Levels of measurement

Nominal is names, no order, can do set operations and classify. Mode

Ordinal has order, can order. Mode and median.

Interval has fixed intervals or scales so you can add and subtract. Mode, median and arithmetic mean or average.

Interval has fixed intervals or scales so you can add and subtract.

Interval scales don’t have a “true zero” but have fixed intervals.

Calendar years, Celsius, and Fahrenheit temperature scales are common examples.

We can say 10° degrees C is 8° degrees hotter than 2° degrees, but it isn’t 5 times as hot. Or 40° degrees F is 20° hotter than 20° F but it isn’t twice as cold.

The year 1000 is a thousand years before 2000 but it isn’t half the time as the year 2000 in the general length of time.

2010 is ten years before 2020 but we can’t talk about a ratio here.

Ratio scales or ratio data, has an “absolute zero” and you can do multiplication and division.

Kelvin is the temperature scale that starts at absolute zero. So, 8° K is twice as hot as 4° K.

Age is a scale that starts with zero as birth, as opposed to calendar year.

If Doc is 4 and Aury is 2 then Doc is twice as old as Aury.

Can you think of some examples or ratio data or scales?

Ratio scales or ratio data, has an “absolute zero” and you can do multiplication and division.

Elapsed time in a certain unit is a ratio scale.

Height, weight, length, age, and others are all ratio scale when they start at zero.

Any questions about the difference between interval and ratio data or levels of measurement?

Now we will talk about number systems.

Historically, with our base ten system, new types of number systems get added.

Counting numbers: 1,2,3…

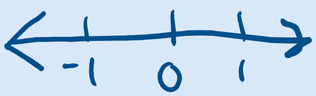
Natural numbers: counting numbers often with zero 0, 1, 2, 3 …

Integers: positive and negative counting numbers …, $^{-}2$, $^{-}1$, 0, 1, 2 …

Rational numbers: can be written as a fraction of two integers … $-\frac{1}{2}$, 0, $\frac{1}{2}$, $\frac{2}{2}$, $\frac{3}{2}$ …

Irrational numbers: decimals that go on forever π $\sqrt{2}$ e

Real numbers: include all the rational and irrational numbers



Complex numbers: include the imaginary numbers $3 + 2i$

$\sqrt{-1}$ is i

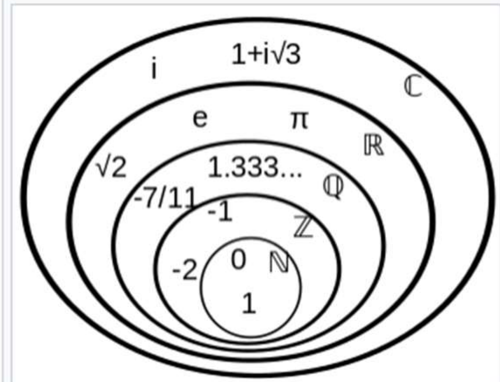
Surreal numbers: include infinitesimals

δ is an infinitely small number

There are sets of such mathematical importance, to which mathematicians refer so frequently, that they have acquired special names and notational conventions to identify them.

Many of these important sets are represented in mathematical texts using bold (e.g. $\mathbf{Z}$) or blackboard bold (e.g. $\mathbb{Z}$) typeface.[38] These include:[14]

- $\mathbf{N}$ or $\mathbb{N}$, denoting the set of all natural numbers: $\mathbf{N} = \{0, 1, 2, 3, \ldots\}$ (some authors exclude 0)[38]
- $\mathbf{Z}$ or $\mathbb{Z}$, denoting the set of all integers (whether positive, negative or zero): $\mathbf{Z} = \{\ldots, -2, -1, 0, 1, 2, \ldots\}$[38]
- $\mathbf{Q}$ or $\mathbb{Q}$, denoting the set of all rational numbers (that is, the set of all proper and improper fractions): $\mathbf{Q} = \{a/b \mid a, b \in \mathbf{Z}, b \neq 0\}$, for example, $1/4 \in \mathbf{Q}$ and $11/6 \in \mathbf{Q}$, and since every integer n can be expressed as the fraction $n/1$, all integers are members of this set ($\mathbf{Z} \subsetneq \mathbf{Q}$)[38]
- $\mathbf{R}$ or $\mathbb{R}$, denoting the set of all real numbers, including all rational numbers, together with all irrational numbers (that is, algebraic numbers that cannot be rewritten as fractions such as $\sqrt{2}$, as well as transcendental numbers such as π, e)[38]
- $\mathbf{C}$ or $\mathbb{C}$, denoting the set of all complex numbers: $\mathbf{C} = \{a + bi \mid a, b \in \mathbf{R}\}$, for example, $1 + 2i \in \mathbf{C}$[38]



The natural numbers $\mathbb{N}$ are contained in the integers $\mathbb{Z}$, which are contained in the rational numbers $\mathbb{Q}$, which are contained in the real numbers $\mathbb{R}$, which are contained in the complex numbers $\mathbb{C}$

Each of the above sets of numbers has an infinite number of elements, and each can be considered to be a proper subset of the sets listed below it.

Sets of positive or negative numbers are sometimes denoted by superscript plus and minus signs, respectively. For example, $\mathbb{Q}^+$ represents the set of positive rational numbers.

Set (mathematics) - Wikipedia