5 is a natural number; *or* the collection of natural numbers contains 5.

Adding 0 to the collection of natural numbers makes the collection of whole numbers.

Merging the algebraic numbers and the transcendental numbers makes the real numbers.

Transcendental numbers are those real numbers which are not algebraic numbers.

Nothing is both transcendental and algebraic, *or* the collection of things both transcendental and algebraic is empty.

Negative integers are both negative and integers.

All integers are rational numbers.

Since all rational numbers are algebraic numbers and all algebraic numbers are real numbers, it follows that all rational numbers are real numbers.

**Axiom (Existence.)**

*There is a set with no elements.*

**Axiom (Extensionality.)**

*If every element of a set $X$ is an element of a set $Y$ and every element of $Y$ is an element of $X$, then $X = Y$.*

(Exercises 1.3.(1–10).)

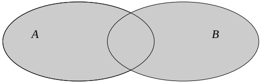
- $-12 \in \mathbb{N}$.
- $-12 \in \mathbb{W}$.
- $-12 \in \mathbb{Z}$.
- $-12 \in \mathbb{Q}$.
- $-12 \in \mathbb{R}$.

- $\frac{1}{56} \in \mathbb{N}$.
- $\frac{1}{56} \in \mathbb{W}$.
- $\frac{1}{56} \in \mathbb{Z}$.
- $\frac{1}{56} \in \mathbb{Q}$.
- $\frac{1}{56} \in \mathbb{R}$.

*Union*

$A \cup B = \{\ x \mid x \in A \text{ or } x \in B\}$

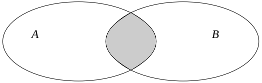
$$\begin{aligned} \{1,2,3\} \cup \{2,3,4\} &= \{1,2,3,4\} \\ \{1,2\} \cup \{3,4\} &= \{1,2,3,4\} \\ \{1,2\} \cup \{1,2,3\} &= \{1,2,3\} \end{aligned}$$




*Intersection*

$A \cap B = \{\ x \mid x \in A \text{ and } x \in B\}$

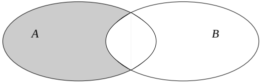
$$\begin{aligned} \{1,2,3\} \cap \{2,3,4\} &= \{2,3\} \\ \{1,2\} \cap \{3,4\} &= \emptyset \\ \{1,2\} \cap \{1,2,3\} &= \{1,2\} \end{aligned}$$




*Difference*

$A - B = \{\ x \mid x \in A \text{ and } x \notin B\}$

$$\begin{aligned} \{1,2,3\} - \{2,3,4\} &= \{1\} \\ \{1,2\} - \{3,4\} &= \{1,2\} \\ \{1,2\} - \{1,2,3\} &= \emptyset \end{aligned}$$



(Exercises 1.4.(11–18).)

$-12 \in \mathbb{R}^-$.

$\mathbb{Q} \cap \mathbb{T} = \emptyset$.

$\mathbb{A} \subseteq \mathbb{C}$.

$\frac{1}{63} \in \mathbb{Q} - \mathbb{R}$.

$\mathbb{R} \subseteq \mathbb{C} \cap \mathbb{R}^-$

$\mathbb{Z} - \mathbb{R}^- = \mathbb{W}$.

$4 \in \mathbb{C}$.

$\mathbb{T} \cup \mathbb{Z} \subseteq \mathbb{A}$.