Open and Closed Sets in a Metric Space- HW Problems

1. Prove the following (assume the standard metric on $\mathbb{R}$ and $\mathbb{R}^2$):
   a. $(-2,2)$ is an open set in $\mathbb{R}$.
   b. $[-2,2]$ is a closed set in $\mathbb{R}$.
   c. $(-2,2]$ is neither an open set nor a closed set in $\mathbb{R}$.
   d. Is $A = \{(x,y) | \ -2 < x < 2, \ \ y = 0\}$ open in $\mathbb{R}^2$? Prove your answer.

3. Let $A, B, C \subseteq X, d$ be non-empty open sets in a metric space X. Prove the following (without using the theorem that states that the union of open sets is open and the finite intersection of open sets is open).
   a. $A \cup B \cup C$ is open in X.
   b. $A \cap B \cap C$ is open in X.

4. Prove that If X, d is a metric space and $E \subseteq F \subseteq X$, then $\bar{E} \subseteq \bar{F}$.