1. If $G$ is open and dense in $\mathbb{R}$, show that $G \setminus \{x\}$ is also open and dense in $\mathbb{R}$. Is this true in any metric space? Explain.

2. Show that $\mathbb{N}$ is first category in $\mathbb{R}$ but second category in $\mathbb{N}$ itself.

5 pts. Evaluation.

③. If $M$ is complete, is every nonempty open set a second category set?

4. Show that the conclusion of Baire's thm. hold in $(\mathbb{N}, |\cdot|)$ but $\mathbb{N}$ is not a complete metric space.

5. If $N$ is homeomorphic to a complete metric space $M$, show that the conclusion of Baire's thm. holds in $N$.

6. Show that $\mathbb{R}^2$ cannot be written as a countable union of lines.

7. Let $V$ be an infinite-dimensional normed vector space, and suppose that $V = \bigcup_{n=1}^{\infty} W_n$ where each $W_n$ is a finite-dimensional subspace of $V$. Prove that $V$ is not complete.