Exponents

Repeated multiplication by the same number is very common.

For example: \(2 \times 2 \times 2 \times 2 \times 2 = 2^5 = 32\). The term \(2^5\) or ‘2 power 5’ or ‘2 raised to the power 5’ is called ‘the exponent form’ of 32.

Where repeated factor 2 is called the ‘base’ and 5 is called the ‘exponent’ or ‘index’.

Illustrative Example

Q1. Find value of the following:
   a. \((-3)^5\)
Solution. \((- 3 )^5 = ( -3 ) \times ( -3 ) \times ( -3 ) \times ( -3 ) \times ( -3 ) = -243\)

b. \((- \frac{4}{5})^4 = \frac{-4}{5} \times \frac{-4}{5} \times \frac{-4}{5} \times \frac{-4}{5} = \frac{256}{625}\)

Q2. Simplify the following:

\(2^3 \times (-3)^2\)

Solution. \(2^3 \times (-3)^2 = 2 \times 2 \times 2 \times (-3) \times (-3) = 8 \times 9 = 72.\)

Q3. Which is the greater number \(6^3\) or \(3^6\)?

Solution. \(6^3 = 6 \times 6 \times 6 = 216\)

\(3^6 = 3 \times 3 \times 3 \times 3 \times 3 \times 3 = 729\)

Since, 729 > 216, therefore \(3^6 > 6^3\).

Q4. Write 512 as powers of 2:

Solution. 512 = \(2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^9\)

Q5. Express 15625 in exponential form:

Solution. 15625 = \(5 \times 5 \times 5 \times 5 \times 5 \times 5 = 5^6\)

Q6. Write the prime factorisation of 420 in exponential form.

Solution. 420 = \(2 \times 2 \times 3 \times 5 \times 7\)

= \(2^2 \times 3^1 \times 5^1 \times 7^1\).

Questions for practice

Q1. Find the value of the following:

i. \(5^5\)  
ii. \(\left(\frac{2}{3}\right)^4\)  
iii. \((-2)^9\)

Q2. Simplify the following:

I. \(7 \times 10^3\)
II. \(3^3 \times 10^4\)
III. \((-3)^2 \times (-5)^2\)
IV. \(25^2 \times (-1)^3\)

Q3. Identify the greater number in each of the following:

i. \(4^3\) or \(3^4\)
Q4. Write the following number as power of 2.
   i. 8  ii. 128  iii. 1024

Q5. Find the value of x in each of the following:
   i. \(7^x = 343\)  ii. \(3^x = 729\)  iii. \((-8)^x = -512\)

Q6. Write the prime factorization of the following numbers.
   i. 72  ii. 360  iii. 405  iv. 540.