

Grade 6 · Exponents and Order of Operations · Lesson

Common Core 6.EE.A.1, 6.EE.A.2c · mathovore.fr

An exponent tells how many times a base is used as a factor, so $2^4 = 2 \times 2 \times 2 \times 2 = 16$. The order of operations, PEMDAS, says to evaluate parentheses first, then exponents, then multiplication and division from left to right, and finally addition and subtraction from left to right.

Grade 6 Common Core: 6.EE.A.1 · 6.EE.A.2c

Key facts:

- In b^n , the base b is multiplied by itself n times, so $3^4 = 81$, not 12.
- A power of 10 has as many zeros as its exponent: $10^5 = 100,000$.
- PEMDAS order: Parentheses, Exponents, Multiplication and Division (left to right), Addition and Subtraction (left to right).
- An exponent affects only the base next to it: $2 \times 3^2 = 18$, but $(2 \times 3)^2 = 36$.

What is an exponent?

An exponent is a small raised number that tells how many times a base is used as a factor. In 5^3 , the base is 5 and the exponent is 3, so $5^3 = 5 \times 5 \times 5 = 125$. Read 5^2 as "five squared" and 5^3 as "five cubed."

Definition: power, base, exponent

A **power** is a number written as b^n . The **base** b is the repeated factor and the **exponent** n counts the factors. For a whole number $n \geq 2$, b^n means n copies of b multiplied together, and $b^1 = b$.

An exponent is not repeated multiplication of the base by the exponent: $2^4 = 2 \times 2 \times 2 \times 2 = 16$, but $2 \times 4 = 8$.



Three factors of 5: $5^3 = 5 \times 5 \times 5 = 125$.

What are powers of 10?

Powers of 10 follow a pattern: the exponent equals the number of zeros after the 1.

Power	Product	Value
10^1	10	10
10^2	10×10	100
10^3	$10 \times 10 \times 10$	1,000
10^4	$10 \times 10 \times 10 \times 10$	10,000
10^6	six factors of 10	1,000,000

Power	Zeros	Value
10^1	1	10
10^2	2	100
10^3	3	1,000
10^4	4	10,000
10^6	6	1,000,000

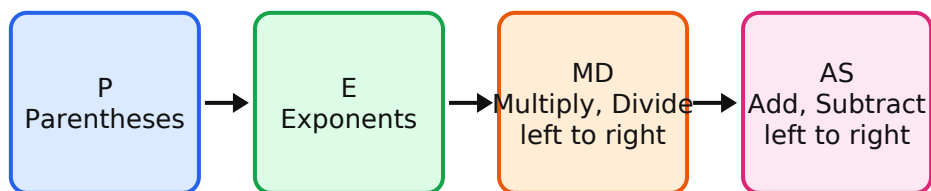
The exponent equals the number of zeros.

What is the order of operations?

Without one agreed order, $2+3 \times 4$ could mean 20 or 14. Everyone uses the same order, remembered as PEMDAS:

1. **P**arentheses and other grouping symbols, innermost first
2. **E**xponents
3. **M**ultiplication and **D**ivision, from left to right
4. **A**ddition and **S**ubtraction, from left to right

Multiplication and division share one level, and so do addition and subtraction. That is why $24 \div 4 \times 3 = 6 \times 3 = 18$, not $24 \div 12 = 2$.



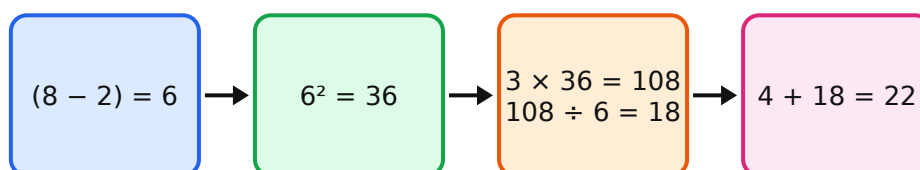
PEMDAS: work down the list.

How do you evaluate an expression with exponents and parentheses?

Work one operation at a time and rewrite the expression after each step. Example: evaluate $4+3\times(8-2)^2\div6$.

1. Parentheses: $8-2=6$, so the expression is $4+3\times6^2\div6$.
2. Exponents: $6^2=36$, so it is $4+3\times36\div6$.
3. Multiplication and division, left to right: $3\times36=108$, then $108\div6=18$.
4. Addition: $4+18=22$.

An exponent applies only to the number or group directly to its left. In 2×3^2 , only the 3 is squared: $2\times9=18$. With parentheses, $(2\times3)^2=6^2=36$.



Worked example: $4+3\times(8-2)^2\div6=22$.

Exponents and Order of Operations: frequently asked questions

What does an exponent mean in math?

An exponent tells how many times to multiply the base by itself. For example, 4^3 means $4\times4\times4=64$. The exponent is not multiplied by the base.

What does PEMDAS stand for?

PEMDAS stands for Parentheses, Exponents, Multiplication and Division, Addition and Subtraction. It lists the order in which operations are done. Multiplication and division share a level, as do addition and subtraction.

Do you always multiply before you divide?

No. Multiplication and division have equal rank, so work them from left to right as they appear.

For example, $36 \div 6 \times 3 = 6 \times 3 = 18$.

How do you write a large number as a power of 10?

Count the zeros after the 1. A number with 7 zeros after the 1, such as 10,000,000, equals 10^7 .

What is the difference between 2 times 3 squared and 2 times 3, all squared?

Without parentheses, only the 3 is squared: $2 \times 3^2 = 2 \times 9 = 18$. With parentheses, the whole product is squared: $(2 \times 3)^2 = 6^2 = 36$.