

- Goals:
- ① Understand set notations
 - ② Perform operations on sets
 - ③ Solve some applications.

Definition of a set:

A set is a collection of objects.

E.g. $A = \{1, 2, 3\}$

$$B = \{a, b, c, d, e, f, g\}$$

$$C = \{\text{Jan, Feb, Mar, Apr, May}\}$$

$$D = \mathbb{R} = \text{set of all real numbers.}$$

$$X = \mathbb{Z} = \text{set of all integers}$$

Notation: $e \in A$

This notation means that e is an element of the set A .

E.g. $A = \{1, 2, 3\}$

$1 \in A; 2 \in A; 3 \in A$

$B = \{\text{all states in the U.S.}\}$

$TX \in B; UT \in B$

$X = \mathbb{Z}; -100 \in X; 10209 \in X$

Notation: $a \notin A$. This means that a is NOT an element of A .

$A = \{1, 2, 3\} \quad 6 \notin A$

$B = \{\text{all states in the U.S.}\} \quad \text{China} \notin B$

$$X = \mathbb{Z}.$$

$$\frac{1}{2} \notin X ; 2.714 \notin X ; \pi \notin X.$$

Empty Set or Null Set.

Describe the set of real numbers that are the solutions of the equation:

$$x^2 + 1 = 0$$

$$x^2 = -1$$

$$x = \sqrt{-1}$$

→ No real solutions

There is nothing in the set of real solutions to this equation. The set with no elements in it is called the empty set or null set.

The notation for the empty set is $\emptyset$

Set Builder Notation.

$A = \{a, b, c, d, \dots, z\} \rightarrow$ the listing method.

Instead of using the listing method we can use set builder notation to describe this set.

$A = \{x \mid x \text{ is a letter of the English alphabet}\}$

$B = \{x \mid x \text{ is a month in the year}\}$

$C = \{x \mid x \text{ is an integer}\}$

Subsets

Definition: A, B are sets.

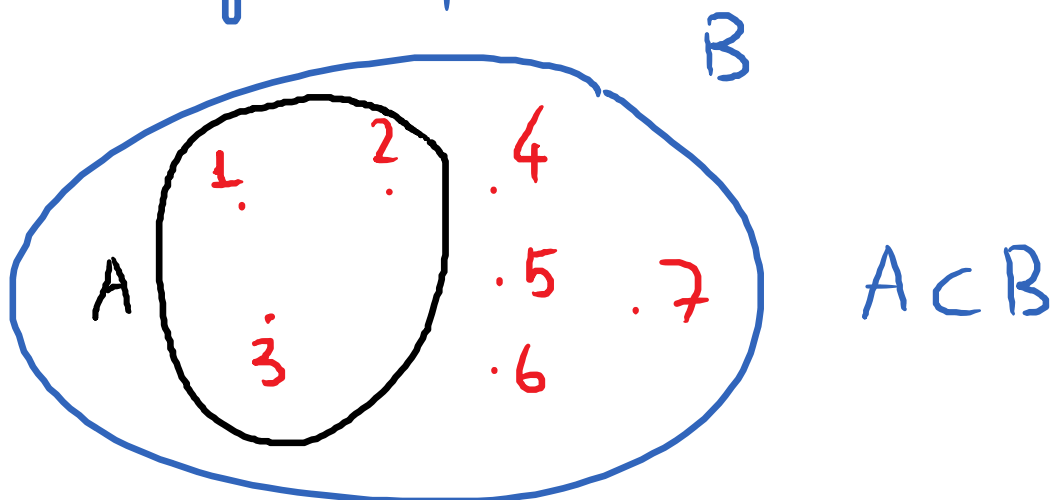
We say that A is a subset of B if every element of A is also an element of B .

E.g. $A = \{1, 2, 3\}$, $B = \{1, 2, 3, 4, 5, 6, 7\}$

A is a subset of B .

Notation for subset: $A \subset B$

Venn Diagram for sets



Note: ϕ is a subset of every set.

E.x. $A = \{1, 2, 3\}$.

list all the subsets of A .

$\phi, \{1\}, \{2\}, \{3\}, \{1, 2\},$

$\{1, 3\}, \{2, 3\}, \{1, 2, 3\} \rightarrow 8$

E.x. $B = \{1, 2, 3, 4\}$

$\phi, \{1, 2, 3, 4\}, \{1\}, \{2\}, \{3\}, \{4\},$

$\{1, 2\}, \{1, 3\}, \{1, 4\}, \{2, 3\}, \{2, 4\},$

$\{3, 4\}, \{1, 2, 4\}, \{1, 3, 4\}, \{2, 3, 4\},$

$\{1, 2, 3\} \rightarrow 16 \text{ subsets}$

Set operations

① Union of sets.

A, B : sets

The union of A and B is the set whose elements are the elements of A and the elements of B

Notation for A union B : $A \cup B$.

E.g. $A = \{1, 2, 3\}$; $B = \{a, b, c, d\}$

Find $A \cup B$.

$$A \cup B = \{1, 2, 3, a, b, c, d\}$$

$$X = \{2, 3, 5\}; Y = \{2, 5, 11\}$$

$$\text{Find } X \cup Y. \quad X \cup Y = \{2, 3, 5, 11\}$$