Exponents and Powers

AIM:

1. Study about the integral exponents of a rational number.
2. The laws of exponents of rational numbers.
3. Scientific notation dealing with large and small numbers.

Exponential Notation

3 x 3 x 3 x 3 = 3^4 is read as three raised to the power four or fourth power of three. The integer '3' is called the base and '4' is called the exponent (index).

$$\frac{4}{7} \times \frac{4}{7} \times \frac{4}{7} \times \frac{4}{7} \times \frac{4}{7} = \left(\frac{4}{7}\right)^5$$

The integer '$\frac{4}{7}$' is called the base and '5' is called the exponent (index).

Integral Exponents of a Rational Number

The product of a rational number multiplied several times by itself can be expressed in the exponential notation.

$$\left(\frac{p}{q}\right)^n = \frac{p}{q} \times \frac{p}{q} \times \frac{p}{q} \times \frac{p}{q} \times \ n\ times$$

$(-1)^n = 1$ when n is even

$(-1)^n = -1$ when n is odd

Positive integral exponent of a rational number

If p and q are two rational numbers and n is a positive integer then

$\left(\frac{p}{q}\right)^n = \frac{p}{q} \times \frac{p}{q} \times \frac{p}{q} \times \frac{p}{q} \times \ n\ times$

$= \frac{p \times p \times p \times p \times n\ times}{q \times q \times q \times q \times n\ times} = \frac{p^n}{q^n}$

$\frac{a}{b} = \ base\ and\ n \ = \ exponent$

Laws of exponents

Law 1 : If a is any rational number and m and n are any two positive integers, then $a^m \times a^n = a^{m+n}$

Law 2 : If a is any rational number and m and n are any two positive integers such that m>n, then

$a^m \div a^n = a^{m-n}$

Law 3 : If a is any rational number and m and n are any two positive integers such that n>m, then

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

Law 4 : If a is any rational number and m and n are any two positive integers, then

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

Law 5 : If a is any non zero rational number, then $a^0 = 1$

Law 6 : If a, b are any two rational numbers and m is a positive integer

$a^m \times b^m = (ab)^m$

Negative integers as exponents

We know that reciprocal of 2 is $\frac{1}{2}$. It is written as 2^{-1} and read as “2 raised to the power -1” .

We know that reciprocal of $\frac{2}{3}$ is $\frac{1}{\frac{2}{3}}$. It is written as $(\frac{2}{3})^{-1}$ and read as “$\frac{2}{3}$ raised to the power -1” .

The reciprocal of $(\frac{p}{q})^m$ is written as $(\frac{p}{q})^{-m}$, $where\ \frac{p}{q} \neq 0$