

## Math 120A: Homework 5

Due: November 7, 2014

1. Read sections 4.1-2 in Pressley.
2. Do problems 3.2.2, 3.2.3, 3.3.4, 4.1.2, 4.1.3, 4.1.7, and 4.1.8 in Pressley.
3. *Another sphere.* Another way to give coordinates to the sphere is called *stereographic projection*. Let  $S$  be the sphere of radius one and center  $(0, 0, 0)$ , so that the south pole of the sphere sits at  $(0, 0, -1)$  and the north pole sits at  $(0, 0, 1)$ . Then if  $p$  is any point on the sphere other than the north pole  $(0, 0, 1)$ , there is a unique line through  $(0, 0, 1)$  and  $p$ ; we map  $p$  to the intersection  $q$  of this line with the  $xy$ -plane. This gives a map  $\sigma : S \setminus \{(0, 0, 1)\} \rightarrow \mathbb{R}^2$ .
  - Write down the map  $\sigma$  and  $\sigma^{-1}$  in coordinates, and show that  $\sigma^{-1}$  is a smooth surface patch for  $S$ .
  - Write down a second surface patch on this general idea so that the two surface patches taken together cover  $S^2$ , and compute the transition map between your surface patches.