1. Construct a Riemann integrable function on \([0, 1] \subset \mathbb{R}\) that has an uncountable number of discontinuities.

2. Let \(A \subset [0, 1]\) be a fat Cantor set (so \(\lambda(A) > 0\)). Prove that there exists no Riemann integrable function \(f\) on \([0, 1]\) such that \(f = \chi_A\) a.e.

3. Give an example of an open set whose boundary is not a null set.

4. Prove that there exists a Jordan measurable set contained in \(\mathbb{R}\) that is not a Borel set. **Hint:** Consider the set we constructed that was in \(\mathcal{L}\) but not \(\mathcal{B}\).