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. Munkres 26.8

4. Midterm 8b

5. Show that if p and q are elements of the interior of the closed unit ball

$$\mathbb{B}^n = \{x \in \mathbb{R}^n : |x| \leq 1\},$$

then there is a homeomorphism $\phi : \mathbb{B}^n \to \mathbb{B}^n$ such that $\phi(p) = q$ and such that $\phi(x) = x$ for all x with $|x| = 1$. Be as rigorous as you can, but avoid writing a tome.

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 $\psi(p) = q$.