Vidya Bhawan, Balika Vidyapith

Shakti Utthan Ashram, Lakhisarai-811311(Bihar)

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Exponential Laws:

For any non-zero integers a & b, and for any integer's m & n, we have the following laws of exponents:

EXERCISE: 12.1 (Page 197)

Q1. Evaluate:. (i) 3^{-2} (ii) $(4)^{-2}$ (iii) $\left(\dfrac{1}{2}\right)^{-5}$

Sol: (i) $3^{-2} = \dfrac{1}{3^2} = \dfrac{1}{3 \times 3} = \dfrac{1}{9}$

(ii) $(-4)^2 = \dfrac{1}{(-4)} = \dfrac{1}{(-4) \times (-4)} = \dfrac{1}{16}$

(iii) $\left(\dfrac{1}{2}\right)^{-5} = \dfrac{1}{\left(\dfrac{1}{2}\right)^5} = \dfrac{1}{\left(\dfrac{1}{2} \times \dfrac{1}{2} \times \dfrac{1}{2} \times \dfrac{1}{2} \times \dfrac{1}{2}\right)} = \dfrac{1}{\left(\dfrac{1}{32}\right)} = 32$

Q2. Simplify and express the result in power notation with positive exponent

(iii) $(-3)^4 \times \left(\dfrac{5}{3}\right)^4$

∵ $a^m \times b^m = (ab)^m$

∴ $(-3)^4 \times \left(\dfrac{5}{3}\right)^4 = \left[(-3) \times \dfrac{5}{3}\right]^4$

$= [(-1) \times 5]^4 = \left[(-1)^4 \times (+5)^4\right]$

$= 1 \times (5)^4 = (5)^4$

(iv) $(3^{-7} \div 3^{-10}) \times 3^{-5}$

∵ $a^m \div a^n = a^{m-n}$ and $a^m \times a^n = a^{m+n}$

∴ $(3^{-7} \div 3^{-10}) \times 3^{-5} = [3^{-7-(-10)}] \times 3^{-5}$

$= [3-7 + 10] \times 3-5$

$= 33 \times 3-5$

$= 3^{3 + (-5)} = 3^{-2} = \dfrac{1}{(3)^2}$

(v) $2^{-3} \times (-7)^{-3}$

∵ $a^m \times b^m = (ab)^m$

∴ $2^{-3} \times (-7)^{-3} = [2 \times (-7)]^{-3} = [-14]^{-3} = \dfrac{1}{(-14)^3}$

exponent.

Q3. Find the value of:

(i) $(3^0 + 4^{-1}) \times 2^2$ (ii) $(2^{-1} + 4^{-1}) \div 2^{-2}$

(iii) $\left(\dfrac{1}{2}\right)^{-2} + \left(\dfrac{1}{3}\right)^{-2} + \left(\dfrac{1}{4}\right)^{-2}$ (iv) $(3^{-1} + 4^{-1} + 5^{-1})^0$

(v) $\left\{\left(\dfrac{-2}{3}\right)^{-2}\right\}^2$

Sol. (i) $(3^0 + 4^{-1}) \times 2^2$

$$\because a^0 = 1 \text{ and } a^{-1} = \frac{1}{a}$$

$$\therefore (3^0 + 4^{-1}) \times 2^2 = \left(1 + \frac{1}{4}\right) \times 2^2$$

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