

The Scientist

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Math – exercises everyday – Physics– Numberphile– Math is fun



Mathematics, a universal language

Today what is the language that everybody knows, knew and will know?

Mathematics, it is the only language shared by all human beings throughout the world and time. French can't speak Japanese, for the most part. Math is a universal language because the principles and foundations of maths are the same everywhere around the world. Pi is always approximately 3.14 regardless of culture, religion, or gender... $2+1$ will always be equal to 3. Even if there are lots of cultural diversities in the world, maths is the only thing that is common to everyone (a circle is always a circle).

Mathematics has existed since 2000 BC with the Babylonians (an ancient civilisation), and their number system looks very close to ours. Numeracy is timeless, Egyptian were using numeracy to build their pyramids and we still use it for architecture. You might think that mathematics is only for specialists but no, you are using it every day. Anything that studies the interaction between quantities, variables, structure, and change, is mathematics. Math is a concept which helps us with everyday life from business to politics. With this universal language we have accomplished so much: from understating our molecular system to cooking meals. This shared language of numbers is what connects us as human beings; it's not only for mathematicians.

Even if some countries use different metric system the principles of maths (the concept of maths) remained always the same: the measures are going to be equal. It works for all mathematics, geometry keeps the same definitions, and probability doesn't change. Mathematics is the most fundamental type of logic possible. The result is going to be common, everywhere in the world.

The universal language of math is a great reminder that we belong to the same community.

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Mathematics, a language of precision

With ordinary words, we can observe and talk about our environment. For example if I see a table, I can say "I see a table". But we can be more precise by using adjectives: "I see a red medium-seized table. In this sentence I was a bit more precise in my description, but we can ask ourselves other questions about this table: What is the shape of my table? What is the exact area of the top of my table? What is the table's colour? We can answer all those questions with mathematics:

What is the shape of my table?

It can be a rectangular table or a round table. These are geometric shapes, this is mathematics.

Rectangle : a quadrilateral with 4 right angles

A circle

What is the exact area of the top of my table?

In both cases, it's possible to express the area of the shapes. For example, in the case of the rectangle, we say that the top of the table measures 6 400 cm². But in the case of the circle, to express the exact area, we must use π , an irrational number. The table can measure 1π m², or approximately 3,14 m².

What is the exact color of my table.

I can say that I have a red table, but we can be more precise. To express the exact colour of an object, we use the wavelength :



This is expressed in nanometers (nm). So I can say that the wavelength of the colour of my red table is 750 nm, for example. This is much more precise than "red table"

To conclude, with mathematics we can be much more precise than with ordinary words, in an universal way that we can understand everywhere.

Fun corner

Here's a math joke that only French can understand:

« $9x^2 + 8x + 3$ ».

« What do you mean by that? »

«Never mind, it is of second degree.»

Express numbers in different languages and what problems may arise

Each language has its own way to express numbers. Some also have different mathematics notations. But Those differences can be the cause of problems, more or less important.

When counting up to 100, Chinese use only ten number names, while English has more than two dozen unique number words. The trouble starts at "11."

English for example has a unique word for 11, and a composite word for 19, while Chinese (as well as Japanese and Korean, among other languages) have words that can be translated as "ten-one"..... This makes easier for children to understand the value of numbers. Let us compare several languages: As we have mentioned, in Chinese, all the numbers from 11 to 19 are made of "ten" plus the "unit", spoken with **shi** (10) first: **shi-yi** for 11 ... **shi-jiu** for 19. In English and German you have special words for 11 and 12. Then, when having to express numbers 13 to 19, first of all you have to say the units, and then you say « **zehn** » in German, « **teen** » in English, meaning 10. Compared to French, it's not totally exactly the same writing, because in French you have special names for numbers from 11 to 16, and it's just when you have to express numbers 17 to 19 that you use 10 and the units. For example in German for 17 you say seven and then ten (siebzehn) and in French you say ten and then seven (dix-sept). So the handwriting for these numbers is the opposite of the one in English and German. In Italian, all numbers between 11 and 19 are composite, but when you have to express numbers 11 to 16, you have to say first the units and then 10, and then for numbers 17 to 19 it's firstly 10 and then the units. For example to say eleven you write **undici** and to say **seventeen** you write **dicassette**.

When doing multi-digit addition and subtraction, children working with English number names for example have a harder time understanding that two-digit numbers are made up of tens and ones than the Chinese, making it more difficult to avoid errors. It feels more natural for Chinese speakers than for English speakers to use the "make-a-ten" addition and subtraction strategies taught to children.



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THE LANGUAGE OF MATHS : English VS French numbers

TWO GUYS, FRENCH AND ENGLISH, ARE TALKING ABOUT NUMBERS...AND THEY DON'T AGREE ON EVERYTHING :



DO YOU KNOW THAT YOU'RE STRANGE, THE FRENCH ?!
LOOK ! AFTER 69 YOU USE "SOIXANTE-DIX" ! YOU ADD 10 ?!
WHY ?

NO NO NO ! WE'RE PERFECTLY NORMAL, WE, AT LEAST DIDN'T INVENT NEW NUMBERS LIKE "SEVENTEEN"



OK, OK THAT'S FINE, BUT WATCH THIS !!
"QUATRE-VINGT ONZE"
(4 TWENTIES AND ELEVEN ??!)



ARE YOU REALLY TRYING TO MAKE IT AS ILLOGICAL AND DIFFICULT AS POSSIBLE ?

YES, YES,...
IT'S AN ANCIENT GAULISH COUNTING SYSTEM WHICH IS BASE 20. THAT'S WHY WE USE QUATRE VINGT : " $4 \times 20 + 11$ "



Mathematics is a universal language. However, French and English numbers do not follow exactly the same system. Let's see the characteristics of these languages.

- First of all, we are going to compare the way these numbers are expressed in words.

In English there are twelve different words for the 12 first numbers. However the French made 16 words for the 16 first numbers.

In the same way, English people express the tens by using ten different numbers (10: ten, 20: twenty, 30: thirty, 40: forty, 50: fifty, 60: sixty, 70: seventy, 80: eighty, 90 ninety). Then they add the units (one to nine) with tens. That's why when an English speaker wants to express 71, he will write : seventy-one. On the contrary, French people have only six words for the five first tens (10: dix, 20: vingt, 30: trente, 40: quarante, 50: cinquante, 60: soixante). After 60, the French express the tens differently.

For example, they write "soixante-dix" for seventy. "Soixante-dix" means sixty-ten. The French haven't invented a word for 70. By the same way they say 72, "soixante-douze", that means sixty + twelve. Also, for 80 French say "quatre-vingt", that means "four-twenty". These rules are very weird for people who are not French, they don't understand their logic. To carry on, as 70, the French express 90 this way: "quatre-vingt-dix" more precisely: $4 \times 20 + 10$.

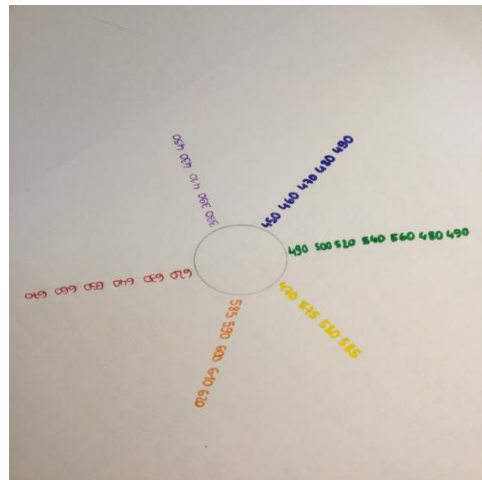
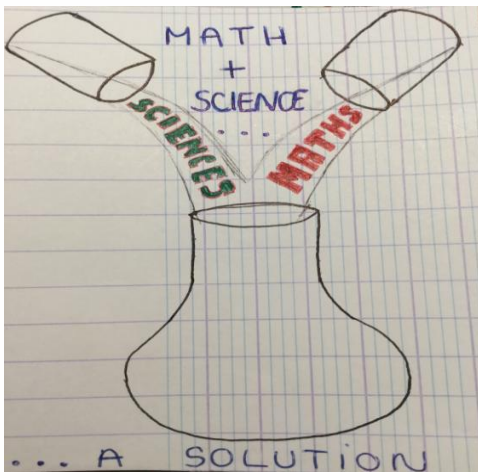
- Secondly, we are going to compare the way these numbers are written.

English use a point (7.69) instead of the French coma (7,69), to separate the units from the decimal part. Also, English use a comma to separate the thousands, the millions (1,876,589) This is confusing because for huge numbers French people often write a point to separate the groups of three numbers (1.876.589). Because of this problem, once, a doctor confused the dose of medicine and the patient died.

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Mathematics: the language of science



Many people think about English, Spanish, German or Chinese when they speak about languages. But a language is not only defined by words or sentences. A language is the way to speak out, share ideas, and to exchange with others, such as the sign language. For mathematics it is the same thing, but it is a unique language because it defines, characterises, expresses, and demonstrates that all the things that compose the world, around us and that we are, is what it is.

Numbers can illustrate physical events such as the speed of the light, wavelengths, the diameter of the earth, the light intensity and the electrical strength. The language of mathematics allows us to describe with a high level of precision the world around us.

Let's see the example of the light. The visible light is shown by different colours. Each colour is associated with a different wavelength. The wavelength of the rays gives the perception of the colour to our brain. A wavelength is a measure of distance between 2 identical peaks (high points) or through (low points) in a wave, a repeating pattern of travelling energy like light or sound. As for Mathematics, it describes with precision the light through the graphical representation of the sinusoidal function. To put it in a nutshell math and physics are closely linked.

In physics we use a lot of mathematical models, very abstract, theoretical mathematics models, always seeking confirmation with the experiments. These models can describe all the universe from the black holes, to relativity, using the description of energy. One of the most famous models, in quantum mechanics, is the equation of Schrödinger, an Austrian physicist. It is a differential equation, known as a wave-equation. When he discovered it, it was a great advance for the other scientists. We also have the equation of Einstein, $E=mc^2$, describing the relation between energy, mass and speed.

So we can see that mathematics is very important in physics and in science in general. It can show things that we can't describe with words or drawings and that we can't observe precisely in real life. So mathematics is a language for science and can lead us to discoveries in the whole universe.

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