfloor$$

6 is even:

$$\lfloor 6 \div 2 = 3 \rfloor$$

Step 3: Check if the quotient is prime

3 is prime, so we stop here.

Final Prime Factors

Collecting all the prime factors:

$$\lfloor 48 = 2 \times 2 \times 2 \times 2 \times 3 = 2^4 \times 3 \rfloor$$

Writing 48 in Its Simplest Form Using Prime Factorization

Once you've decomposed 48 into its prime factors, the next step is to write it in the simplest form. This typically involves expressing it as a product of primes with exponents, which makes it easy to understand and manipulate algebraically.

The Simplest Prime Factorization of 48

$$\lfloor \boxed{48 = 2^4 \times 3} \rfloor$$

This is the most concise and standard way to express 48 via prime factors.

Analyzing Multiple Choice Options: Which Calculation Is Correct?

Suppose you're presented with several options for expressing 48 using prime factorization, and you need to select the correct one. Here are typical options you might encounter and how to analyze them:

Common Incorrect Options

1. Option A: $\lfloor 48 = 2 \times 24 \rfloor$

- Analysis: This is a partial factorization, not prime factorization since 24 is composite.

2. Option B: $\lfloor 48 = 2^3 \times 6 \rfloor$

- Analysis: While $\lfloor 2^3 \times 6 = 8 \times 6 = 48 \rfloor$, 6 is composite and not prime, so this isn't fully prime factorized.

3. Option C: $\lfloor 48 = 2^4 \times 3 \rfloor$

- Analysis: Correct. All factors are prime, and the expression accurately represents the prime factorization.

4. Option D: $\lfloor 48 = 3 \times 16 \rfloor$

- Analysis: 16 is composite; this isn't prime factorization.

Correct Option

Based on the analysis, Option C is the correct calculation that uses prime factorization to write 48 in the simplest form.

Practical Applications of Prime Factorization

Understanding and correctly applying prime factorization has broad applications:

- Simplifying Fractions:

For example, simplifying $\left(\frac{48}{60}\right)$ involves prime factorization:

$$\begin{aligned} 48 &= 2^4 \times 3, \quad 60 = 2^2 \times 3 \times 5 \end{aligned}$$

The GCD is $(2^2 \times 3 = 12)$, simplifying the fraction to $\left(\frac{4}{5}\right)$.

- Finding Least Common Multiple (LCM):

Using prime factors helps to determine the LCM efficiently.

- Finding Greatest Common Divisor (GCD):

Prime factors reveal common factors quickly.

Summary: The Correct Calculation for 48 Using Prime Factorization

To summarize the key points:

- Prime factorization involves breaking down a number into prime components.
- For 48, the prime factorization is $(2^4 \times 3)$.
- The most simplified and standard way to express this is $48 = 2^4 \times 3$.
- When selecting among multiple options, verify whether each factorization fully decomposes the number into primes.
- The correct answer will only contain prime numbers as factors, with exponents indicating repeated factors.

Final Tips for Mastering Prime Factorization

- Always start dividing by the smallest prime (2) and proceed upward.
- Continue dividing until the quotient is prime.
- Use exponents to write repeated prime factors efficiently.
- Practice with different numbers to become comfortable with the process.

In conclusion, understanding how to correctly use prime factorization to write 48 in its simplest form is a fundamental skill that enhances your overall mathematical fluency. Recognizing the proper

method ensures accuracy in various calculations and problem-solving scenarios. The correct prime factorization of 48 is $2^4 \times 3$, and selecting an answer that accurately reflects this demonstrates your grasp of the concept.

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