7th Standard- Maths 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 10⁴ 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.

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

(-1)an even natural number = +1

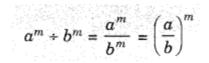
 $a^m \times a^n = a^{m+n}$, where m and n are whole numbers and a ($\neq 0$) is an integer. This formula can be used to write answers to above questions.

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)



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

a⁰ = 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

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

Expressing Larg<mark>e Nu</mark>mbers i<mark>n the Standard Form</mark>

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 $1 \le k < 10$ 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 \times a (n times). a^n is known as the nth 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 × 10 × 10 × 10 = 10⁴.

10 is the base and 4 is the exponent.

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

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 QUESTION 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. (6²)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

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

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 $a^{-1} = 1a$ e.g. $2^{-5} = 125$

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 × 10000 + 5 × 1000 + 6 × 100 + 7 × 10 + 2 × 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 × 10000 = 5.6782 × 10⁴.

It is the standard form of 56782.

