PROBLEM SET #9

Issued: 5 Mar 09
Due: 12 Mar 09

Reading: Abraham, Marsden, and Ratiu (MTA), Sections 7.4–7.5, 8.1–8.2

Problems:

1. Calculate exterior derivatives of the following forms in $\mathbb{R}^3$:
   
   (a) $z^2dx \wedge dy + (z^2 + 2y)dx \wedge dz$
   
   (b) $z^2dx \wedge dy + (z^2 + 2y)dx \wedge dz$
   
   (c) $f \, dg$, where $f$ and $g$ are functions on $\mathbb{R}^3$
   
   (d) $(x + 2y^3)(dz \wedge dx + \frac{1}{2}dy \wedge dx)$

2. MTA, 7.4-3: practice with exterior derivatives

3. MTA, 7.5-6: divergence of a Lie bracket

4. MTA, 8.2-1: pullback and exterior derivatives

5. MTA, 8.2-2: exterior derivative on a manifold without boundary

6. Consider the locomotion system given by a disk rolling on the plane from homework #7. Using the exterior derivative of the kinematic connection, determine if the system is totally controllable and/or fiber controllable.