AQA Computer Science A-Level

4.5.1 Number Systems

Advanced Notes

Specification:

4.5.1.1 Natural numbers:

Be familiar with the concept of a natural number and the set $\mathbb{N}$ of natural numbers (including zero).

4.5.1.2 Integer numbers:

Be familiar with the concept of an integer and the set $\mathbb{Z}$ of integers.

4.5.1.3 Rational numbers:

Be familiar with the concept of a rational number and the set $\mathbb{Q}$ of rational numbers, and that this set includes the integers.

4.5.1.4 Irrational numbers:

Be familiar with the concept of an irrational number.

4.5.1.5 Real numbers :

Be familiar with the concept of a real number and the set $\mathbb{R}$ of real numbers, which includes the natural numbers, the rational numbers and the irrational numbers.

4.5.1.6 Ordinal numbers:

Be familiar with the concept of ordinal numbers and their use to describe the numerical positions of objects.

4.5.1.7 Counting and measurement:

Be familiar with the use of:

- natural numbers for counting
- real numbers for measurement

Natural numbers

$$\mathbb{N} = \{0, 1, 2, 3\ldots\}$$

The natural numbers are a set of numbers containing all positive whole numbers and zero. They can be used to count how many of a certain item you have. For example, three keyboards, seven printers or two servers.

The symbol for the natural numbers is $\mathbb{N}$.

Synoptic Link

A **set** is an unordered collection of data that contains each item no more than once.

Sets are covered in **maths for regular expressions** under **theory of computation**.

Integer numbers

$$\mathbb{Z} = \{\ldots -2, -1, 0, 1, 2\ldots\}$$

The integers are a set of whole numbers, both positive and negative, including zero.

The symbol used for integers is $\mathbb{Z}$.

Rational numbers

Also called quotients, rational numbers can (but do not necessarily) have a fractional part. They can be positive or negative, zero is a rational number.

If a number can be written exactly as a fraction of one number over another, then the number is rational.

Examples of rational numbers include:

$$4.5 \qquad 74 \qquad \frac{13}{27} \qquad 6.4525 \qquad -33.1 \qquad \frac{-55}{4}$$

The symbol for rational numbers (quotients) is $\mathbb{Q}$.

Note

74 could be written in fraction form as 74 over 1 so is a rational number.

Irrational numbers

In contrast to a rational numbers, irrational numbers cannot be written exactly as a fraction.

Examples of irrational numbers include:

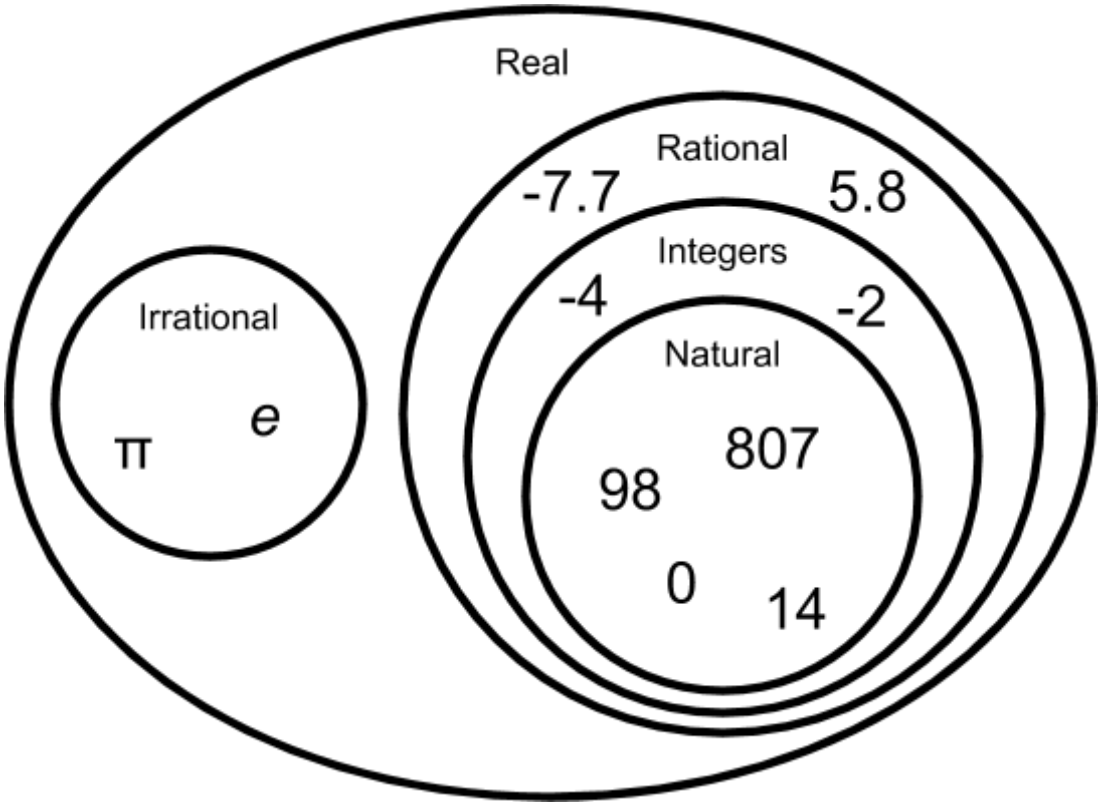
$$\pi \qquad \sqrt{2} \qquad e \qquad \sqrt{3}$$

The set of irrational numbers has no symbol!

Real numbers

The set of real numbers includes all possible real word quantities. It includes all of the members of the irrational numbers, the rational numbers and hence the integers and natural numbers too.

The real numbers are given the symbol $\mathbb{R}$.



Ordinal numbers

Ordinal numbers are integers used to describe the numerical positions of objects in relation to others. For example: 1st, 2nd or 3rd.

Arrays index items using ordinal numbers, typically starting with an element in position 0.

Array

A finite set of related elements of the same data type, where each element is individually indexed.

Counting and measuring

If you need to count how many of a certain object you have, natural numbers should be used. However, if you're measuring a quantity, you may not by using whole numbers. In this situation, real numbers should be used.

Counting	Measuring
$\mathbb{N}$	$\mathbb{R}$