1. Let $X \subset \mathbb{R}^N$ be an embedded submanifold. Show that almost every vector space $V$ of a fixed dimension $l$ in $\mathbb{R}^N$ intersects $X$ transversely.

2. Let $N$ be a closed embedded submanifold of $M$. Show that every smooth vector field $X \in \Gamma(N, TN)$ can be extended to a smooth vector field on $M$.

3. Let $X$ be a compact manifold, and let $Y$ be a connected manifold. We assume $\dim X = \dim Y$. For a smooth map $f : X \to Y$ such that $\deg_2(f) \neq 0$, show that $f$ is surjective.

4. Let $X$ be a vector field on a $m$-dimensional manifold $M$. Suppose $X_p \neq 0$. Show that there is a coordinate chart $(U, \varphi)$ with $\varphi(p) = 0 \in \mathbb{R}^m$ such that

$$X_q = \frac{\partial}{\partial x_1}$$

for all $q \in U$. Here $x_1$ is the first coordinate of $(x_1, x_2, \ldots, x_m) \in \mathbb{R}^m$. 
