Exercise 1
Show that the unit tangent bundle of the 2-sphere is equivalent to \( SO(3) \cong \mathbb{R}P^3 \).

Exercise 2
Let \( \xi = (E, \pi, M, F) \) be a locally trivial fiber bundle over a smooth manifold \( M \). Let \( N \) be another smooth manifold and \( f : N \to M \) a smooth function. Show that the pullback bundle \( f^*\xi \) is a locally trivial fiber bundle over \( N \).

Exercise 3
Let \( \xi = (P, \pi, M, G) \) be a principal \( G \)-bundle over \( M \). Let \( N \) be a smooth manifold and let \( f : N \to M \) be a smooth map. Show that the pullback bundle \( f^*\xi \) is a principal \( G \)-bundle over \( N \).

Exercise 4
Let \( G \) be a Lie group and \( H \leq G \) a closed subgroup. Let \( G/H \) be the corresponding homogeneous space of \( G \) and let \( \pi : G \to G/H \) be the quotient map. Show that \( (G, \pi, G/H, H) \) is a principal \( H \)-bundle over \( G/H \) with total space \( G \).

Due: Friday, 6.6.2014, during the exercise class.