Name:

**Problem 1:** For each of the following, say if it is true or false. No justification is needed.

(a) The space  $\mathbb{R}$  in the usual topology is compact.

(b) Since  $\mathbb{R}$  is Hausdorff and  $Y = \{0\} \cup \{\frac{1}{n} \mid n \in \mathbb{Z}_+\}$  is compact, Y is closed in  $\mathbb{R}$ .

(c) In a compact space, every compact subspace is closed.

(d) Let X be a topological space, with subspace  $Y \subset X$ . To determine if Y is compact, we can consider whether every open cover of Y has a finite subcover, where here "open" can mean open in Y or open in X. However, to determine if Y is connected, we must decide if it admits a separation into two disjoint and nonempty sets that are open in Y, and this condition cannot be replaced by sets that are open in X.