Problem 1

Let $X$ be a nonempty set. Prove that if a collections $C$ of $\mathcal{P}(X)$ is closed under countable intersections then it is closed under finite intersections.
Problem 2

What is a Vitali set? (You are allowed in this problem to use other resources)

(a) Why is this set important?

(b) Explain how Giuseppe Vitali used the axiom of choice to construct a Vitali set.

(c) Explain that the set is non-measurable.