Uncover the Secrets of Exponents: A Comprehensive Guide to the Law of Indices

In the realm of mathematics, exponents, also known as indices, hold a pivotal role. They provide a powerful tool for expressing and simplifying complex mathematical operations. This article delves into the intricacies of the Law of Indices, exploring its fundamental principles, applications, and a myriad of solved examples to enhance your understanding. Prepare to embark on an enlightening journey into the world of indices and empower yourself with the knowledge and confidence to conquer any mathematical challenge that comes your way.

The Law of Indices governs the manipulation of exponential expressions, providing a set of rules that ensure consistent and accurate calculations. These rules are essential for simplifying complex expressions, solving equations, and performing a wide range of mathematical operations.

One of the cornerstones of the Law of Indices is the rule for multiplying or dividing terms with the same base. When two terms with the same base are multiplied, their exponents are added. Conversely, when two terms with the same base are divided, their exponents are subtracted.

Questions, Answers and Solutions on the Law of Indices: Flavor Of Mathematics by Temitope James

★★★★★ 5 out of 5

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Example:

Multiply: 2^3 × 2^5

Solution:

2^3 × 2^5 = 2^(3 + 5) = 2^8

Divide: 8^4 ÷ 8^2

Solution:

8^4 ÷ 8^2 = 8^(4 - 2) = 8^2

The Law of Indices also provides a rule for powering an exponential expression. When a power is raised to another power, the exponents are multiplied.

Example:

Find: (3^2)^3

Solution:

(3^2)^3 = 3^(2 × 3) = 3^6

Negative exponents represent the reciprocal of the corresponding positive exponents. A term with a negative exponent can be rewritten as the denominator of the same term with a positive exponent.

Example:

Simplify: 5^-2

Solution:

5^-2 = 1/5^2 = 1/25

Any non-zero number raised to the power of zero results in 1.

Example:

Find: 7^0

Solution:

7^0 = 1

The Law of Indices finds widespread applications in various fields, including mathematics, physics, engineering, and computer science. Here are some notable examples:

Exponents are used to express very large or very small numbers in a concise and readable form known as scientific notation. For instance, the number 602,214,129,000,000,000,000,000 can be written as 6.02214129 × 10^23 using scientific notation.

Exponents play a crucial role in modeling exponential growth and decay patterns. For example, the population growth of a city can be represented using an exponential function, where the exponent represents the growth rate.

Exponents are often encountered when solving equations, particularly those involving logarithmic functions. By applying the laws of exponents, it becomes possible to simplify complex equations and find their solutions.

To solidify your understanding of the Law of Indices, let's delve into a few solved examples:

Simplify the expression: $2^3 \times 3^4 \div 6^2$

Solution:

Using the laws of exponents, we can simplify as follows:

$2^3 \times 3^4 \div 6^2 = (2^3 \times 3^4) \div (2 \times 3)^2$

$= (8 \times 81) \div (6)^2$

$= 648 \div 36$

$= 18$

Rationalize the denominator of the expression: $1/\sqrt{3}$

Solution:

Multiply and divide by $\sqrt{3}$ to rationalize the denominator:

$1/\sqrt{3} = 1/\sqrt{3} \times \sqrt{3}/\sqrt{3}$

$= \sqrt{3}/3$

Solve the equation: 4^x = 64

Solution:

Convert 64 to a power of 4:

64 = 4^3

Now we can equate the exponents:

x = 3

The Law of Indices forms a cornerstone of mathematical operations, providing a comprehensive set of rules for manipulating exponential expressions. By understanding these principles and practicing with solved examples, you can become proficient in simplifying, solving, and applying exponents in a wide range of mathematical and scientific contexts. Embrace the power of indices today and unlock the gateway to a deeper understanding of mathematics.

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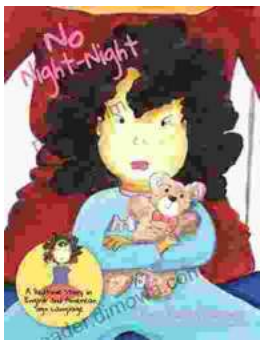

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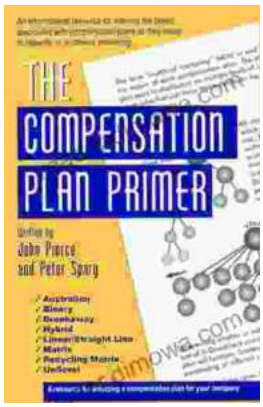

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