

CBSE Class 7 Maths Notes Chapter 11 Exponents and Powers

Exponents

We can write large numbers in a short form using exponents.

For example: $10,000 = 10 \times 10 \times 10 \times 10 = 10^4$

Here, '10' is called the base and '4' the exponent. The number 10^4 is read as 10 raised to the power of 4 or simply as the fourth power of 10.

10^4 is called the exponential form of 10,000.

(1)^{any natural number} = 1

(-1)^{an odd natural number} = -1

(-1)^{an even natural number} = +1

$a^m \times a^n = a^{m+n}$, where m and n are whole numbers and a ($\neq 0$) is an integer.

This formula can be used to write answers to above questions.

For any non-zero integer a,

$a^m \div a^n = a^{m-n}$ where m and n are whole numbers and $m > n$.

For any non-zero integer a,

$(a^m)^n = a^{mn}$ (where m and n are whole numbers)

For any non-zero integer a

$a^m \times b^m = (ab)^m$ (where m is any whole number)

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

(where m is a whole number; a and b are any non-zero integers)

$a^0 = 1$ (for any non-zero integer a)

Any number (except 0) raised to the power (or exponent) 0 is 1.

Decimal Number System

$$10,000 = 10^4$$

$$1000 = 10^3$$

$$100 = 10^2$$

$$10 = 10^1$$

$$1 = 10^0$$

We can write the expansion of a number using powers of 10 in the exponent form.

Expressing Large Numbers in the Standard Form

Large numbers can be expressed conveniently using exponents. Such a number is said to be in standard form if it can be expressed as $k \times 10^m$, where $1 \leq k < 10$ and m is a natural number.

Note that, one less than the digit count (number of digits) to the left of the decimal point in a given number, is the exponent of 10 in the standard form.

For any rational number a and positive integer n , we define a^n as $a \times a \times a \times \dots \times a$ (n times). a^n is known as the n th power of a and is read as 'a raised to the power n '. The rational a is called the base and n is called the exponent or power.

e.g. $10,000 = 10 \times 10 \times 10 \times 10 = 10^4$.

10 is the base and 4 is the exponent.

$$\text{Reciprocal of } \left(\frac{a}{b}\right)^m = \frac{b^m}{a^m} = \left(\frac{b}{a}\right)^m, \text{ so the reciprocal of } \left(\frac{a}{b}\right)^m \text{ is } \left(\frac{b}{a}\right)^m.$$

Multiplying Powers with the Same Base: If a is any non-zero integer and whole numbers are m and n , then

$$a^m \times a^n = a^{m+n}$$

e.g. $2^4 \times 2^2$

$$a = 2, m = 4, n = 2$$

$$2^4 \times 2^2 = 2^{4+2} = 2^6$$

Dividing Powers with the Same Base: If a is any non-zero integer and m, n are the whole number, then $a^m \div$

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

e.g. $2^4 \div 2^2$

$$a = 2, m = 4, n = 2$$

$$2^4 \div 2^2 = 2^{4-2} = 2^2$$

Taking Power of a Power: If a is any non-zero integer and m, n are whole numbers, $(a^m)^n = a^{mn}$

e.g. $(6^2)^4$

$a = 6, m = 2, n = 4$

$$(6^2)^4 = (6)^{2 \times 4} = 6^8.$$

Multiplying Powers with the Same Exponents: If a, b are two non-zero integers and m is any whole number, then

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

e.g. $2^3 \times 3^3$

$a = 2, b = 3, m = 3$

$$2^3 \times 3^3 = (2 \times 3)^3 = 6^3.$$

Dividing Powers with the Same Exponents: If a, b are two non-zero integers and m is a whole number, then

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

e.g. $2^3 \div 3^3$

$a = 2, b = 3, m = 3$

$$2^3 \div 3^3 = \frac{2^3}{3^3} = \left(\frac{2}{3}\right)^3$$

Numbers with Exponent Zero: If a be any non-zero integer, then, $a^0 = 1$

e.g. $\frac{2^5}{2^5} = 2^{5-5} = 2^0 = 1$

Numbers with Negative Exponent: If a is any non-zero integer, then $a^{-1} = \frac{1}{a}$

e.g. $2^{-5} = \frac{1}{2^5}$

In decimal number system, the exponents of 10 start from a maximum value and go on decreasing from the left to right upto 0.

e.g. $45672 = 4 \times 10000 + 5 \times 1000 + 6 \times 100 + 7 \times 10 + 2 \times 1$

$$= 4 \times 10^4 + 5 \times 10^3 + 6 \times 10^2 + 7 \times 10^1 + 2 \times 10^0$$

It is called expanded form of a number.

Any number can be expressed as a decimal number between 1.0 and 10.0 including 1.0 multiplied by a power of 10. Such a form of a number is called its standard form.

e.g. $56782 = 5.6782 \times 10000 = 5.6782 \times 10^4$.

It is the standard form of 56782.