Problems 1-5 gives statements which should be proved for a metric space using the associated definitions of open, closed, limits, etc.

1. The empty set ϕ and the whole space X are both closed and open.
2. A set A is closed if and only if $A^c = X \backslash A$ is open.
3. The union of any collection of open sets is open.

   Finite intersections of closed sets are closed.
4. Arbitrary intersections and finite unions of closed sets are closed.
5. f is continuous $\Longleftrightarrow f^{-1}(V)$ is open whenever V is open.
6. Give a reasonable definition of *pointwise continuity* in a general topological space and show that f is continuous if and only if f is pointwise continuous at every point.
7. Show that the open sets in a metric space form a topology.
8. Show that the two definitions of closed sets and closure coincide for metric spaces.
9. f is continuous if and only if the inverse image of every closed set is closed.