8th CBSE Math

10. Exponents and Powers

Lecture 1

$2 \times 2 \times 2 \times 2 \times 2 = 2^5$

5 ← Power / Exponents / Index

2 ← base

$7^3 = 7 \times 7 \times 7$

$5^4 = 5 \times 5 \times 5 \times 5$

$a^m = a \times a \times a \times a \times \ldots\ldots\ldots$ m times

$a^n = a \times a \times a \times a \times \ldots\ldots$ n times

Laws of Exponents

(i) $a^m \times a^n = a^{m+n}$

$a^m \cdot a^n$

$2^3 \cdot 2^5 = 2^{3+5} = 2^8$

(ii) $(a^m)^n = a^{m \times n} = a^{mn}$

$(2^3)^4 = 2^{3 \times 4} = 2^{12}$

(iii) $\frac{a^m}{a^n} = a^{m-n}$

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

$= a^{m+(-n)}$

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

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

$\frac{2}{3} = 2 \times \frac{1}{3} = \frac{2}{3}$

(iv) $a^m \cdot b^m = (ab)^m$

Note:

$\sqrt{x} = x^{1/2}$

$\sqrt{2} = 2^{1/2}$

$\sqrt{4} = 4^{1/2}$

$\sqrt[n]{a} = a^{1/n}$

$\sqrt[3]{x} = x^{1/3}$

$\sqrt[3]{7} = 7^{1/3}$

$$a^{\frac{m}{n}} = \sqrt[n]{a^m}$$

$$\sqrt[n]{a^m} = (a^m)^{1/n} = a^{(m \times \frac{1}{n})} = a^{\frac{m}{n}}$$

(v) $\frac{a^m}{b^m} = \left(\frac{a}{b}\right)^m$

$\left(\frac{a}{b}\right)^m$ $\frac{a^m}{b^m}$

(i) $(-4)^5 \times (-4)^{-10}$ (ii) $2^5 \div 2^{-6}$

(i) $(-4)^5 \times (-4)^{-10} = (-4)^{5+(-10)} = (-4)^{5-10} = (-4)^{-5}$

$= \frac{1}{(-4)^5}$

(ii) $\frac{2^5}{2^{-6}} = 2^{5-(-6)}$

$= 2^{5+6}$

$= 2^{11}$

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

(i) $(-4)^5 \div (-4)^8$

$\frac{am}{an} = a^{m-n}$

$$\frac{(-4)^5}{(-4)^8} = (-4)^{5-8} = (-4)^{-3} = \frac{1}{(-4)^3}$$

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

$$\left(\frac{3^{-7}}{3^{-10}}\right) \times 3^{-5} = 3^{-7-(-10)} \times 3^{-5}$$

$$= 3^{-7+10} \times 3^{-5}$$

$$= 3^7 \times 3^{-5} = 3^{7+(-5)}$$

$$= 3^{7-5} = 3^{-2} = \frac{1}{3^2}$$

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

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

$(2 \times -7)^{-3} = (-14)^{-3} = \frac{1}{(-14)^3}$

(i) $(2^5 \div 2^8)^5 \times 2^{-5}$

$\left(\frac{2^5}{2^8}\right)^5 \times 2^{-5} = (2^{5-8})^5 \times 2^{-5}$

$= (2^{-3})^5 \times 2^{-5}$

$= 2^{-15} \times 2^{-5}$

$= 2^{-15+(-5)} = 2^{-15-5} = 2^{-20} = \frac{1}{2^{20}}$

Find m so that $(-3)^{m+1} \times (-3)^5 = (-3)^7$

$(-3)^{(m+1)+5} = (-3)^7$

$(-3)^{m+6} = (-3)^7$

$m+6 = 7$

$m = 7-6$

$\boxed{m = 1}$

Find x, $2^{x+3} = 4^{x-1}$

$$2^{x+3} = \left(2^2\right)^{x-1}$$

$$2^{x+3} = 2^{2(x-1)}$$

$$x+3 = 2(x-1)$$

$$x+3 = 2x-2$$

$$3+2 = 2x-x$$

$$\boxed{x = 5}$$

$x = ?$

$$9 \times 3^x = (27)^{2x-5}$$

$$3^2 \times 3^x = (3^3)^{2x-5}$$

$$3^{2+x} = 3^{3(2x-5)}$$

$$2+x = 3(2x-5)$$

$$2+x = 6x-15$$

$$2+15 = 6x-x$$

$$17 = 5x$$

$$\frac{17}{5} = x$$

$$3\frac{2}{5} = x$$

3 | 27
3 | 9
3 | 3
1

5 | 17 (3
15
2

(i) $\dfrac{25 \times t^{-4}}{5^{-3} \times 10 \times t^{-8}} \quad (t \neq 0)$

$2^1 \times 5^{-1}$

$\dfrac{5^2 \times t^{-4}}{5^{-3} \times 5^1 \times 2^1 \times t^{-8}} = \dfrac{5^2 \times t^{-4-(-8)}}{5^{-2} \times 2}$

$= \dfrac{5^{2-(-2)} \times t^{-4+8}}{2}$

$= \dfrac{5^4 \times t^4}{2}$

$= \dfrac{5^4 . t^4}{2}$

(ii) $$\frac{3^{-5}\times 10^{-5}\times 125}{5^{-7}\times 6^{-5}}$$

$$\frac{3^{-5}\times (2\times 5)^{-5}\times 5^{3}}{5^{-7}\times (2\times 3)^{-5}}$$

$$3^{-5}\times 2^{-5}\times 5^{-5}\times 5^{3}$$

$$5^{-7}\times 2^{-5}\times 3^{-5}$$

$$= \frac{5^{-5+3}}{5^{-7}}$$

$$= \frac{5^{-2}}{5^{-7}}$$

$$= 5^{-2-(-7)}$$

$$= 5^{-2+7} = 5^{5}$$

$(a\times b)^{m} = a^{m}\times b^{m}$

125 = 5 × 25, 25 = 5 × 5, 5 = 5 × 1

$= 5^{-2+7} = 5^5$

(ii) $\dfrac{3^{-5} \times 10^{-5} \times 125}{5^{-7} \times 6^{-5}}$

$$\frac{(30)^{-5} \times 5^3}{5^{-7} \times 6^{-5}} = \frac{(5 \times 6)^{-5} \times 5^3}{5^{-7} \times 6^{-5}}$$

$$= \frac{5^{-5} \times 6^{-5} \times 5^3}{5^{-7} \times 6^{-5}}$$

$$= \frac{5^{-2}}{5^{-7}}$$

$$= 5^5$$

Thank You !!