Language: set notation

set-builder notation: $\{1, 2, 3, 4, \ldots \} = \mathbb{N}$ - natural numbers

How to specify a set:

1) List all its elements

2) Write down the conditions defining our set as a subset of a universal set.

could be $\mathbb{R}$, or $\mathbb{R}^n = \mathbb{R} \times \mathbb{R} \times \cdots \times \mathbb{R}$ will define

real numbers

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About the course

Instructor: Julia Gordon, MATH 217

Most of the course materials will be on the course website (not Canvas)

On Canvas:
- assignments
- solutions
- link to Piazza
- computer projects (in October and November)

Text: Janisch "Linear Algebra"
(online at UBC library)

email: gor@math.ubc.ca
Why need the universal set:
- to avoid "set of all sets" paradox.
  - is this set an element of itself?
    - both Yes and No.

Speaking of sets of sets:
How to build everything from nothing:
\(\emptyset\) - empty set
\(\{\emptyset\}\) - a set of one element: the empty set
  (imagine: a box containing an empty box)
\(\{\{\emptyset\},\emptyset\}\) - a set of 2 elements
When listing elements, repetitions do not matter: \[ \{ 1, 1, 2, 3 \} = \{ 1, 2, 3 \} = \{ 3, 2, 1 \} \].

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**Defining sets by a condition:**

1) \( \{ x \in \mathbb{R} : x > 0 \} \) - the set of positive numbers

   \( \{ x \in \mathbb{R} | x > 0 \} \)

   \( \text{an element of} \)

   \( \text{lin} - \text{TeX} \)

   \( \text{also used:} \)

   \( \text{read as "such that"} \)

2) \( A = \{ x \in \mathbb{N} : x \text{ is even} \} \)

   \( 2 \in A \) but \( 27 \notin A \).
More notation:

$\forall$ - universal quantifier
$\exists$ - existential quantifier

Example

$\exists x \in \mathbb{R}: x^2 + 3x - 2 = 0$  

"exists a real number $x$ such that $x^2 + 3x - 2 = 0$".

True

How to prove:  
- exhibit the $x$ that satisfies it.

- or give an argument:

  $ax^2 + bx + c = 0$

  has a real root if and only if $b^2 - 4ac \geq 0$