1. Let $n \in \mathbb{N}$ and $U \subset S^n$ be open in the subspace topology relative to $\mathbb{R}^{n+1}$. Show that $U - \{x\}$ is open in S^n for every $x \in S^n$.

2. Show that if X is compact and $A \subset X$ then X/A is compact.

3. Let X be a topological space on which an equivalence relation $\sim$ is defined. Show that $U \subset X/{\sim}$ is open if
$$\left(\bigcup_{[a] \in U} [a] \right) \in \mathcal{T}_X$$

4. Proof or counterexample: if $A \cong C$ and $B \cong D$ then $A \times B \cong C \times D$.

5. Prove that $[0,1]/\partial[0,1] \cong S^1$. (Give all details here: explicitly define the homeomorphism, show it is bijective, and show that it satisfies the continuity requirements.)

6. Give an example of a topological space X and an equivalence relation $\sim$ on X such that $X/{\sim}$ is connected but X is not.

7. Give an example of a topological space X and an equivalence relation $\sim$ on X such that $X/{\sim}$ is compact but X is not.