

MATH 4503 - 001 Differential Geometry and Vector Calculus

MoWeFr 2:30PM - 3:20PM
Classroom SCEN 0404
Instructor Luca Capogna

Textbook: Either
"Calculus on Manifolds", by Michael Spivak, Westview Press, 5th Edition.

or

"Analysis on Manifolds", by James R. Munkres, Westview Press.

Class Syllabus:

Part I: Euclidean spaces, a review of multivariable calculus.

Review of Linear Algebra
Matrix inversion and determinants
Review of Topology
Compact subspaces and connected subspaces

The derivative
Continuously differentiable functions
The chain rule
The inverse function theorem
The implicit function theorem

The integral over a rectangle
Existence of the integral
Evaluation of the integral
The integral over a bounded set
Rectifiable set

Partitions of Unity
The change of variables theorem (with proof)
Diffeomorphisms
Applications of Change of Variables

Part II: Manifolds

Manifold in Euclidean space
Volume of a parallelepiped
Volume of a parametrized manifold
Boundary of a manifold
Integrating a scalar function over a manifold

Differential forms
Multilinear algebra
Alternating tensors
The wedge product
The differential operator
The action of a differentiable map

Integrating forms over parametrized manifolds
Orientable manifolds
A geometric interpretation of forms and integrals
The generalized Stokes Theorem

Introduction to Riemannian Geometry