1. Find an differentiable atlas for \( S^1 \times S^1 \),

2. Show that if \( M \) and \( N \) are differentiable manifolds then \( M \times N \) is a differentiable manifold.

3. Find a differentiable atlas for \( \mathbb{R} \) such that the identity map is not smooth.

4. Show that for every differentiable structure on \( \mathbb{R} \) there is a smooth, strictly increasing function from \( \mathbb{R} \) to \( \mathbb{R} \) where the second copy of \( \mathbb{R} \) has the standard structure. Use this to show that any two differentiable structures on \( \mathbb{R} \) are diffeomorphic.

5. \( SL_n(\mathbb{R}) \) is the space of \( n \times n \) matrices with determinant one. Show that \( SL_n(\mathbb{R}) \) is a differentiable manifold of dimension \( n^2 - 1 \). (Hint: The space of all \( n \times n \) matrices is naturally homeomorphic to \( \mathbb{R}^{n^2} \). The determinant is then a map from \( \mathbb{R}^{n^2} \) to \( \mathbb{R} \). Show that 1 is regular value of this map.)

6. Do #5, #7 in Section 4 of Guillemin and Pollack (pages 25-26).