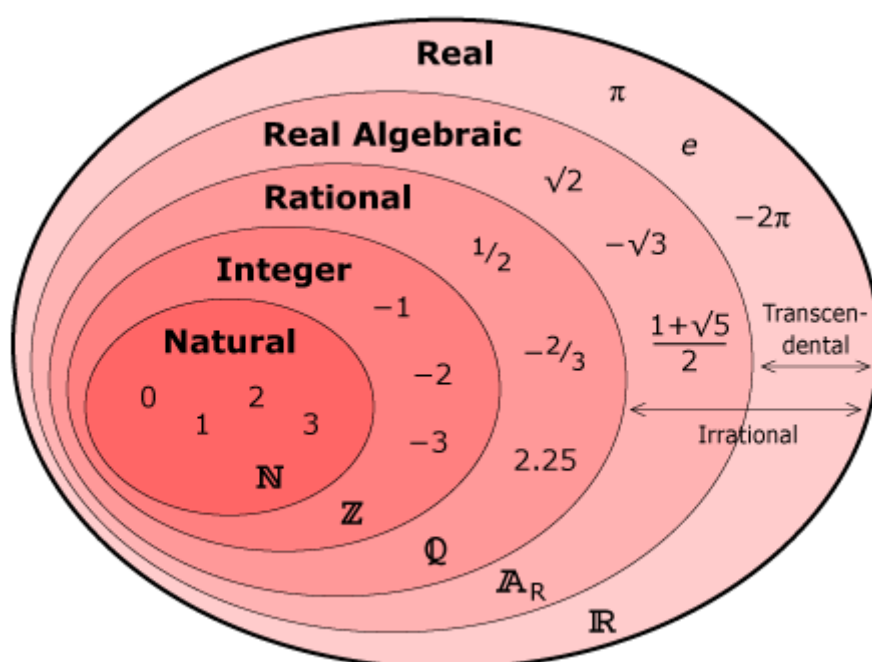


Types of numbers

Natural numbers \mathbb{N}

Natural numbers are the numbers which we normally use for counting, 1,2,3,4,5,6,7,8,9,10 etc. Some people call these counting numbers. Some people say that 0 is a natural number, too.

Another name for these numbers is positive numbers. These numbers are sometimes written as +1 to show that they are different from the negative numbers. But not all positive numbers are natural (for example $\frac{1}{2}$ is positive, but not natural).



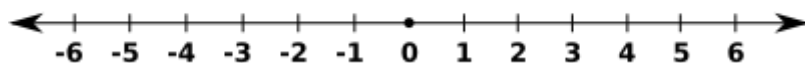
Integers \mathbb{Z}

Integers are the natural numbers and their negatives {... -3, -2, -1, 0, 1, 2, 3, ...}.

(Z is from German *Zahl*, "number".)

Negative numbers

Negative numbers are numbers less than zero.



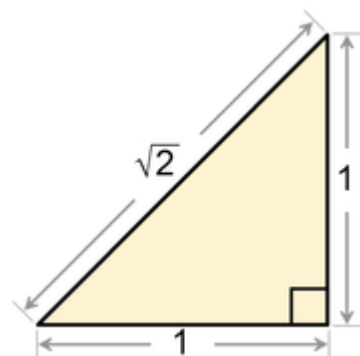
Rational numbers Q

Rational numbers are numbers which can be written as fractions. This means that they can be written as a divided by b , where the numbers a and b are integers, and b is not equal to 0.

Some rational numbers, such as $1/10$, need a finite number of digits after the decimal point to write them in decimal form. The number one tenth is written in decimal form as 0.1. Numbers written with a finite decimal form are rational. Some rational numbers, such as $1/11$, need an infinite number of digits after the decimal point to write them in decimal form. There is a repeating pattern to the digits following the decimal point. The number one eleventh is written in decimal form as 0.09090909....

Irrational numbers (Real algebraic numbers)

Irrational numbers are numbers which cannot be written as a fraction, but do not have imaginary parts.



Irrational numbers often occur in geometry. Irrational numbers are often referred to as "I" for its symbol. For instance if we have a square which has sides of 1 meter, the distance between opposite corners is the square root of two. This is an irrational number. In decimal form it is written as 1.414213... Mathematicians have proved that the square root of every natural number is either an integer or an irrational number.

One well known irrational number is pi. This is the circumference of a circle divided by its diameter. This number is the same for every circle. The number pi is approximately 3.1415926359... .

An irrational number cannot be fully written down in decimal form. It would have an infinite number of digits after the decimal point. These digits would also not repeat.

Real numbers \mathbb{R}

Real numbers is a name for all the sets of numbers listed above

- The rational numbers, including integers
- The irrational numbers

Real Number Line

Natural, \mathbb{N}

Start with the counting numbers (zero may be included).



Integer, \mathbb{Z}

Extend the line backward to include the negatives.



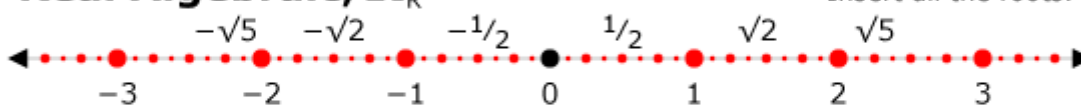
Rational, \mathbb{Q}

Insert all the fractions.



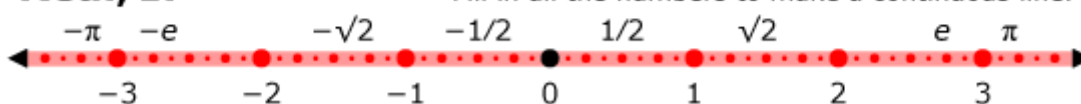
Real Algebraic, \mathbb{A}_R

Insert all the roots.



Real, \mathbb{R}

Fill in all the numbers to make a continuous line.



Properties of the Number Sets

	Natural Integer Rational Real Algebraic Complex					
	N	Z	Q	R	A	C
Closed under Addition	X	X	X	X	X	X
Closed under Multiplication	X	X	X	X	X	X
Closed under Subtraction		X	X	X	X	X
Closed under Division ¹			X	X	X	X
Dense			X	X	X	X
Complete (Continuous)				X		X
Algebraically Closed					X	X