

**MANIFOLDS: FALL 2014**  
**EXERCISE 2**

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ABSTRACT. Chapters 1.1-1.3 by Guillemin-Pollack

**Problem 1.** *Show that the linear structure on  $T_p M$  is well-defined (i.e. does not depend on the choice of  $\phi$ ).*

**Problem 2.** *Check that the charts  $(TU, (\phi, d\phi))$  form an atlas on  $TM$  (i.e. that the transition maps are smooth).*

**Problem 3.** *Construct an atlas making the product  $M \times N$  of two manifolds a smooth manifold.*

**Problem 4.** *Prove that  $T\mathbb{S}^1$  is diffeomorphic to a cylinder  $\mathbb{S}^1 \times \mathbb{R}$ .*

**Problem 5.** *1.2.5, 1.3.3, 1.3.4, 1.3.10 by Guillemin, Pollack*