**NATIONAL ACADEMY OF SCIENCE AND TECHNOLOGY**

A Project Report On

# THE SHORT HISTORY ON THE REAL NUMBER SYSTEM

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# ACKNOWLEDGEMENT

I want to express my special Gratitude to – **Khem Raj Pandey sir** who gave me this opportunity to present a report on the topic **The Short History of Real Number System**. I want to extend my gratitude to my parents who supported and motivated me while doing the Project. I want to thank my friends Ritik Chand, Prasab Kunwar, and Ashish Chand who helped me to finish this report within a limited time. I have also taken some references from websites mentioned on the last page.

THANKS TO EVERYBODY WHO HELPED ME WITH THIS PROJECT

Amrit Pant

# *Certificate of Completion*

This is to certify that this Project is made by **Amrit Pant** a student of **Class 11 (Section F).** From the **National Academy of Science and Technology** on the topic of **The Short History of Real Number System.** Under the guidance of **Mr. Khem Raj Pandey** and have been completed.

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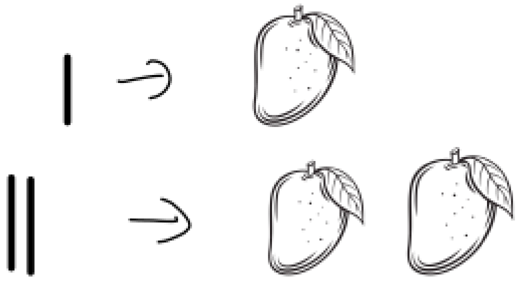
# Introduction to Numbers

A number is an arithmetic value used to represent the quantity and make calculations. There are many ways to express a quantity i.e There are many types of Number systems. eg Roman Number System, Decimal Number System, Tally Number System.

## ***<u>Tally Number System.</u>***

Let’s assume one stick equals one value and 5 sticks are equal to 5 values.



This is one of the most fundamental methods of counting. This is known as Tally Number System. But nowadays we don’t use it because this method is not relevant when there is a high quantity. The system which we use currently is known as the decimal number system.

## ***<u>Roman Number System.</u>***

Let’s assume the Letter “I” equals one value.

| | |
|---|---|
| I |  |
| II |  |
| III |  |
| IV |  |
| V |  |

This Number System is Known as the Roman Number System. Where the English alphabets are used to represent the quantity. This was a very famous Number System until the decimal arrives. This is still used in some parts of the world.

## Decimal Number System

Here the number king arrives, the Decimal Number System. It’s the most used and most popular number system. It starts with “0” and ends at “9”. It's a base 10 Number System. The Number Which I am currently using is also a decimal Number System.

| | |
|---|---|
| 1 |  |
| 2 |  |
| 3 |  |
| 4 |  |
| 5 |  |

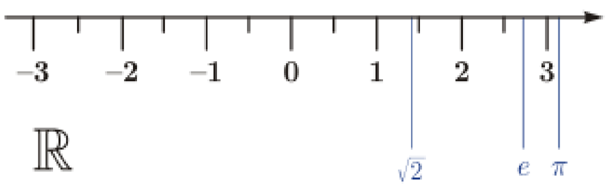
This number system was not discovered by a single person or a single group. This number system is discovered by Arabic, Indian, and some Chinese People. One of the biggest contributions to the Decimal Number system was “0”. 0 doesn’t have any meaning on its own but it has meaning when used with other numbers. The great mathematician Aryabhata discovered this number.

## Introduction to Real Numbers

We have discussed a lot about Number Systems and their history. Let's figure out what is a Real Number. *All the numbers which can be represented in the Number Line are known as Real Numbers. eg. 1, 2, -3, 3.66, -12, -12.99,* $\pi$. It's represented by the symbol $\mathbb{R}$.

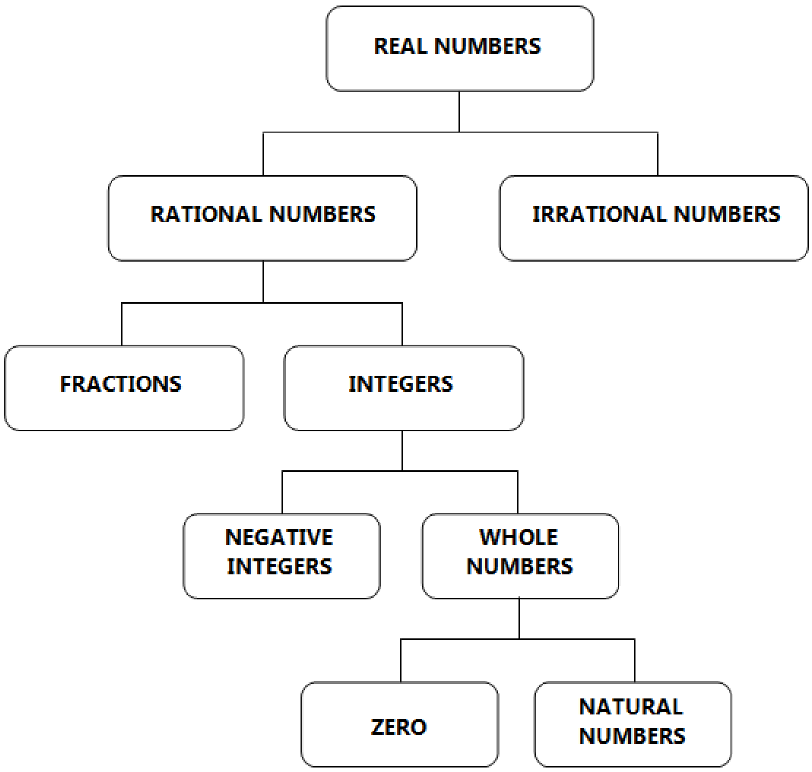
### What is a Number line

The horizontal line in which numbers are marked at intervals, used to illustrate simple numerical operations is called the Number line?




### What actually is the real number?

The collection of Rational and irrational numbers is known as real numbers. What is rational and irrational? We will discuss that in the history of Real Numbers.



## History of Real Number System

Simple fractions were used by the Egyptians around 1000 BC; the Vedic "Shulba Sutras" ("The rules of chords") in c. 600 BC include what may be the first "use" of irrational numbers. The concept of irrationality was implicitly accepted by early Indian mathematicians such as Manava (c. 750–690 BC), who were aware that the square roots of certain numbers, such as 2 and 61, could not be exactly determined. Around 500 BC, the Greek mathematicians led by Pythagoras realized the need for irrational numbers, in particular the irrationality of the square root of 2.

The Middle Ages brought about the acceptance of zero, negative numbers, integers, and fractional numbers, first by Indian and Chinese mathematicians, and then by Arabic mathematicians, who were also the first to treat irrational numbers as algebraic objects (the latter being made possible by the development of algebra). Arabic mathematicians merged the concepts of "number" and "magnitude" into a more general idea of real numbers. The Egyptian mathematician Abū Kāmil Shujā ibn Aslam (c. 850–930) was the first to accept irrational numbers as solutions to quadratic equations, or as coefficients in an equation (often in the form of square roots, cube roots and fourth roots).

In the 16th century, Simon Stevin created the basis for modern decimal notation, and insisted that there is no difference between rational and irrational numbers in this regard.

In the 17th century, Descartes introduced the term "real" to describe roots of a polynomial, distinguishing them from "imaginary" ones.

In the 18th and 19th centuries, there was much work on irrational and transcendental numbers. Johann Heinrich Lambert (1761) gave the first flawed proof that π cannot be rational; Adrien-Marie Legendre (1794) completed the proof, and showed that π is not the square root of a rational number. Paolo Ruffini (1799) and Niels Henrik Abel (1842) both constructed proofs of the Abel–Ruffini theorem: that the general quintic or higher equations cannot be solved by a general formula involving only arithmetical operations and roots.

Évariste Galois (1832) developed techniques for determining whether a given equation could be solved by radicals, which gave rise to the field of Galois theory. Joseph Liouville (1840) showed that neither e nor e2 can be a root of an integer quadratic equation, and then established the existence of transcendental numbers; Georg Cantor (1873) extended and greatly simplified this proof. Charles Hermite (1873) first proved that e is transcendental, and Ferdinand von Lindemann (1882), showed that π is transcendental. Lindemann's proof was much simplified by Weierstrass (1885), still further by David Hilbert (1893), and has finally been made elementary by Adolf Hurwitz and Paul Gordan.

The development of calculus in the 18th century used the entire set of real numbers without having defined them rigorously. The first rigorous definition was published by Georg Cantor in 1871. In 1874, he showed that the set of all real numbers is uncountably infinite, but the set of all algebraic numbers is countably infinite. Contrary to widely held beliefs, his first method was not his famous diagonal argument, which he published in 1891. For more, see Cantor's first uncountability proof.

# References

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