(1) Let $M \subset R^n$ be a k-manifold. Let X be a smooth vector field on R^n. For any $p \in M$ let $X^T(p)$ be the result of the orthogonal projection of $X(p)$ onto T_pM.

Prove that X^T is a smooth vector field on M.

(2) Let $M \subset R^3$ be given by $\{z = x + y - 2\} \cap \{x^2 + y^2 - z^2 = 0\}$.

Show that M is a manifold and find T_pM for $p = (3, 4, 5)$.

(3) let $f\colon R^n \to R$ be C^∞ and let $c \in R$ be a regular value. let $M = \{f = c\}$. We know that M is an $n - 1$-manifold. Show that M is orientable.