1. Let X be a subspace of a topological space Y, and assume that X is closed in Y. Prove that a subset C of X is closed in X if and only if it is closed in Y.

2. Prove that if U is open in a topological space X and A is closed in X, then $U \setminus A$ is open in X, and $A \setminus U$ is closed in X.

3. Let A, B and A_j for each j in some index set J be subsets of a topological space. Prove that
   (1) $\overline{A \cup B} = \overline{A} \cup \overline{B}$;
   (2) $\overline{\cup_{j \in J} A_j} \supseteq \cup_{j \in J} \overline{A_j}$, and give an example where equality fails.