Exponents and Powers

NOTES

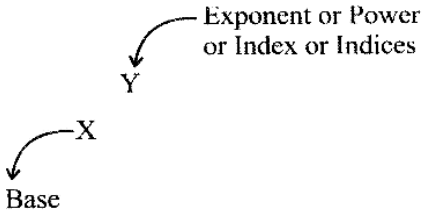
FUNDAMENTALS

Exponent:-

- The exponent of a number says how many times it should be used in a multiplication.

Example:- $3 in 2^3 \Rightarrow 2^3 = 2 \times 2 \times 2;$

$5 in 2^5 \Rightarrow 2^5 = 2 \times 2 \times 2 \times 2 \times 2$



- Exponent is also called power or index or indices
- x^y can be read as y^{th} power of x (or) x raised to the power y.
- $2 \times 2 \times 2 \times 2 \times 2 = 2^5$,

  Here $2 \times 2 \times 2 \times 2 \times 2$ is called the product form (or) expanded form and 2^5 is called the exponential form.
- **Product Rule**:- $a^m \times a^n = a^{m+n}$ (Where $a \neq 0$ be any rational number and m, n be rational numbers)

  Example:- $2^5 \times 2^6 = (2)^{5+6} = 2^{11}$
- **Quotient Rule:-** $\frac{a^m}{a^n} = a^{m-n}$ (Where $a \neq 0$ be any rational number)
- **Example:-** $5^6 \div 5^3 = 5^{6-3} = 5^3$
- $(a^m)^n = a^{m \times n}$ (Where m, n are rational numbers, $a \neq 0$)

Example:- $(3^5)^6 = 3^{5 \times 6} = 3^{30}$

- $\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$, (Where $a \neq 0$, $b \neq 0$)

Note:-

- The first power of a number is the number itself. i.e., $\mathbf{a^1 = a}$
- The second power is called square. E.g., square of '5' is 5^2
- The third power is called cube. E.g., cube of y is y^3

Number in Standard form:-

- A number written as $(x \times 10^y)$ is said to be in standard form if x is a decimal number such that $1 \leq x \leq 10$ and y is either a positive or a negative integer.

- Expressing large numbers in standard form

  E.g., Express 246784 in standard form

  Solution:- $246784 = 2.46784 \times 100000$

  $= \left(2.4678 \times 10^5\right)$

  Expressing very small numbers is standard form

  E.g., Express 0.00003 in standard form.

- $\left(\frac{2}{3}\right)^2 = \frac{2}{3} \times \frac{2}{3} = \frac{2^2}{3^2}.$
- $a^m \times b^m = (ab)^m$ ($ab \neq 0$ and m is positive integer)

  e.g., $2^3 \times 3^3 = \left(2 \times 3\right)^m = 6^3.$
- $(a)^0 = 1$ $(where\, a \neq 0)$

  e.g., $\left(3\right)^0 = 1$
- $(a)^{-n} = \left(\frac{1}{a}\right)^n$ $(where\, a \neq 0)$

  e.g., $(2)^{-3} = \frac{1}{2^3} = \frac{1}{8}.$
- $a^m = a^n$

$\Rightarrow m = n$ if

$a \neq 0, -1, 1$

e.g., $2^3 = 2^x$

$\therefore x = 3$

Rule for One

- 1 raised to any integral power gives E.g., $(1)^{1000} = 1$
- (-1) raised to any odd natural number gives '-1' E.g., $(1)^{3789} = -1$
- (-1) raised to any even natural number gives '+1' or simply 1. E.g., $(-1)^{4628} = 1$