1. Countable or uncountable (with proof)?
   (a) $\oplus_{\mathbb{N}}\mathbb{Q} = \{(q_1, q_2...) \in \mathbb{Q} \times \mathbb{Q} \times \mathbb{Q} \times ... :$ only finitely many q_i are non-zero.$\}$.
   (b) $\Pi_{\mathbb{N}}\mathbb{Q} = \{(q_1, q_2...) \in \mathbb{Q} \times \mathbb{Q} \times \mathbb{Q} \times ...\}$
2. Let $f : A \to B$, A and B subsets or $\mathbb{R}^n$. True or false with proof:
   (a) $\cup f^{-1}(A_j) = f^{-1}(\cup A_j)$
   (b) $\cap f^{-1}(A_j) = f^{-1}(\cap A_j)$
3. Let A be a convex set in $\mathbb{R}^n$ and show A^o and $\bar{A}$ are convex also.
4. (Lempert) Let A be an open, non-empty, convex set in $\mathbb{R}^n$, and show $A_r := \{x \in A : d(x, A^c) < r\}$ is also convex.
5. For any open $G \subseteq \mathbb{R}$, show G is a countable union of balls, i.e. $\exists\{B_{r_j}(x_j)\}_{j\in\mathbb{N}}$ with $G = \cup_j B_{r_j}(x_j)$.
6. Ture of False:

   If (X, d) is a non-empty metric space, and $x \in X$ then $\overline{N_1(x)} = \{y : d(x, y) \leq 1\}$
7. Recall, if G_α are open, and C_α are closed, then we know $\cup G_\alpha$ is open and $\cap C_\alpha$ is closed.

   Exhibit an example of open sets, G_α in say $\mathbb{R}^n$ such that $\cap G_\alpha$ is not open.

   Notice, by de Morgan's Law, we obtain a sequence C_α with $\cup C_\alpha$ not closed.
8. Consider $\mathbb{Z}$ the integers as a subspace of $\mathbb{R}$. Let $A \subseteq \mathbb{Z}$. Is A open in $\mathbb{Z}$ (i.e. is A open relative to $\mathbb{Z}$?) Is A open in $\mathbb{R}$. What about closed relative to $\mathbb{Z}$? $\mathbb{R}$?