

Grade 8 - Scientific Notation - Lesson

Common Core 8.EE.A.3, 8.EE.A.4 · maths-pdf.fr/en/

Scientific notation writes a number as a product $a \times 10^n$, where a is at least 1 and less than 10 and n is an integer. It makes very large numbers, like 93,000,000, and very small numbers, like 0.00032, short and easy to compare and calculate with. The exponent counts how many places the decimal point moves.

Grade 8 · Common Core State Standards: **8.EE.A.3, 8.EE.A.4**

Key facts

- Form: $a \times 10^n$ with $1 \leq a < 10$.
- $93,000,000 = 9.3 \times 10^7$ and $0.00032 = 3.2 \times 10^{-4}$.
- To multiply, multiply the front numbers and add the exponents; to divide, subtract the exponents.
- To add or subtract, first write both numbers with the same power of 10.
- To tell how many times as large one value is, divide the two values.

What is scientific notation?

Scientists use scientific notation to write very large or very small numbers without a long string of zeros. A number is in scientific notation when it looks like a single nonzero digit, a decimal part, and a power of 10.

Scientific notation

A number is in **scientific notation** when it is written as $a \times 10^n$, where $1 \leq a < 10$ and n is an integer. Large numbers have a positive n ; numbers between 0 and 1 have a negative n .

How do you convert to and from scientific notation?

Move the decimal point until exactly one nonzero digit is to its left. The number of places you moved is the exponent. Moving left gives a positive exponent, and moving right gives a negative exponent.



Move the decimal point 3 places

$$4,500 = 4.5 \times 10^3 \text{ (move the point 3 places left).}$$

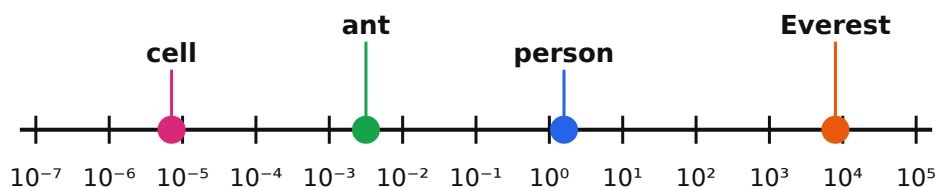


Move the decimal point 4 places right

$$0.00032 = 3.2 \times 10^{-4} \text{ (move the point 4 places right).}$$

How do you compare very large and very small numbers?

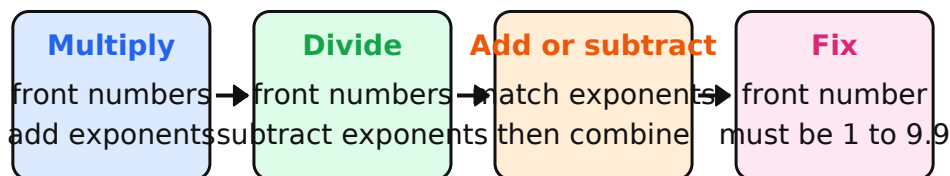
Compare the exponents first, then the front numbers. The distance of Earth from the Sun is about 9.3×10^7 miles and a red blood cell is about 7×10^{-6} meter wide. A number line of powers of 10 shows the huge difference in scale.



Each tick is 10 times the one before.

To say how many times as large one quantity is, divide: $\frac{6 \times 10^8}{3 \times 10^5} = 2 \times 10^3$, so the first is 2,000 times the second.

How do you calculate with scientific notation?



Rules for the four situations.

Worked example. Multiply $(4 \times 10^5)(5 \times 10^3)$. Multiply the front numbers: $4 \times 5 = 20$. Add the exponents: $5 + 3 = 8$. That gives 20×10^8 , but 20 is too large, so write 2×10^9 .

For addition, write both numbers with the same power of 10 first:

$3.5 \times 10^4 + 4.2 \times 10^3 = 3.5 \times 10^4 + 0.42 \times 10^4 = 3.92 \times 10^4$. Choose sensible units too: use 10^{-6} meter for cells and 10^7 miles for planets.

Questions about scientific notation

How do I know if the exponent is positive or negative?

A number greater than or equal to 10 has a positive exponent. A number between 0 and 1 has a negative exponent. The number 1 itself has exponent 0.

Is 45×10^3 in scientific notation?

No, because 45 is not between 1 and 10. Move one place: $45 \times 10^3 = 4.5 \times 10^4$.

Why use scientific notation?

It avoids counting zeros and makes comparison easy. A mass of 5.97×10^{24} kg is easier to read than 5,970,000,000,000,000,000,000,000 kg.

How do I multiply numbers in scientific notation?

Multiply the front numbers, add the exponents, and rewrite the answer if the front number is 10 or more. For example, $(3 \times 10^4)(2 \times 10^3) = 6 \times 10^7$.

Can I use a calculator?

Yes. Calculators show $a \times 10^n$ as aEn, such as 3.2E-4. On paper, always rewrite it as a product with a power of 10.