Problem 1 Consider the unit circle $S^1$ of Example 4.19 of text-book as a topological manifold and the atlas $\{U_j, \phi_j\}, \ j = 1, 2$ defined in the example.

1. Calculate the transition functions $\phi_1 \circ \phi_2^{-1}, \phi_2 \circ \phi_1^{-1}$.

2. Decide whether $S^1$ is a $C^r$, $C^\infty$, or $C^\omega$ manifold.

3. prove that $U_1$ (the same is true for $U_2$) is an open set in the subset topology of $S^1$.

Problem 2 Consider $P^2$ as a topological manifold as discussed in the example 4.20 in the textbook.

1. Prove that $U_j, \ j = 0, 1, 2$, used in the atlas are open sets in the topology assigned to $P^2$ in the compactification process (see notes).

2. Find the transition maps $\phi_j \circ \phi_k^{-1}, \ j, k = 0, 1, 2, \ j \neq k$. 