Example 12.

Let A be the set of whole numbers and B be the set of negative integers. Then $A \cup B$ the union of A and B consists of all integers.

Remark: Both A and B are always in $A \cup B$, that is $A \subset (A \cup B)$ and $B \subset (A \cup B)$.

Intersection

The intersection of sets A and B is a set of elements which are common to A and B, that is, those elements which belong to A and which also belongs to B. We denote the intersection of A and B by $A \cap B$, which is read "A intersection B".

The intersection of A and B may also be defined concisely by

$$A \cap B = \{x \mid x \in A, x \in B\}$$

Here, the comma has the same meaning as "and".

Remark:

Each of the sets A and B contains $A \cap B$ as a subset, i.e:

$(A \cap B) \subset A$ and $(A \cap B) \subset B$.

Example 13.

1. Let P be the set of prime numbers and Q be the set of even numbers. Then the intersection of P and Q is the set of 2, i.e $P \cap Q = \{2\}$.
2. Let $A = \{1, 2, 3, 4\}$, $B = \{2, 4, 6, 8\}$, $C = \{1, 2, 3, 6\}$. Then $A \cap B \cap C = \{2\}$.

Difference

The difference of sets A and B is the set of elements which belong to A but which do not belong to B. We denote the difference of A and B by $A - B$ which is read "A difference B", or simply "A minus B".

The intersection of A and B may also be defined concisely by

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

Remark:

Set A contains $A - B$ as a subset, i.e.:

$$(A - B) \subset A.$$

Example 14.

1. Let P be the set of integers and Q be the set of negative integers. Then $P - Q$ consists of positive integers and zero.
2. Let $A = \{1, 2, 3, 4\}$, $B = \{1, 4\}$. Then $A - B = \{2, 3\}$ and $B - A = \{\ \}$.

Complement

The complement of a set A is the set of elements which do not belong to A, that is, the difference of the universal set U and A. We denote the complement of A by A'. The complement of set A may also be defined concisely by

$$A' = \{x \mid x \in U, x \notin A\}$$

or, simply

$$A' = \{x \mid x \notin A\}$$

Example 15.

Let U be the universal set consisting of the name of days in a week, and let P = {Monday, Tuesday, Thursday, Saturday}. Then P′ = {Sunday, Wednesday, Friday}.