

online class part V

class - VIII

subject - Maths

Chapter - 2 - "Exponents"

Introduction \rightarrow you have learnt in class VII that if we multiply an integer by itself again and again then it can be written in a short form in exponential or power notation.

A numeral such as $(\frac{1}{2})^7$ is called

an exponential expression.

In $(\frac{1}{2})^7$, $\frac{1}{2}$ is called the base

and 7 the exponent.

We read $(\frac{1}{2})^7$ as $\frac{1}{2}$ raised to the power 7.

Note \rightarrow

[1] A negative rational number raised to an even power is positive

$$\text{eg } \left(\frac{-2}{3}\right)^2 = \frac{4}{9}$$

[2] A negative rational number raised to an odd power is negative eg $\left(\frac{-2}{3}\right)^3 = \frac{-8}{27}$

[3] When the power of -1 is any even natural number, the product is always 1

$$(-1)^{\text{even natural number}} = 1$$

[4] When the power of -1 is any odd natural number, the product is always -1

$$(-1)^{\text{odd natural number}} = -1$$

Thus $(-1)^{47} = -1, (-1)^{193} = -1$

$$(-1)^{50} = 1, (-1)^{376} = 1$$

[5] If $\frac{p}{q}$ is any rational number and

n is any integer, then $\left(\frac{p}{q}\right)^n = \frac{p^n}{q^n}$

e.g: $\left(\frac{5}{7}\right)^2 = \frac{5^2}{7^2} = \frac{25}{49}$

Law of exponents for all integral powers \rightarrow

Let $\frac{a}{b}$ and $\frac{c}{d}$ be any non zero rational number and let m and n be any integers then

$$\text{Law I} \quad \left(\frac{a}{b}\right)^m \times \left(\frac{a}{b}\right)^n = \left(\frac{a}{b}\right)^{m+n}$$

For example:

$$\begin{aligned} \left(\frac{9}{11}\right)^{-4} \times \left(\frac{9}{11}\right)^{-5} &= \left(\frac{9}{11}\right)^{(-4)+(-5)} \\ &= \left(\frac{9}{11}\right)^{-9} \end{aligned}$$

$$\text{Law II} \quad \therefore \left[\left(\frac{a}{b}\right)^m\right]^n = \left(\frac{a}{b}\right)^{mn}$$

For example:

$$\begin{aligned} \left[\left(\frac{3}{5}\right)^{-3}\right]^3 &= \left(\frac{3}{5}\right)^{-3 \times 3} \\ &= \left(\frac{3}{5}\right)^{-9} \end{aligned}$$

Law III $\therefore \left(\frac{a}{b}\right)^m \times \left(\frac{c}{d}\right)^m = \left(\frac{a \times c}{b \times d}\right)^m$

For example:

$$7^3 \times \left(\frac{3}{14}\right)^3 = \left(\frac{7 \times 3}{14}\right)^3 = \left(\frac{3}{2}\right)^3 = \frac{27}{8}$$

Law IV $\left(\frac{a}{b}\right)^m \div \left(\frac{a}{b}\right)^n = \left(\frac{a}{b}\right)^{m-n}$

For example:

$$\begin{aligned} \left(\frac{-3}{8}\right)^{11} \div \left(\frac{-3}{8}\right)^{-5} &= \left(\frac{-3}{8}\right)^{11 - (-5)} \\ &= \left(\frac{-3}{8}\right)^{16} \end{aligned}$$

Law V For any non zero rational number $\frac{a}{b}$, and a positive integer

$$n, \left(\frac{a}{b}\right)^{-n} = \left(\frac{b}{a}\right)^n$$

For example

$$\begin{aligned} (-5)^{-1} &= \left(\frac{-5}{1}\right)^{-1} \\ &= \frac{1}{-5} = -\frac{1}{5} \end{aligned}$$

Exercis 2.1

Q.1 Express each of the following in exponential form:

[i] $\frac{2}{3} \times \frac{2}{3} \times \frac{2}{3} \times \frac{2}{3}$

[ii] $\frac{3}{8} \times \frac{3}{8} \times \frac{3}{8} \times \frac{3}{8} \times \frac{3}{8}$

[iii] $\frac{-5}{7} \times \frac{-5}{7} \times \frac{-5}{7} \times \frac{-5}{7} \times \frac{-5}{7} \times \frac{-5}{7}$

Q.2 Find the value of

[i] $\left(\frac{1}{3}\right)^3 \times \left(\frac{3}{2}\right)^2$ [ii] $\left(\frac{-2}{3}\right)^4 \times \left(\frac{-3}{4}\right)^3$

[iii] $\left(\frac{-1}{5}\right)^3 \times \left(\frac{-1}{5}\right)^2$ [iv] $\left(\frac{4}{-5}\right)^2 \times (-5)^3$

Q.3 Find the Reciprocal of:

[i] $\frac{16}{125}$ [ii] $\frac{-27}{64}$ [iii] $(-2)^4$

[iv] $\left(\frac{-3}{7}\right)^2$ [v] $\frac{15}{18}$ [vi] $\frac{19}{169}$

Q:4 Simplify and express with positive exponents."

[i] $\left(\frac{5}{7}\right)^3 \times \left(\frac{5}{7}\right)^{-5}$ [ii] $\left(\frac{-7}{9}\right)^{-8} \times \left(\frac{-7}{9}\right)^{-11} \times \left(\frac{-7}{9}\right)$

Q:5 Simplify and express with positive exponents: .

[i] $\left(\frac{3}{11}\right)^4 \div \left(\frac{3}{11}\right)^{-3}$ [ii] $\left(\frac{-5}{9}\right)^6 \div \left(\frac{-5}{9}\right)^5$

Q:6 Simplify: .

[i] $\left[\left(\frac{2}{5}\right)^{-3}\right]^4$ [ii] $\left[\left(\frac{-6}{11}\right)^{-5}\right]^{-3}$

[iii] $\left(\frac{-2}{3}\right)^{-4} \times \left(\frac{1}{8}\right)^{-4}$ [iv] $\left(\frac{5}{7}\right)^{-1} \times \left(\frac{7}{3}\right)^{-1}$