1.1 Set Identities

Sets: A, B, C
Universal set: I
Complement : A'
Proper subset: $A \subset B$
Empty set: $\varnothing$
Union of sets: $A \cup B$
Intersection of sets: $A \cap B$
Difference of sets: $A \setminus B$

1. $A \subset I$

2. $A \subset A$

3. $A = B$ if $A \subset B$ and $B \subset A$.

4. Empty Set
   $\varnothing \subset A$

5. Union of Sets
   $C = A \cup B = \{x \mid x \in A \text{ or } x \in B\}$

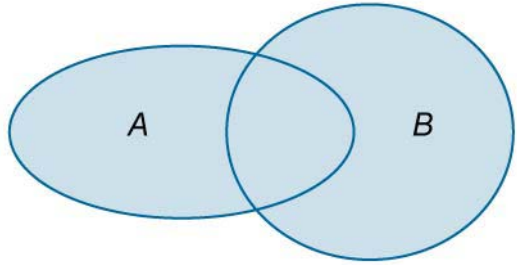

Figure 1.

6. Commutativity

$$A \cup B = B \cup A$$

7. Associativity

$$A \cup (B \cup C) = (A \cup B) \cup C$$

8. Intersection of Sets

$$C = A \cup B = \{x \mid x \in A \text{ and } x \in B\}$$

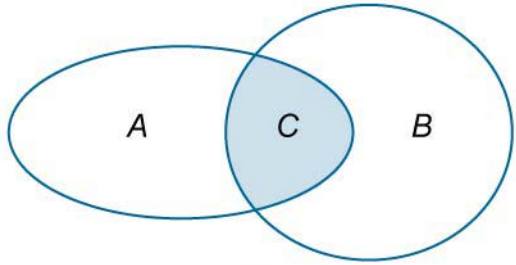

Figure 2.

9. Commutativity

$$A \cap B = B \cap A$$

10. Associativity

$$A \cap (B \cap C) = (A \cap B) \cap C$$

11. Distributivity

$$A \cup (B \cap C) = (A \cup B) \cap (A \cup C),$$
$$A \cap (B \cup C) = (A \cap B) \cup (A \cap C).$$

12. Idempotency

$$A \cap A = A,$$
$$A \cup A = A$$

13. Domination

$$A \cap \varnothing = \varnothing,$$
$$A \cup I = I$$

14. Identity

$$A \cup \varnothing = A,$$
$$A \cap I = A$$

15. Complement

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

16. Complement of Intersection and Union

$$A \cup A' = I,$$
$$A \cap A' = \varnothing$$

17. De Morgan's Laws

$$(A \cup B)' = A' \cap B',$$
$$(A \cap B)' = A' \cup B'$$

18. Difference of Sets

$$C = B \setminus A = \{x \mid x \in B \text{ and } x \notin A\}$$

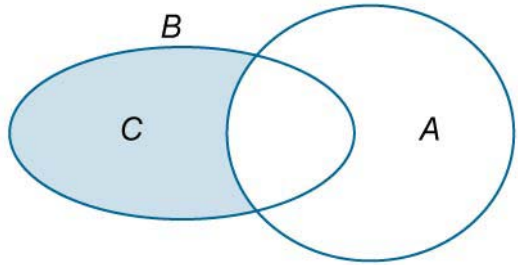

Figure 3.

19. $B \setminus A = B \setminus (A \cap B)$

20. $B \setminus A = B \cap A'$

21. $A \setminus A = \varnothing$

22. $A \setminus B = A$ if $A \cap B = \varnothing$.

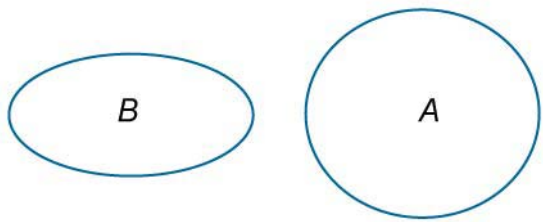

Figure 4.

23. $(A \setminus B) \cap C = (A \cap C) \setminus (B \cap C)$

24. $A' = I \setminus A$

25. Cartesian Product
$C = A \times B = \{(x, y) \mid x \in A \text{ and } y \in B\}$