

Number Systems

$\mathbb{N} = \{1, 2, 3, \dots\}$ - the set of **natural numbers**

$\mathbb{Z} = \{\dots, -3, -2, -1, 0, 1, 2, 3, \dots\}$

– the set of **integers** (\mathbb{Z} : Zahl (**German**) = number)

\mathbb{Q} – the set of **rational numbers** (fractions) - \mathbb{Q} : “quotients”

Examples: $\frac{1}{2}, -\frac{329}{29}, 1 = \frac{1}{1}, \dots$

\mathbb{R} – the set of **real numbers** (all decimal expansions)

Examples: $\frac{1}{2} = 0.5 = 0.499999\dots$, $\frac{1}{3} = 0.3333\dots$, $\pi = 3.14159\dots$

\mathbb{C} – the set of **complex numbers**: $a + bi$

Examples: $1 + i, \sqrt{2}, \sqrt{-2} = i\sqrt{2}, \dots$

Notes: 1) $\mathbb{N}, \mathbb{Z}, \mathbb{Q}, \dots$ are special symbols called **blackboard bold** letters by printers.

2) We have the following “hierarchy” of numbers:

$$\mathbb{N} \subset \mathbb{Z} \subset \mathbb{Q} \subset \mathbb{R} \subset \mathbb{C}$$

3) \mathbb{R} is “very large”, certainly much larger than necessary for practical purposes (\rightarrow computers), but is theoretically very convenient (\rightarrow Calculus).