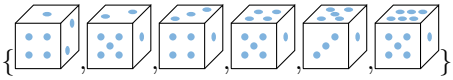
SET THEORY

A DEFINITIONS

Definition Set

A **set** is a collection of objects, called elements.
We list its elements between curly brackets.

Ex: List all possible results when rolling a standard die  .

Answer: $E = \{1, 2, 3, 4, 5, 6\} = \{$  $\}$.

Definition Element

- An **element** is an object contained in a set.
- $\in$ means "is an element of" or "belongs to".
- $\notin$ means "is not an element of" or "does not belong to".

Ex: $2 \in \{1, 2, 3, 4, 5, 6\}$ and $7 \notin \{1, 2, 3, 4, 5, 6\}$.

Definition Equal sets

Two sets are **equal** if they have exactly the same elements.

Ex: Determine if the sets $\{2, 6, 4\}$ and $\{2, 4, 6\}$ are equal.

Answer: Yes, the sets $\{2, 6, 4\}$ and $\{2, 4, 6\}$ are equal because they contain the same elements: 2, 4, and 6.

Ex: Determine if the sets $\{1, 2, 3\}$ and $\{1, 2, 4\}$ are equal.

Answer: No, the sets $\{1, 2, 3\}$ and $\{1, 2, 4\}$ are not equal because element 3 belongs to $\{1, 2, 3\}$ but not to $\{1, 2, 4\}$.

B ORDERED PAIR

Definition Ordered Pair

An **ordered pair**, denoted (a, b) or ab, is a pair of objects in which their order is significant. The ordered pair (a, b) is different from the ordered pair (b, a) unless $a = b$.

Ex: In a sprint relay race, two runners are paired up. Let L be Louis and H be Hugo. The ordered pair (L, H) means Louis runs first, then passes the baton to Hugo. The ordered pair (H, L) means Hugo runs first, then passes to Louis. These are different races.

C CARDINALITY

Definition Cardinality

$n(A)$ denotes the number of elements in the set A.

Ex: $n(\{1, 2, 3, 4, 5, 6\}) = 6$.

D COMPLEMENT

Definition Universal set

A **universal set** is the set of all elements considered.

Definition Complement

The **complement** of a set A, denoted A', consists of all elements in U that are not in A. Sets A and A' are said to be **complementary**.

Ex: Given the universe $U = \{1, 2, 3, 4, 5, 6\}$ and the set $A = \{1, 3, 5\}$, find the complement A'.

Answer: Start with the universe $U = \{1, 2, 3, 4, 5, 6\}$.
The set $A = \{1, 3, 5\}$ includes 1, 3, and 5.
The complement A' is all the elements in U that are not in A:

$$A' = \{2, 4, 6\}$$