

**Topics in Topology**  
(Homework 2)  
January 12, 2015

---

- Each question is worth 10 points.
  - Due date - January 28, 2015.
- 

1. Prove that an open submanifold of an  $R$ -orientable manifold  $M$  is also  $R$ -orientable. Use it to conclude that  $M$  is  $R$ -orientable if and only if all its connected components are.
2. Suppose  $M$  is connected. Then prove that two  $R$ -orientations of  $M$  which agree at one point are equivalent.
3. Let  $X$  denote the quotient space of  $\mathbb{R}$  obtained by imposing the following equivalence relation:  $x \sim y$  iff  $x = -y$  and  $|x| > 1$ . Show that  $X$  is a non-Hausdorff 1-manifold.
4. Is the space  $X$ , constructed above, orientable? Justify your answer.
5. Let  $M$  be a manifold and let  $M_R$  denote the  $R$ -orientation sheaf. Show that for a subspace  $A$  of  $M$  the set of all sections  $\gamma_A$  over  $A$  has an  $R$ -module structure.