Number systems

What we need for the course.

$\mathbb{N}$ nonnegative integers
$\mathbb{Z}$ integers
$\mathbb{Q}$ rationals
$\mathbb{R}$ reals $\boxed{\text{MAIN SYSTEM}}$
$\mathbb{C}$ complex numbers

Key property for the last three: (1) Can do $+, -, \times, \div$ (if denominator nonzero).

(2) Ordering for first four $<$ [reverse $>$]
Trichotomy, transitive
Positive elements closed under $+$ and $\times$.

(3) Reals — can approximate by rationals
largest such system.
If $x_1 \le x_2 \le x_3 \le \dots \le M$, then there is a limit. Example: ∞ decimals $0.x_1x_2x_3x_4\cdots$

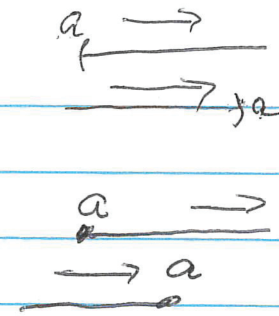
(4) Complex numbers — expressible as $a + bi$, where $a + b$ real, $i^2 = -1$.

Open interval (a, b) $\quad a < x < b$ $\quad (a, b)$
Closed interval $[a, b]$ $\quad a \le x \le b$ $\quad [a, b]$
Half open intervals $[a, b)$ + $(a, b]$

Conventions (a, ∞), $(-\infty, a)$

$a < x$ $\quad$ $x < a$

$[a, \infty)$, $(-\infty, a]$



Also, $\mathbb{R} = (-\infty, \infty)$. $\longleftrightarrow$

Systematic use of real numbers allows us to streamline much of the Greek (Euclid) approach to geometry.

Three parts of the course

I. Use reasonable assumptions to coordinatize Euclidean geometry

II. Indicate how vector methods are powerful tools for attacking many geometrical issues.

III. Discuss + develop classical non-Euclidean geometry to a limited extent

In today's mathematics the reasonable framework for I is set theory

lines $\subseteq$ planes etc.

planes, lines etc. are sets
points are members of sets.