

Grade 8 · Scientific Notation · Lesson

Common Core 8.EE.A.3, 8.EE.A.4 · mathovore.fr

Scientific notation writes a number as a coefficient from 1 up to (but not including) 10 times a power of 10, such as 4.5×10^7 or 6.2×10^{-4} . Large numbers get positive exponents and numbers below 1 get negative exponents. Multiply by adding exponents and divide by subtracting them.

Grade 8 Common Core: 8.EE.A.3 · 8.EE.A.4

Key facts:

- Standards 8.EE.A.3 and 8.EE.A.4: write, compare and calculate with numbers in the form $a \times 10^n$.
- Move the decimal point after the first nonzero digit; the number of places moved is the exponent.
- To find how many times as much, divide the coefficients and subtract the exponents.
- Multiply by adding exponents; add or subtract only after both numbers share the same power of 10.
- Calculator notation 3.2E5 means 3.2×10^5 , and 7.5E-3 means 7.5×10^{-3} .

What is scientific notation?

Scientific notation writes a number as a product $a \times 10^n$, where a is at least 1 but less than 10 and n is an integer. The distance from the Sun to Earth, about 93,000,000 miles, becomes 9.3×10^7 miles. It saves you from counting zeros.

Vocabulary

Coefficient: the factor a with $1 \leq a < 10$.

Power of 10: 10^n ; a positive n tells how many 10s multiply, and a negative n means a reciprocal, so $10^{-3} = \frac{1}{1000}$.

Order of magnitude: the power of 10 that a number is closest to; it shows how big the number is.

10^{-3}	10^{-2}	10^{-1}	10^0	10^1	10^2	10^3
0.001	0.01	0.1	1	10	100	1,000

tive exponents: numbers less than 1. Positive exponents: numbers 10 or more

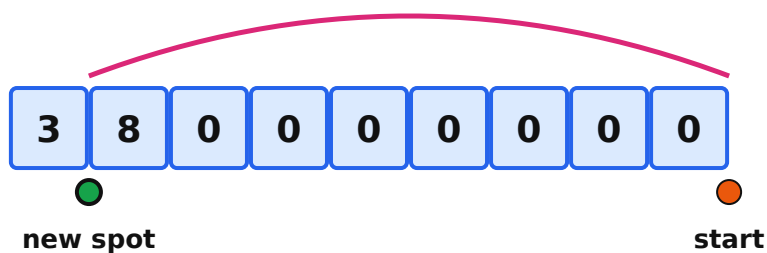
Each step right multiplies by 10, and each step left divides by 10.

How do you write a number in scientific notation?

1. Move the decimal point so that it sits just after the first nonzero digit.
2. Count the places you moved it.
3. Use that count as the exponent: positive when the original number is 10 or more, negative when it is less than 1.

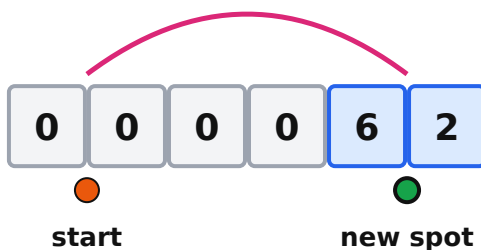
Worked example. For 380,000,000, the point moves 8 places left, so it is 3.8×10^8 . For 0.00062, the point moves 4 places right, so it is 6.2×10^{-4} .

8 places left



Moving the point left 8 places: $380,000,000 = 3.8 \times 10^8$.

4 places right

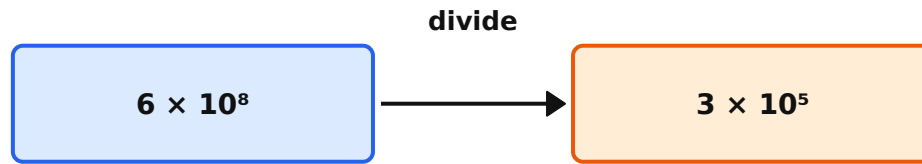


Moving the point right 4 places: $0.00062 = 6.2 \times 10^{-4}$.

How do you compare numbers in scientific notation?

Compare exponents first; the larger exponent wins when the coefficients are between 1 and

10. To find **how many times as much** one number is as another, divide: $\frac{6 \times 10^8}{3 \times 10^5} = 2 \times 10^3$, so the first is 2,000 times as large.

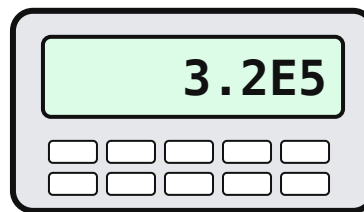


Divide the coefficients ($6 \div 3 = 2$) and subtract the exponents ($8 - 5 = 3$).

How do you calculate with scientific notation?

- **Multiply:** multiply the coefficients and add the exponents. $(3 \times 10^4)(2 \times 10^3) = 6 \times 10^7$.
- **Divide:** divide the coefficients and subtract the exponents.
- **Add or subtract:** rewrite both numbers with the same power of 10 first.
- **Fix the coefficient:** $(4 \times 10^5)(5 \times 10^{-2}) = 20 \times 10^3 = 2 \times 10^4$.

A calculator shows 3.2×10^5 as 3.2E5, and 7.5×10^{-3} as 7.5E-3. Pick units that keep numbers readable: miles for city distances, inches for a sheet of paper.



The display 3.2E5 means 3.2×10^5 , which is 320,000.

Scientific Notation: frequently asked questions

Why must the coefficient be at least 1 and less than 10?

This rule gives each number exactly one scientific-notation form, so numbers are easy to compare. For example, 45×10^3 is rewritten as 4.5×10^4 .

What does a negative exponent mean?

It means the number is less than 1. Since $10^{-3} = \frac{1}{1000}$, the number 2×10^{-3} is 0.002.

How do you tell which of two numbers in scientific notation is larger?

Compare the exponents first. The larger exponent gives the larger number. If the exponents match, compare the coefficients: 6.1×10^4 is larger than 5.9×10^4 .

How do you add numbers in scientific notation?

Rewrite one number so both have the same power of 10, add the coefficients, and then fix the coefficient if needed. So $4.8 \times 10^5 + 3.7 \times 10^6 = 0.48 \times 10^6 + 3.7 \times 10^6 = 4.18 \times 10^6$.

What does E mean on a calculator?

E stands for "times 10 to the power". The display 1.8E7 means 1.8×10^7 , which is 18,000,000. The display 4E-5 means 0.00004.