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THE NEW NUMERICAL METHOD

Mathematics surpasses the level of just arithmetic. With mathematics you do not only work with numbers, but also with letters so we can make formulas (and equations) and work with them. With these formulas we can express relations a lot easier. Mathematics enables us to communicate without useless human language. Just adding, multiplying, is-equal-to, etcetera. A language that is understood all over the world. The mathematical symbols are the same, whether you speak English, French, Spanish or Dutch.

Mathematics creates order in the chaos of the world

There are all kinds of relations in the world around us. Easy relations like between time and speed or time and the amount in your savings account, but also difficult relations like the (gravitational) forces between two planets. All these relations can be expressed in formulas to create order in or understanding of the universe. Formulas are therefore not only important within the subject mathematics itself. They are essential for subjects as physics, chemistry, biology and economics. So, you have to be able to work with formulas to progress in these subjects. This is the reason why the Dutch government has declared mathematics a 'core subject'. For all those students who are studying these exact sciences. In school but also after.

Further education / science

A diploma of a secondary school gives you a broad basis. With this diploma you can, sometimes dependent on your chosen subjects, go to any further education.

Some choose a study in which they do not need maths at all. Others choose to study maths or a study in which they use maths. You can say this about any subject in secondary school. Saying that "Maths does not have to be taught at secondary school, because you do not use it everyday life" can also be said about other subjects like for example French, history or musical studies.

Mathematics is highly necessary in science. Without mathematicians we would not have computers, no mobile phones, no space flight, no weather forecasts, no DVDs, no MRI scanners and I can go on and on. Of course, not everyone will become a scientist. However, when you are in secondary school, you can impossibly foresee where you will end up your working life. Fifty per cent of students switch during their study or want to. Furthermore, a lot of people switch between professions in their later life.

Problem solving capabilities / logical reasoning

You learn how to solve problems when learning mathematics. You will get an uncountable number of mathematical problems during your school career. All these problems you solve by using a certain approach. In most cases this approach consists of a couple of questions you ask yourself. Which information is given? What is asked of me? What do I need as well? How can I get/calculate what is asked of me with the available information? Mathematics makes you a better problem solver!

Computers

Everyday new apps and programs are coming out. Programming is essential here. Why does your computer or smart phone work? Right! Because a mathematician started programming. The processor in your computer or phone is only adding ones and zeros. Really! A smart mathematician has developed this 'calculator' further and further and at a point in time he developed the first programming languages. Programming still is a process in which logic and mathematical knowledge is indispensable. A robot arm in a factory has to be designed, but also programmed. Both will need a lot of maths. All data created or sent in by users have to be stored somewhere.

I would like to bring to your attention that the numerical method was developed over 5,000 years ago. The first evidence we have of zero is from the Sumerian culture in Mesopotamia, some five thousand years back. There, a slanted double wedge was inserted between cuneiform symbols for numbers, written positionally, to indicate the absence of a number in a place (as we would write 102, the '0' indicating no digit in the tens column).

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The symbol changed over time as positional notation (for which zero was crucial), made its way to the Babylonian empire and from there to India, via the Greeks (in whose own culture zero made a late and only occasional appearance; the Romans had no trace of it at all). Arab merchants brought the zero they found in India to the West. After many adventures and much opposition, the symbol we use was accepted and the concept flourished, as zero took on much more than a positional meaning. Since then, it has played a vital role in mathematizing the world.

Before the zero came into existence, mathematicians struggled to perform the simplest arithmetic calculations. Today, zero — both as a symbol (or numeral) and a concept meaning the absence of any quantity — allows us to perform calculus, do complicated equations, and to have invented computers.

"The Indian (shunya) zero, widely seen as one of the greatest innovations in human history, is the cornerstone of modern mathematics and physics.

The mathematical zero and the philosophical notion of nothingness are related but are not the same. Nothingness played a central role very early on in Indian thought (here called shunya), and we find speculation in virtually all cosmogonic myths about what must have preceded the world's creation. In India, the mathematician Brahmagupta and others used small dots under numbers to show a zero placeholder, but they also viewed the zero as having a null value, called "shunya." Brahmagupta was also the first to show that subtracting a number from itself results in zero and when a number is multiplied by zero it becomes zero.

The concept of zero, both as a placeholder and as a symbol for nothing, is a relatively recent development. Our understanding of zero is profound when you consider this fact: We don't often, or perhaps ever, encounter zero in nature. Zero's influence on our mathematics today is twofold. One: It's an important placeholder digit in our number system. Two: It's a useful number in its own right.

Here's an example of what I mean: Think of the number 103. The zero in this case stands for "there's nothing in the tens column." It's a placeholder, helping us understand that this number is one-hundred and three and not 13.

Okay, you might be thinking, “this is basic.” But the ancient Romans didn’t know this. Do you recall how Romans wrote out their numbers? 103 in Roman numerals is CIII. The number 99 is XCIX. You try adding CIII + XCIX. It’s absurd. Placeholder notation is what allows us to easily add, subtract, and otherwise manipulate numbers. Placeholder notation is what allows us to work out complicated math problems on a sheet of paper.

If zero had remained simply a placeholder digit, it would have been a profound tool on its own. But around 1,500 years ago (or perhaps even earlier), in India, zero became its own number, signifying nothing. The ancient Mayans, in Central America, also independently developed zero in their number system around the dawn of the common era.

Zero slowly spread across the Middle East before reaching Europe, and the mind of the mathematician Fibonacci in the 1200s, who popularized the “Arabic” numeral system we all use today.

From there, the usefulness of zero exploded. Think of any graph that plots a mathematical function starting at 0,0. This now-universal method of graphing was only first invented in the 17th century after zero spread to Europe. That century also saw a whole new field of mathematics that depends on zero: calculus.

Today, it’s difficult to imagine how you could have mathematics without zero. In a positional number system, such as the decimal system we use now, the location of a digit is really important. Indeed, the real difference between 100 and 1,000,000 is where the digit 1 is located, with the symbol 0 serving as a punctuation mark.

Yet for thousands of years we did without it. The Sumerians of 5,000BC employed a positional system but without a 0. In some rudimentary form, a symbol or a space was used to distinguish between, for example, 204 and 20000004. But that symbol was never used at the end of a number, so the difference between 5 and 500 had to be determined by context.

The first problem is deciding exactly what one means by "zero" or, for that

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matter, "0". Is it a number in the mathematical sense - that is to say, the cardinality of the empty set? The length of a point? The result of subtracting 1 from 1? The digit "0" was a basic part of decimal place value notation. There is no doubt that it was invented in India, but exactly how and for what purpose is unclear.

An inscription on a temple wall in Gwalior, India, dates back to the ninth century, and has been considered the oldest recorded example of a zero, according to the University of Oxford. Another example is an ancient Indian scroll called the Bhakshali manuscript. Discovered in a field in 1881, researchers thought it also had originated in the ninth century. However, recent carbon dating has revealed that it was probably written in the third or fourth century, which pushes the earliest recorded use of zero back 500 years.

Marcus du Sautoy, a professor of mathematics at the University of Oxford, said, "Today we take it for granted that the concept of zero is used across the globe and is a key building block of the digital world. But the creation of zero as a number in its own right, which evolved from the placeholder dot symbol found in the Bakhshali manuscript, was one of the greatest breakthroughs in the history of mathematics.

"We now know that it was as early as the third century that mathematicians in India planted the seed of the idea that would later become so fundamental to the modern world. The findings show how vibrant mathematics have been in the Indian sub-continent for centuries."

Over the next few centuries, the concept of zero caught on in China and the Middle East. According to Nils-Bertil Wallin of YaleGlobal, by 773, zero reached Baghdad where it became part of the Arabic number system, which is based upon the Indian system.

A Persian mathematician, Mohammed ibn-Musa al-Khowarizmi, suggested that a little circle should be used in calculations if no number appeared in the tens place. The Arabs called this circle "sifr," or "empty." Zero was crucial to al-Khowarizmi, who used it to invent algebra in the ninth century. Al-Khowarizmi also developed quick methods for multiplying and dividing numbers, which are known as algorithms — a corruption of his name.

Zero found its way to Europe through the Moorish conquest of Spain and was further developed by Italian mathematician Fibonacci, who used it to do equations without an abacus, then the most prevalent tool for doing arithmetic. This development was highly popular among merchants, who used Fibonacci's equations involving zero to balance their books.

Medieval religious leaders in Europe did not support the use of zero, van der Hoek said. They saw it as satanic. "God was in everything that was. Everything that was not was of the devil," she said.

Wallin points out that the Italian government was suspicious of Arabic numbers and outlawed the use of zero. Merchants continued to use it illegally and secretively, and the Arabic word for zero, "sifr," brought about the word "cipher," which not only means a numeric character, but also came to mean "code."

By the 1600s, zero was used fairly widely throughout Europe. It was fundamental in Rene Descartes' Cartesian coordinate system and in calculus, developed independently by Sir Isaac Newton and Gottfried Wilhem Liebniz. Calculus paved the way for physics, engineering, computers and much of financial and economic theory.

"The concept of emptiness is now central to modern physics: the entire known universe is seen as 'zero sum game' by among others, such as Stephen Hawking," said Gobets.

The numeral and concept of zero, imported from India, has manifested in various ways. "So, commonplace has zero become that few, if any, realize its astounding role in the lives of every single person in the world," said Gobets.

What’s more, 0 at the end of a number makes multiplying and dividing by 10 easy, as it does with adding numbers like 9 and 1 together. The invention of zero immensely simplified computations, freeing mathematicians to develop vital mathematical disciplines such as algebra and calculus, and eventually the basis for computers.

Algebra, algorithms, and calculus — three pillars of modern mathematics, are all the result of a notation for nothing. Mathematics is a science of

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invisible entities that we can only understand by writing them down. India, by adding zero to the positional number system, unleashed the true power of numbers, advancing mathematics from infancy to adolescence, and from rudimentary toward its current sophistication.

The binary number system, also called the base-2 number system, is a method of representing numbers that counts by using combinations of only two numerals: zero (0) and one (1). Computers use the binary number system to manipulate and store all of their data including numbers, words, videos, graphics, and music. In mathematics and digital electronics, a binary number is a number expressed in the base-2 numeral system or binary numeral system which uses only two symbols: typically, "0" and "1". The base-2 numeral system is a positional notation with a radix of 2. Each digit is referred to as a bit.

When we type some letters or words, the computer translates them in numbers as computers can understand only numbers. A computer can understand the positional number system where there are only a few symbols called digits and these symbols represent different values depending on the position they occupy in the number.

The value of each digit in a number can be determined using −

- The digit
- The position of the digit in the number
- The base of the number system (where the base is defined as the total number of digits available in the number system)

Roman Numerals

- The Roman numeral system is the most well-known system that is not a positional system. It is an additive system. The system has no symbol for zero and does not use negative numbers.
- Symbol Value Value as a number
- I one 1

- V five 5
- X ten 10
- L fifty 50
- C one hundred 100
- D five hundred 500
- M one thousand 1000
- Let us start with the list from 1 to 10:
- I, II, III, IV, V, VI, VII, VIII, IX, X
- The original rules were that the value of individual symbols is added unless a symbol with a lower value comes before a value with a higher value. In that case the lower value is subtracted from the higher value. V, L and D are only allowed once in a number. The numbers are written from high to low.
- The following rules are added later, to get an unambiguous system:
- - At most three times the same symbol in succession.
- - At most one lower symbol in front of a higher symbol.
- And these two rules that are not always taken in to account:
- - V, L and D are not used to subtract, so not VC but XCV.
- - A symbol can only be subtracted from a symbol that is five or ten times bigger, so not IC but XCIX

Examples:

- Value Roman numeral

78 LXXVIII

1244 MCCXLIV

2021 MXXI

1987 CMLXXXVIII

Exception: the number four

- On clocks you often see IIII instead of IV for four. The most heard explanation is that IV were the first letters of Jupiter (IVPITER in Latin) and therefore not used. Another reason can be that IV is often upside down on a clock. It may be confused with VI. The IIII also gives a certain symmetry. As you have I, II, III, IIII (= four numerals with I), V, VI, VII, VIII (= four numerals with V) and IX, X, XI, XII (= four numerals with X).
- If you strictly uphold all rules, the biggest number possible is MMMCMXCIX = 3999, as you can only use M thrice in succession.

Decimal Number System

The number system that we use in our day-to-day life is the decimal number system. Decimal number system has base 10 as it uses 10 digits from 0 to 9. In decimal number system, the successive positions to the left of the decimal point represent units, tens, hundreds, thousands, and so on.

Each position represents a specific power of the base (10). For example, the decimal number 1234 consists of the digit 4 in the unit's position, 3 in the tens position, 2 in the hundreds position, and 1 in the thousands position. Its value can be written as

$(1 \times 1000) + (2 \times 100) + (3 \times 10) + (4 \times 1)$
$(1 \times 10^3) + (2 \times 10^2) + (3 \times 10^1) + (4 \times 10^0)$
$1000 + 200 + 30 + 4$
1234

As a computer programmer or an IT professional, one should understand the following number systems which are frequently used in computers.

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Sl. No.	Number System and Description
1	**Binary Number System** Base 2. Digits used: 0, 1
2	**Octal Number System** Base 8. Digits used: 0 to 7
3	**Hexadecimal Number System** Base 16. Digits used: 0 to 9, Letters used: A- F

Binary Number System

Characteristics of the binary number system are as follows −

- Uses two digits, 0 and 1
- Also called as base 2 number system
- Each position in a binary number represents a **0** power of the base (2). Example 2^0
- Last position in a binary number represents a **x** power of the base (2). Example 2^x where **x** represents the last position - 1.

Example

Binary Number: 10101_2

Calculating Decimal Equivalent −

Step	Binary Number	Decimal Number

Step 1	10101_2	$((1 \times 2^4) + (0 \times 2^3) + (1 \times 2^2) + (0 \times 2^1) + (1 \times 2^0))_{10}$
Step 2	10101_2	$(16 + 0 + 4 + 0 + 1)_{10}$
Step 3	10101_2	21_{10}

Note − 10101_2 is normally written as 10101.

Octal Number System

Characteristics of the octal number system are as follows −

- Uses eight digits, 0, 1, 2, 3, 4, 5, 6, 7
- Also called as base 8 number system
- Each position in an octal number represents a **0** power of the base (8). Example 8^0
- Last position in an octal number represents a **x** power of the base (8). Example 8^x where **x** represents the last position - 1

Example:

Octal Number: 12570_8

Calculating Decimal Equivalent −

Step	Octal Number	Decimal Number
Step 1	12570_8	$((1 \times 8^4) + (2 \times 8^3) + (5 \times 8^2) + (7 \times 8^1) + (0 \times 8^0))_{10}$
Step 2	12570_8	$(4096 + 1024 + 320 + 56 + 0)_{10}$

Step 3	12570_8	5496_{10}

Note − 12570_8 is normally written as 12570.

Hexadecimal Number System

Characteristics of hexadecimal number system are as follows −

- Uses 10 digits and 6 letters, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F
- Letters represent the numbers starting from 10. A = 10. B = 11, C = 12, D = 13, E = 14, F = 15
- Also called as base 16 number system
- Each position in a hexadecimal number represents a **0** power of the base (16). Example, 16^0
- Last position in a hexadecimal number represents a **x** power of the base (16). Example 16^x where **x** represents the last position - 1

However, we are still teaching wrong numerical system to our children in the schools. During their early schooling years, children are not aware of the value of 'ZERO' but when they grow up and take admission to college and are confronted with the subject of Calculus, suddenly the value of 'ZERO' arises. Due to this suddenness, the students find themselves in a confusing situation as they never respected the value of 'ZERO' in their school curriculum.

Now in study of Calculus they learn to respect 'ZERO' but I think it's caused a lot of delay for them to realize the value of 'ZERO' in their life. With this delay, their study of Calculus is going to be a failure in college and the student throughout his life spends time in understanding the meaning of value of 'ZERO'.

In the above scenario my new Numerical System should be taught to children from the initial period in school so that they understand the meaning of 'ZERO' from childhood. If this is followed then while they study Calculus in college they will not land in confusion. Instead in college during the study of Calculus they will succeed. My new Numerical Method solves this problem.

INTRODUCTION TO MY NEW NUMERICAL METHOD

There are 11 numbers totally and they are as follows:

0 1 2 3 4 5 6 7 8 9 10

The basic digits are 0 1 2 3 4 5 6 7 8 9. 10 is formula Digit. This is due to the fact that it is constructed by using the formula of taking 1 and 0 and making 10; from 10 onwards the formula digits appear and this means that the value of digits will depend on their placement (position).

The new Numerical Method is detailed as follows:

I	II	III	IV	V	VI	VII	VIII	IX	X
0									
1	11	21	31	41	51	61	71	81	91
2	12	22	32	42	52	62	72	82	92
3	13	23	33	43	53	63	73	83	93
4	14	24	34	44	54	64	74	84	94
5	15	25	35	45	55	65	75	85	95
6	16	26	36	46	56	66	76	86	96
7	17	27	37	47	57	67	77	87	97
8	18	28	38	48	58	68	78	88	98
9	19	29	39	49	59	69	79	89	99
10	20	30	40	50	60	70	80	90	100

There is a total of 101 numerals.

This is the new Numerical Method which should be introduced in Mathematics text books.

► The first vertical row contains the 11 numerals. They are the basic numbers.

► The second vertical row contains 10 numerals and the same will continue till the number 100.