

(Revised) Exercise Set #2 due Friday Jan 29

1. Show that if  $n \neq k$  then  $\mathbb{R}^n$  is not diffeomorphic to  $\mathbb{R}^k$ .
2. Let  $\det: \text{Hom}(\mathbb{R}^2, \mathbb{R}^2) \rightarrow \mathbb{R}$  be the determinant. Compute  $D(\det)$  and  $D^2(\det)$ .
3. Let  $E = \text{Hom}(\mathbb{R}^n, \mathbb{R}^n)$  and let  $f: E \rightarrow E$  be  $f(A) = A^2$ . Compute  $Df$ ,  $D^2f$  and  $D^3f$ . That is, compute

$$Df(A)(B), \quad D^2f(A)(B)(C), \quad D^3f(A)(B)(C)(D)$$

for  $A, B, C, D \in E$ .