1. Let $\mathcal{F}$ be the sheaf of abelian groups on $\mathbb{R}$ that assigns to $U \subset \mathbb{R}$ the abelian group of continuous functions $\sigma : U \to \mathbb{R}$ that vanish on some neighborhood of $0 \in \mathbb{R}$ whenever $0 \in U$.
   Calculate the stalk of $\mathcal{F}$ at $0 \in \mathbb{R}$.

2. Let $\mathcal{F}$ be the presheaf of abelian groups on $\mathbb{R}$ that assigns to $U \subset \mathbb{R}$ the abelian group of continuous, bounded functions $\sigma : U \to \mathbb{R}$.
   Explain why $\mathcal{F}$ is not a sheaf.

3. Let $S^1 = \{ z \in \mathbb{C} \mid |z| = 1 \}$ be the circle.
   Let $f : \mathbb{R} \to S^1$ be the universal covering $f(x) = \exp(2\pi ix)$.
   Let $\mathcal{F}$ be the sheaf of sets on $S^1$ that assigns to $U \subset S^1$ the set of continuous sections of $f$ over $U$. (A section of $f$ over $U$ is a map $\sigma : U \to \mathbb{R}$ such that $f \circ \sigma$ is the identity of $U$.)
   Set $U_\alpha = S^1 \setminus \{1\}, U_\beta = S^1 \setminus \{-1\}$.
   Calculate the diagram of restriction maps
   $\mathcal{F}(S^1) \to \mathcal{F}(U_\alpha) \times \mathcal{F}(U_\beta) \to \mathcal{F}(U_\alpha \cap U_\beta)$
   and verify that it exhibits $\mathcal{F}(S^1)$ as an equalizer.