

Powers, Powers of Ten and Order of Operations

Grade 6 math · Lesson · Standards: 6.EE.A.1, 6.EE.A.2c

Quick answer: An exponent tells how many times a base is used as a factor, so $4^3 = 4 \times 4 \times 4 = 64$. A power of 10 has as many zeros as its exponent: $10^5 = 100,000$. For expressions with several operations, use PEMDAS: grouping symbols, exponents, multiply and divide left to right, then add and subtract left to right.

Standards: 6.EE.A.1, 6.EE.A.2c · **Level:** Grade 6

What is an exponent?

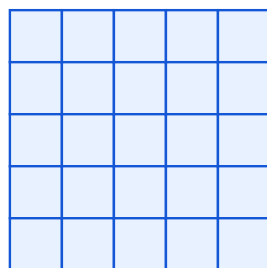
Power, base and exponent

A **power** is a short way to write repeated multiplication. The **base** is the number being multiplied, and the **exponent** tells how many times it appears as a factor. So $4^3 = 4 \times 4 \times 4 = 64$.

$$\begin{array}{c}
 \text{exponent: how many times} \\
 \text{4}^3 \\
 \text{base: the factor that repeats}
 \end{array}
 = 4 \times 4 \times 4 = 64$$

In 4^3 , the base is 4 and the exponent is 3.

Read 5^2 as “5 squared” and 5^3 as “5 cubed.” Squaring 5 gives a 5-by-5 array of 25 tiles.



5 tiles per side

$$5^2 = 5 \times 5 = 25 \text{ tiles.}$$

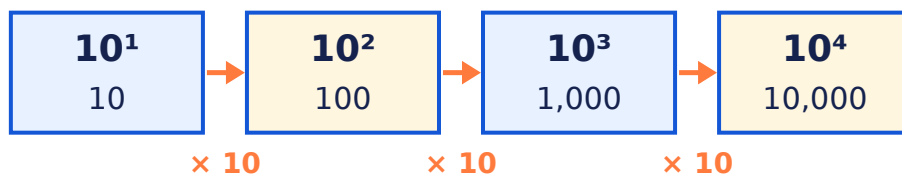
Common mistake

Multiplying the base by the exponent. 4^3 is 64, not $4 \times 3 = 12$.

Power	Read as	Repeated product	Value
2^4	2 to the fourth	$2 \times 2 \times 2 \times 2$	16
3^3	3 cubed	$3 \times 3 \times 3$	27
9^2	9 squared	9×9	81

How do powers of 10 work?

Powers of 10 are the easiest to write out: the exponent equals the number of zeros.



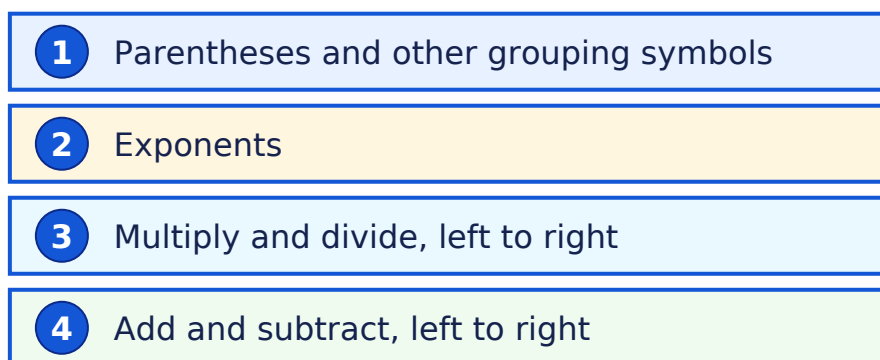
Each power of 10 has one more zero than the one before.

So $10^6 = 1,000,000$ (six zeros), and $100,000 = 10^5$.

What is the order of operations?

Grouping symbols include parentheses, brackets and fraction bars. Whatever sits inside them is treated as a single number and is simplified before the rest of the expression.

When an expression mixes operations, everyone must get the same answer, so we agree on an order. Remember it as PEMDAS (or GEMS: grouping, exponents, multiply/divide, subtract/add).



The order of operations (PEMDAS).

Method: evaluate step by step

1. Work inside grouping symbols first, using the order within them.
2. Evaluate every power.
3. Multiply and divide in order from left to right.
4. Add and subtract in order from left to right.

Worked example

Evaluate $7 + 2 \times (9 - 4)^2 \div 5$.

Grouping: $7 + 2 \times 5^2 \div 5$. Exponent: $7 + 2 \times 25 \div 5$. Multiply, then divide: $7 + 50 \div 5 = 7 + 10$. Add: **17**.

Mathbot's tip

Rewrite the whole expression after every single step. That keeps the order clear and stops slips.

Key points to remember

- a^n means a used as a factor n times.
- 10^n is a 1 followed by n zeros.
- Evaluate grouping symbols first, then exponents.
- Multiplication and division share a level; so do addition and subtraction.
- Within a level, work from left to right.

Powers, Powers of Ten and Order of Operations: frequently asked questions

What does 2 to the 5th power mean?

It means $2 \times 2 \times 2 \times 2 \times 2$, five factors of 2. The value is 32. It is not $2 \times 5 = 10$.

Why does order of operations matter?

Without an agreed order, one expression could have several answers. For example, $3 + 4 \times 5$ is 23 because multiplication comes before addition, not 35.

Does multiplication always come before division?

No. They share a level, so work left to right. In $24 \div 6 \times 2$, divide first to get 4, then multiply to get 8.

How many zeros does 10 to the 7th power have?

Seven zeros, so $10^7 = 10,000,000$. The exponent on 10 always equals the number of zeros.

What is the difference between PEMDAS and GEMS?

They name the same order. GEMS stands for grouping, exponents, multiply or divide, subtract or add, and it reminds students that those pairs are on one level.