



Basic Concepts of Exponents

FOR CLASS 7 & 9

12 FEB, 2023

Introduction

Exponent is defined as the method of expressing large numbers in terms of powers. That means, exponent refers to how many times a number multiplied by itself. For example, 6 is multiplied by itself 4 times, i.e. $6 \times 6 \times 6 \times 6$. This can be written as 6^4 . Here, 4 is the exponent and 6 is the base. This can be read as 6 is raised to power 4.

Exponent Symbol

The symbol used for representing the exponent is \wedge . This symbol (\wedge) is called a carrot. For example, 4 raised to 2 can be written as 4^2 or 4_2 . Thus, $4^2 = 4 \times 4 = 16$. The below table shows the representation of a few numerical expressions using exponents.

Exponent Laws

Multiplication Law: Bases – multiplying the like ones; add the exponents and keep the base the same.

When bases are raised with power to another, multiply the exponents and keep the base the same.

Division Law: Bases – dividing the like ones; subtract the exponent of the denominator from the exponent of the numerator Exponent and keep the base the same.

Let 'a' be any integer or a decimal number and 'm', 'n' are positive integers, that represent the powers to the bases such that the above laws can be written as:

$$a^m \cdot a^n = a^{m+n}$$

$$(a^m)^n = a^{mn}$$

$$(ab)^n = a^n b^n$$

$$(a/b)^n = a^n/b^n$$

$$a^m/a^n = a^{m-n}$$

$$a^m/a^n = 1/a^{n-m}$$

These laws referred to the properties of exponents. These are used to simplify complex algebraic expressions and write large numbers in an understandable manner.

Exponent and Powers

As defined above, the exponent defines the number of times a number is multiplied by itself. The power is an expression that shows repeated multiplication of the same number or factor. For example, in the expression 6^4 , 4 is the exponent and 6^4 is called the 6 power of 4. That means, 6 is multiplied by itself 4 times.

Exponent Formula and Rules

Exponents have certain rules which we apply in solving many problems in maths. Some of the [exponent rules](#) are given below.

Zero rule: Any number with an exponent zero is equal to 1.

Example: $8^0 = 1$, $a^0 = 1$

One Rule: Any number or variable that has the exponent of 1 is equal to the number or variable itself.

Example: $a^1 = a$, $7^1 = 7$

Negative Exponent Rule: If the exponent value is a negative integer, then we can write the number as:

$$a^{-k} = 1/a^k$$

Example: $3^{-2} = 1/3^2 = 1/(3 \times 3) = 1/9$

Exponent Table

The below table shows the values of different expressions in terms of exponents along with their expansions and values. This will help you in understanding the simplification of numbers with exponents in detail.

Type of Exponent	Expression	Expansion	Simplified value
Zero exponent	6^0	1	1
One exponent	4^1	4	4
Exponent and power	2^3	$2 \times 2 \times 2$	8
Negative exponent	5^{-3}	$1/5^3 = 1/(5 \times 5 \times 5)$	1/125
Rational exponent	$9^{1/2}$	$\sqrt{9}$	3
Multiplication	$3^2 \times 3^3$	$3^{(2+3)} = 3^5$	273
Quotient	$7^5 / 7^3$	$7^{(5-3)} = 7^2$	49
Power of exponent	$(8^2)^2$	$8^{(2 \times 2)} = 8^4$	4096

Solved Examples

Example 1: Simplify $(3^2 \times 3^{-5}) / 9^{-2}$

Solution:

$$(3^2 \times 3^{-5}) / 9^{-2} = 3^{(2-5)} \times 9^2$$

$$= 3^{-3} \times (3^2)^2$$

$$= 3^{-2} \times 3^4$$

$$= 3^{(-2+4)}$$

$$= 3^2$$

$$= 9$$

Therefore, Simplify $(3^2 \times 3^{-5}) / 9^{-2} = 9$

Example 2: Simplify and write the answer in exponential form.

(i) $(2^5 \div 2^8)^5 \times 2^{-5}$

(ii) $(-4)^{-3} \times (5)^{-3} \times (-5)^{-3}$

(iii) $(1/8) \times (3)^{-3}$

Solution:

(i) $(2^5 \div 2^8)^5 \times 2^{-5}$

$$= (2^{5-8})^5 \times 2^{-5}$$

$$= (2^{-3})^5 \times 2^{-5}$$

$$= 2^{(-15-5)}$$

$$= 2^{-20}$$

(ii) $(-4)^{-3} \times (5)^{-3} \times (-5)^{-3}$

$$= [(-4) \times 5 \times (-5)]^{-3}$$

$$= [100]^{-3}$$

(iii) $(1/8) \times (3)^{-3}$

$$= [1/(2^3)] \times (3)^{-3}$$

$$= 2^{-3} \times 3^{-3}$$

$$= (2 \times 3)^{-3}$$

$$= 6^{-3}$$

Practice Problems

Find m such that $(-4)^{m+1} \times (-4)^5 = (-4)^7$.

Find the value of $(5^0 + 4^{-1}) \times 2^2$.

Expand the following numbers using exponents.

(i) 1025.63

(ii) 1256.249

Thanks For Having Patience

Presented By

Md. Abu Tayeb Hossain

Craft Instructor

Kachua Govt. Technical School & College

Kachua, Chandpur.