Several of the problems on this assignment are repeats. Use nets!

- **1.** Show that a topological space in *X* is Hausdorff if and only if every convergent net in *X* has exactly one limit.
- **2.** Consider the product space $X \times Y$. Find (and prove) a condition in terms of coordinate functions that characterizes convergence of nets in the product. Does your condition also work for an arbitrary product?
- **3.** Show that a space *X* is Hausdorff if and only if the diagonal in $X \times X$ is closed.
- **4.** Let *G* be a topological group and let *H* be a subgroup. Show that \overline{H} is a subgroup.
- **5.** Suppose *X* is a space and *Y* is compact and Hausdorff. Show that a function $f : X \to Y$ is continuous if and only if the graph of *f* is closed.
- **6.** Show that the homeomorphism group of a connected manifold acts transitively. In other words, show that if *M* is a connected manifold, then for any two points *p* and *q* in *M* there is a homeomorphism $\psi : M \to M$ such that $\psi(p) = q$.