1. Let the universe be the set of all real numbers. Let \( A = [3, 8), \ B = [2, 6], \ C = (5, \infty) \).
   Find
   (a) \( A \cap B \)
   (b) \( A \cup B \)
   (c) \( A \cup (B \cap C) \)
   (d) \( A - B \)
   (e) \( A^c \)

2. Prove that \( A \cup B = B \) iff \( A \subseteq B \)

3. Prove that \( (A - B) \cap (A - C) = A - (B \cup C) \).

4. Give a counterexample to the following statement:
   If \( (A \cap B) \subseteq (C \cap B) \), then \( A \subseteq C \).

5. Let the family of sets \( A_n, n \in \mathbb{N} \), be defined by \( A_n = \left( -n, \frac{1}{n} \right) \) (here \( \mathbb{N} = \{1, 2, \ldots \} \) is the set of positive integers).
   Find \( \bigcup_{n=1}^{\infty} A_n, \bigcap_{n=1}^{\infty} A_n \).

6. Prove that if \( A_i, i \in I \) is a family of sets indexed by \( i \in I \), then for any set \( B \), we have
   \[
   B \cap \left( \bigcup_{i \in I} A_i \right) = \bigcup_{i \in I} (B \cap A_i).
   \]

7. Give an example of a family of subsets \( A_i \subset \mathbb{Z} \) indexed by \( i \in \mathbb{N} \) such that intersection of any finite collection of them is nonempty, but intersection \( \bigcap A_i \) over all \( i \) is empty.