

Mathematical Notation and Definitions

1. Definitions

- (a) Set: well defined collection of objects, consisting of elements. Denoted by capital letters. Order of elements does not matter.
- (b) Cardinality: size of a set, $|A|$, can be any number from 0 to infinity. Empty set B has cardinality of 0, $|B| = 0$
- (c) Equal Sets: two sets that have the same elements
- (d) Subset A : every element in A is contained in B .
Proper subset A : every element in A is contained in B and B has elements that are not in A , $|B| > |A|$ since A excludes at least one element of B .
- (e) Complement of A : all the elements that are in the universal set but not in A Relative complement of A in B : all elements in B that are not in A .

2. Notation and Important Properties

- (a) subset: $A \subseteq B$
- (b) proper subset: $A \subset B$
- (c) intersection: $A \cap B$
 - i. $A \cap B = B \cap A$
 - ii. $A \cap B = \emptyset$, then A and B are disjoint (no common elements)
 - iii. $A \cap B = A$, then A is a subset of B
 - iv. $A \cap \emptyset = \emptyset$
 - v. $A \cap U = A$ where U is the universal set
- (d) union: $A \cup B$
 - i. $A \cup B = B \cup A$
 - ii. $A \cup \emptyset = A$
 - iii. $A \cup U = U$ where U is the universal set
 - iv. $A \cup B = A$, then B is a subset of A (A contains all elements in B and possibly more)
- (e) relative complement: $A \setminus B$
 - i. If relative complement of A in B has cardinality of non zero, then A is a proper subset of B .
 - ii. $A \setminus A = \emptyset$
 - iii. $A \setminus \emptyset = A$
 - iv. $\emptyset \setminus A = \emptyset$

3. Important Sets

- (a) \mathbb{N} : natural numbers (0,1,2,3, ...)
- (b) \mathbb{Z} : integers (... -3, -2, -1, 0, 1, 2, 3, ...)
- (c) \mathbb{Q} : rational numbers ($\frac{a}{b}$ such that $a, b \in \mathbb{Z}$)
- (d) \mathbb{R} : real numbers
- (e) \mathbb{C} : complex numbers