Exponent

To make vary large number's
Easy to read, understand and
compare ,we use exponents

Solve : $\frac{2 \times 3^4 \times 2^5}{9 \times 4^2}$

$= \frac{2 \times 3^4 \times 2^5}{3^2 \times (2^2)^2} = \frac{2^{5+1} \times 3^4}{3^2 \times 2^4}$

$= 2^{6-4} \times 3^{4-2}$

$= 2^2 \times 3^2$

$= 4 \times 9 = 36$

10^3m= 1km

10^5cm= 1km

eg : (i) $3^x = 81 = 3 \times 3 \times 3 \times 3 = 3^4 \Rightarrow x=4$

(ii) $(-5)^x = -125 = (-5) \times (-5) \times (-5)$

$= (-5)^3 \Rightarrow x = 3$

$a = a^1$

$a \times a = a^2$

$a \times a \times a = a^3$ exponent/inden/power

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

a multiplied n times

exponential notation/power notation

eg : $\frac{(\frac{2}{3})^4 \times (\frac{5}{6})^3}{(\frac{5}{6})^4 \times (\frac{2}{3})^2}$

$= (\frac{2}{3})^{4-2} \times \frac{(\frac{2}{3})^2}{(\frac{5}{6})^{4-3}} \times (\frac{2}{3})^2 \times (\frac{5}{6})^{-1}$

$= \frac{2^2}{3^2} \times \frac{6}{5} = \frac{4}{9} \times \frac{6}{5} = \frac{8}{15}$

$a^n \rightarrow$'a' raised to power n

or

n^{th} power of 'a'

$10^2 \rightarrow$10 squared or 10 raised to power 2

$10^3 \rightarrow$10 cubed or 10 raised to power 3

Express 432 as product of powers of prime no.

Prime factorisation

2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

$= 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 = 2^4 \times 3^3$

multiplication

(1) $a^m \times a^n = a^{m+n}$ (base same; Powers added)

eg : $2^3 \times 2^5 = 2^{3+5} = 2^8$

division powers subtracted

(2) $a^m \div a^n = a^{m-n}$ [m > n] (base same)

eg : $3^5 \div 3^2 = 3^{5-2} = 3^3$

(6) $a^o = 1$

$1 = a^m \div a^m = a^{m-m} = a^o$

eg : $2^o + 3^o + 4^o = 1 + 1 + 1 = 3$

Low's of Exponents

(3) $(a^m)^n = a^{m \times n}$ (bracket; Powers multiplied)

eg : $(5^3)^7 = 5^{3 \times 7} = 5^{21}$

(5) $(\frac{a}{b})^m = \frac{a^m}{b^m} \neq a^m - b^m$

eg : $(\frac{2}{3})^4 = \frac{2^4}{3^4} \neq 2^4 - 3^4$

power same

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

base different

eg : $(-2)^4 \times (-3)^4 = (-2 \times -3)^3 = (+6)^4$

Standard form/Scientfic notation

$\Rightarrow$ **$A \times 10^n$**

$1.0 < A < 10.0$; $n \rightarrow$ integers

eg : $59 = 5.9 \times 10^1$

$590 = 5.9 \times 10^2$

$5900 = 5.9 \times 10^3$

eg : **Compare**

(a) 2.7×10^8 ; 1.5×10^8 (Same; Compare)

2.7×10^8 ; 1.5×10^8

different

(b) 2.7×10^8 ; 1.5×10^{12} (Compare)

$2.7 \times 10^8 < 1.5 \times 10^{12}$

eg : Express in exponential notation

(i) $625 = 5 \times 5 \times 5 \times 5 = 5^4$

(ii) $-27 = (-3) \times (-3) \times (-3) = (-3)^3$

(iii) $a \times a \times a \times b \times b \times y \times y = a^3 b^2 y^2$

Note : $b^3 a^2 \neq b^2 a^3$

Expand form : 47561

$= 4 \times 10^4 + 7 \times 10^3 + 6 \times 10^2 + 1 \times 10^0$

eg : $1000 = 10 \times 100 = 10 \times 10 \times 10$

$= (2 \times 5) \times (2 \times 5) \times (2 \times 5)$

$= 2^3 \times 5^3$