Definition 1. *A set is just a collection of objects satisfying certain properties. If an object(say x) is belong to a set(say A), then we say x is an element of A, and denote it as $x \in A$.*

Definition 2. *A set A is an subset of B if $\forall x \in A$, then $x \in B$. And we denote this by $A \subseteq B$. Moreover, if A is an subset of B and there A does not contain all elements of B, we call A as a proper subset of B, and we denote this by $A \subset B$.*

Example 1. *Let $A = \{0, 1, 2, 3, 4, 5\}$. Then*

$$2 \in A$$
$$3, 4, 5 \in A$$
$$0, 1 \subset A$$
$$0, 3, 4, 5 \subset A$$

Important sets

Example 2.

$\mathbb{N}$ *is the set of all natural numbers.*
$\mathbb{Z}$ *is the set of all integers.*
$\mathbb{Q}$ *is the set of all real numbers.*
$\mathbb{R}$ *is the set of all rational numbers.*
$\mathbb{R} \backslash \mathbb{Q}$ *is the set of all irrational numbers.*

Curly Bracket notation

Example 3. *$\{x | x > 4\}$ is the set of real number x, such that x is greater than 4.*

Example 4. *$\{x \in \mathbb{Q} | x < -1\}$ is the set of rational numbers x such that x is less that -1.*

Interval notation

Example 5. *$[1, 2]$ is the set of all real numbers between 1 and 2, including the end points 1 and 2.*
$(-1, 2)$ is the set of all real numbers between -1 and 2, excluding the end points 1 and 2.
$(-1, 3]$ is the set of all real numbers between -1 and 3, endpoint 3 is included but -1 is excluded.
$[-2, 3)$ is the set of all real numbers between -2 and 3, -2 is included but 3 is excluded.
$[0, \infty)$ is the set of all real numbers from 0 to ∞, 0 is included.
$(-\infty, 1]$ is the set of all real numbers from $-\infty$ to 1, 1 is included.

Set Operations

There are 3 basic operations we have to learn.

Definition 3. *Union of two sets A and B, $A \cup B$ is defined by joining all elements in set A and B together.*

Example 6. *Let $A = [3, 5)$, and $B = [5, \infty)$, then $A \cup B = [3, \infty)$*

Definition 4. *Intersection of two sets A and B, $A \cap B$ is defined by taking the intersection(common part) of two sets.*

Example 7. *Let $A = [3, 5]$ and $B = (-2, 4)$, then $A \cap B = [3, 4)$.*

Definition 5. *Difference between two sets A and B, usually denoted by $A \backslash B$ or $A - B$, is defined by taking all elements of A except those are also belong to B.*

Example 8. *The set of all irrational numbers consists of all real numbers that are not rational. In other words, $\mathbb{R} \backslash \mathbb{Q}$ (or maybe you can denote it by $\mathbb{R} - \mathbb{Q}$).*