Set Notation

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A set is a collection of objects that are called "elements" of the set.

A set is denoted as $A = \{a_1, a_2, a_3, a_4\}$, where a is an element of the set A. There can be infintely many elements in a set. You can write "..." to denote that a set goes on forever, like so: $B = \{b_1, b_2, b_3, ...\}$.

1 Number sets

- $\mathbb{N}$ is the set of **"natural numbers"**: $\mathbb{N} = \{0, 1, 2, 3, ...\}$
  (All positive integers and zero)
- $\mathbb{Z}$ is the set of **"integers"**: $\mathbb{Z} = \{..., -3, -2, -1, 0, 1, 2, 3, ...\}$
  (All integers and zero)
- $\mathbb{Q}$ is the set of **"rational numbers"** (eg. $\frac{1}{2}, -\frac{5}{3}, 0.3$)
  (All numbers of the form $\frac{n}{m}$ where n and m are integers and $m \neq 0$. In other words, all fraction of two integers where the denominator is not 0.)
- $\mathbb{R}$ is the set of **"real numbers"**: (eg. $\pi, e, -\sqrt{5}$)
  (All rational numbers and all irrational numbers)
  To review: Irrational numbers, such as $\sqrt{2}$ and π, are numbers that can't be expressed as $\frac{n}{m}$ where n and m are integers.
- $\mathbb{C}$ is the set of **"complex numbers"**: (eg. $1 + 2i, 5i, 3 + 4i$)
  (Every number set mentioned above combined, plus all imaginary numbers)
  To review: Imaginary numbers, such as $3i$ and $-2i$, are numbers of the form bi, where b is a real number and i is the imaginary unit defined as $\sqrt{-1}$.

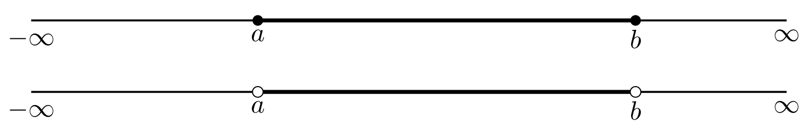
2 Two-sets notation

- "$\in$" should be read as **"is an element of"**
- "$\subseteq$" should be read as **"is a subset of"**
- "$\subset$" should be read as **"is strictly as subset of"**
- "$\supseteq$" should be read as **"contains"**

- ”$\notin$” should be read as **”is not an element of”**
- ”$\not\subseteq$” should be read as **”is not a subset of”**
- ”$\cup$” denote the **union** of two sets, and it is the set of elements of either one or both of the sets.
  Example: $\{1,2,3\} \cup \{3,4,5\} = \{1,2,3,4,5\}$
- ”$\cap$” denote the **intersection** of two sets, and it is the set of elements present in both sets.
  Example: $\{1,2,3\} \cap \{2,3,4\} = \{2,3\}$
- ”$\setminus$” denote the **subtraction** of one set from another, and it should be read as **”minus”** or **”without”**
  Example: $\{1,2,3\} \setminus \{3,4,5\} = \{1,2\}$

3 Interval notation

An interval is a set of real numbers that lie between two given values.



There's two way in which you can denote an interval:

1. First, we can write $\{x \in \mathbb{R} \mid a \leq x \leq b\}$.
   Here, we're saying x is an element of the set of real numbers R which ranges from and including a and b. And, when we do not want to include a and b, we write $<$ instead of $\leq$, like so: $\{x \in \mathbb{R} \mid a < x < b\}$
2. A shorter way to express the interval is by writting $[a,b]$ instead, when a and b are included. When a and b are not included, we can write (a,b).

   So, in summary:

   - ”[” and ”]” replaces ”$\leq$”, denoting that the interval INCLUDES the endpoints.
   - ”(” and ”)” replaces ”$<$”, denoting that the interval does NOT INCLUDE the endpoints.

   Of course, you can also write $(a,b]$ and $[a,b)$, just as you can write $a < x \leq b$ and $a \leq x < b$