

Geometric Analysis, Autumn 2014

University of Maryland, Department of Mathematics course 742

HW 1: (due by September 11.)

1. Prove the Levi-Civita connection is unique.
2. Explain carefully why

$$\nabla_{\dot{\gamma}} \dot{\gamma} = [\ddot{\gamma}^k + \Gamma_{ij}^k \dot{\gamma}^i \dot{\gamma}^j] \partial_k.$$

3. Using your favorite method (spherical coordinates, stereographic projection, you name it) write down Christoffel symbols for the round sphere in \mathbb{R}^3 . Use this to write down and solve the geodesic equation and show that the solutions are great circles.