

1. Exponent.

Exponentiation is a mathematical operation, written as b^n , involving two numbers, the **base** b and the **exponent** n . When n is a positive integer, exponentiation corresponds to repeated multiplication of the base: that is, b^n is the product of multiplying n bases:

$$b^n = \underbrace{b \times \cdots \times b}_n$$

In that case, b^n is called the n -th power of b , or b raised to the power n .

Properties of exponent:

If the same base raised to the different power and then multiplied:

$$b^3 \times b^4 = (b \times b \times b) \times (b \times b \times b \times b) = b \times b \times b \times b \times b \times b \times b = b^{3+4} = b^7$$

Or in a more general way:

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

If the base raised to the power of n then raised again to the power of m :

$$(b^2)^3 = (b \cdot b)^3 = (b \cdot b) \cdot (b \cdot b) \cdot (b \cdot b) = b^{2 \cdot 3} = b^6$$

$$(b^n)^m = b^{n \cdot m}$$

$$b^1 = b;$$

$$b^0 = 1, \text{ for any } b \text{ except } 0.$$

If two different bases raised to the same power, then:

$$(a \cdot b)^3 = (a \cdot b) \cdot (a \cdot b) \cdot (a \cdot b) = a \cdot a \cdot a \cdot b \cdot b \cdot b = a^3 b^3$$

$$(a \cdot b)^n = a^n b^n$$

The exponent indicates how many copies of the base are multiplied together. For example, $3^5 = 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 = 243$. The base 3 appears 5 times in the repeated multiplication, because the exponent is 5. Here, 3 is the *base*, 5 is the *exponent*, and

243 is the *power* or, more specifically, *the fifth power of 3*, *3 raised to the fifth power*, or *3 to the power of 5*.

$$2^3 \cdot 2^2 =$$

$$5^2 \cdot 5 =$$

$$2^5 \cdot 2^3 \cdot 2 =$$

$$(2^3)^2 =$$

$$(3^7)^2 =$$

$$(n^5)^3 =$$