1. In each case below, determine the accumulation points of $A$. Also determine the closure $\overline{A}$, the boundary $\partial A$ and interior($A$).
   (a) $A = (0, 2)$.
   (b) $A = (0, 2) \cap \mathbb{Q}$.
   (c) $A = (0, 2) \cup \{3\}$.
   (d) $A = \{n + 1/n : n \in \mathbb{N}\}$.

2. Let $A \subseteq \mathbb{R}$, and $a \in A$. Prove that $a$ is either an interior point of $A$ or an accumulation point of $A^c$, but that it cannot be both.

3. Assume that $A \subseteq \mathbb{R}$ is bounded above. Prove that if $\sup A \not\in A$, then $\sup A$ is an accumulation point of $A$.

4. Determine, with proof, whether each of the following statements is true or false.
   (a) If $A \subseteq \mathbb{R}$ and $x \in \mathbb{R}$ is an upper bound of $A$, then $x$ is not in the interior of $A$.
   (b) If $A, B \subseteq \mathbb{R}$, and $x$ is both an interior point of $A$ and an interior point of $B$, then $x$ is an interior point of $A \cap B$.
   (c) If $A, B \subseteq \mathbb{R}$, and $x$ is both a boundary point of $A$ and a boundary point of $B$, then $x$ is a boundary point of $A \cap B$.
   (d) If $A \subseteq \mathbb{R}$ is open, then $A \cap (0, 1)$ is open.
   (e) If $A \subseteq \mathbb{R}$ is closed, then $A \cap (0, 1)$ is not closed.
   (f) If $A \subseteq \mathbb{R}$, then $\overline{A} = A \cap \overline{\mathbb{Q}}$.
   (g) If $A \subseteq \mathbb{R}$, then $\overline{A^c} = \overline{A^c}$.