Math T680 Topics in Geometry

HW #2

Due: Wednesday, April 26, 2017

1. Study the proof of Theorem 3.12.

   Fill in the proof of the converse part of theorem. See my notes for some clarifications.

2. In the lecture notes for Chapter 3, look at the linear map $S_p : \Omega^p(U) \to \Omega^{p-1}(U)$ I write down *after* I finish proving the Poincaré lemma. Prove that this map satisfies

   $$dS_p\omega + S_{p+1}d\omega = \omega,$$

   for any differential p-form on U, $p > 0$. Explain why this map can be used to prove the Poincaré lemma.

Figure 1: Henri Poincaré

3. Bonus question: Is this S_p the same as the one used in the proof by Madsen & Tornehave ?

4. Open question: How many different such maps can there be?