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Class:- 7th Date ,-- 11.11.2020 Subject: Mathematics)

Introduction to Exponents and Powers

The exponents tells us that how many times the number should be multiplied. It is called the Exponential form. This is written like this:

Here 10 is the base and 9 is the exponent and this complete number is the power. We pronounce it as 10 raised to the power 9. The exponent could be positive or negative.

This tells us that the number 10 will be multiplied 9 times, like, 10 × 10 × 10 × 10 × 10 × 10 × 10 × 10 × 10

Powers with Negative Exponents

The exponents could be negative also and we can convert them in positive by the following method.

$$100^{-3} = \frac{1}{100^3}$$

This shows that for any non-zero negative integers a,

$$a^{-m} = \frac{1}{a^m}$$

where m is the positive integer and a^m is the multiplicative inverse of a^{-m}.

Laws of Exponents

If we have a and b as the base and m and n as the exponents, then

Laws of Exponents	Example
$a^m \times a^n = a^{m+n}$	$7^3 \times 7^4 = 7^{3+4} = 7^7$
$(a^m)^n$	$(7^3)^4 = 7^{3\times4} = 7^{12}$
$\frac{a^m}{a^n} = a^{m-n}, m > n$	$\frac{7^4}{7^3} = 7^{4-3} = 7^1 = 7$
$a^m b^m = (ab)^n$	$7^3 4^3 (7\times 4)^3 = 28^3$
$a^0 = 1$	$7^0 = 1$

$a^1 = a$	$7^1 = 7$
$\frac{1}{a^n} = a^{-n}$	$\frac{1}{7^3} = 7^{-3}$

Some More Examples

$$(6^{-3})^4 = 6^{-3\times4} = 6^{-12} = \frac{1}{6^{12}}$$

$$(3^2)^4 = 6^{-3\times4} = 6^{-12} = \frac{1}{3^{10}}$$

$$(x_2)^{-3} = x^{(-2)(-3)} = x^6$$

$$(3x^2y^3)^2 = 3^2x^{2\times2}\,y^{3\times2} = 9x^4y^6$$

Use of Exponents to Express Small Numbers in Standard Form

Sometimes we need to write the numbers in very small or large form and we can use the exponents to represent the numbers in small numbers.

1. Standard form to write the natural numbers like xyz000000.....

Step 1: First of all count the number of digits from left leaving only the first digit.

Step 2: To write it in exponent or standard form, write down the first digit.

Step 3: If there are more digits in the number then put a decimal after the first digit and then write down the other digits until the zero comes. And if there are no digits after the first digit then skip this step.

Step 4: Now place a multiplication sign and then write down the counted digits in the first step as the exponent to the base number 10.

$$2 \times 10^9$$

2.000000000

1 2 3 4 5 6 7 8 9

2,000,000,000

Example:

Express 1730000000000 in exponent form.

Solution:

In standard form, the number 1730000000000 will be written as 1.73×10^{12}.

2. Standard form to write decimal numbers like 0.00000.....xyz.

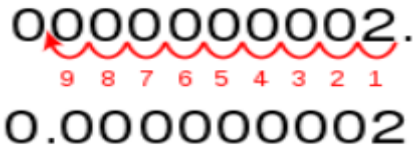
Step 1: First of all count the number of digits from the decimal point to the last digit.

Step 2: If there is only one digit after the zeros then simply write down that digit. Place a multiplication sign and write down the counted digits in step-1 with a negative sign as the exponent to base number 10.

Step 3: If there are two or more non-zero digits at the end of the number. Then, write down the digits followed by a decimal point after the first digit

and the other non-zero digits.
Step 4: Now calculate the number of digits in the first step and minus the number of digits appearing after the decimal point.
Step 5: Place a multiplication sign and write down the counted digits in step-4 with a negative sign as an exponent to base number 10.

$$2 \times 10^{-9}$$



Example:
Express 0.000000000000073 in exponent form.
Solution:
In standard form, the number will be written as 7.3×10^{-14}.