

Introduction to Differential Geometry

M533, Fall 2005

MWF 10:10 am - 11:00 am

Instructor: Chris Judge, Rawles 241

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Description: The sequence M533-534 introduces graduate students to modern differential geometry, a rapidly developing subject with a broad range of applications to other areas of mathematics. This course emphasizes Riemannian geometry, the study of spaces that are like Euclidean space at an infinitesimal level. Very basic examples such as curves and surfaces in $\mathbf{R}^3$, spheres and hyperbolic space, will serve to motivate and illustrate the theory. In the Fall semester, M533, we will emphasize the ‘local’ aspects of the theory for which the abstraction of manifolds is not necessary. In the Spring semester, M534, Professor Dadok will continue the discussion and present a few of the beautiful ‘global’ results, for example, the Gauss-Bonnet theorem.

Prerequisites: The prospective student should have a good understanding of undergraduate linear algebra (M303) and undergraduate analysis (M413).

List of topics for M533-M534:

- metrics, lengths of curves, length spaces
- submanifolds of Euclidean space, coordinates
- geodesics, calculus of variations
- covariant derivative, connections, curvature
- spaces of constant curvature, Lie groups
- manifolds, bundles, tensors

References:

- *Riemannian Geometry* by Peter Petersen
- *Riemannian Geometry* by Gallot, Hulin, and Lafontaine
- Notes on Riemannian geometry by Matthias Weber. Donationware:

<http://iu-math-133.math.indiana.edu/projects/notes/riemann/index.html>