(1) Let $\pi : \tilde{X} \to X$ be a covering space. Let $\Phi$ be a smooth structure on $X$. Prove that there is a smooth structure $\tilde{\Phi}$ on $\tilde{X}$ so that $\pi : (\tilde{X}, \tilde{\Phi}) \to (X, \Phi)$ is an immersion.

(2) Prove that the following are submanifolds of the space of $n \times n$ matrices, $Mat_{n,n}(\mathbb{R}) \cong \mathbb{R}^{n^2}$. Compute their dimensions.

1. $GL_n(\mathbb{R})$
2. $SL_n(\mathbb{R})$
3. $SO(n)$

(3) Due the following problems from Hirsch, “Differential Topology”:

- Chapter 1, section 1, # 1, 2, 3
- Chapter 1, section 2, # 10, 12, 13