# Introduction to Sets Course

Sets are collections of objects. A knowledge of sets forms the foundation for many areas of mathematics and is essential for understanding more advanced topics.

1 Definitions and Symbols

- $\emptyset$: The empty set, a set with no elements.

- $\in$: Symbol for "is an element of." For example, $a \in A$ means a is an element of set A.

- $\notin$: Symbol for "is not an element of." For example, $b \notin B$ means b is not an element of set B.

- $\subset$: Symbol for "is a subset of." For example, $A \subset B$ means every element of A is also an element of B.

- $\cup$: Union of two sets. $A \cup B$ is the set of elements in either A or B or both.

- $\cap$: Intersection of two sets. $A \cap B$ is the set of elements in both A and B.

- $\setminus$: Difference between two sets. $A \setminus B$ is the set of elements in A but not in B.

- $\mathbb{N}$: The set of natural numbers $\{1, 2, 3, \ldots\}$.

- $\mathbb{Z}$: The set of integers $\{\ldots, -2, -1, 0, 1, 2, \ldots\}$.

- $\mathbb{Q}$: The set of rational numbers (fractions).

- $\mathbb{R}$: The set of real numbers.

2 Venn Diagrams

Venn diagrams are a way to visually represent sets and their relationships.
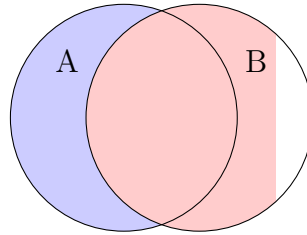
In the Venn diagram above:

- The blue area represents set A.

- The red area represents set B.

- The purple area represents the intersection $A \cap B$.

- The combined areas represent the union $A \cup B$.

3   Exercises

Question 1

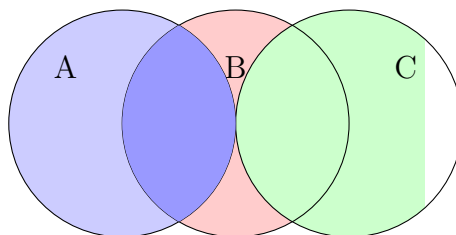Given the sets $A = \{1, 2, 3, 4\}$ and $B = \{3, 4, 5, 6\}$, find $A \cup B$, $A \cap B$, and $A \setminus B$.

Answer 1

- $A \cup B = \{1, 2, 3, 4, 5, 6\}$
- $A \cap B = \{3, 4\}$
- $A \setminus B = \{1, 2\}$

Question 2

Draw a Venn diagram for the sets $A = \{1, 2, 3\}$, $B = \{3, 4, 5\}$, and $C = \{5, 6, 7\}$. Shade the region representing $A \cap (B \cup C)$.

Answer 2

Explanation

The region representing $B \cup C$ is the union of the red and green circles. The intersection $A \cap (B \cup C)$ is where the blue circle overlaps with this union.

Question 3

If $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$ is the universal set, and $A = \{2, 4, 6, 8\}$, find the complement of A, denoted A^c.

Answer 3

The complement of A is the set of elements in U that are not in A:

$$A^c = \{1, 3, 5, 7, 9\}$$

Explanation

The universal set U contains all elements under consideration. The complement of A includes all elements of U that are not in A.