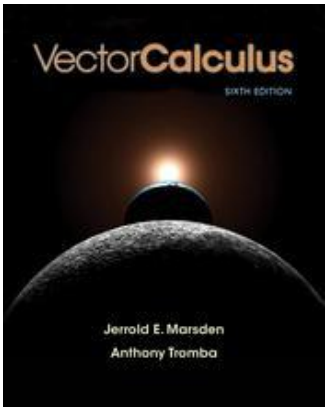
Department of Mathematics
Johns Hopkins University

110.202 Calculus III
Course Syllabus

The following list of topics is considered the core content for the course 110.202 Calculus III. The current text for the course is:

Text: **Vector Calculus,** *6th Edition*, Marsden, J., and Tromba, A., W.H. Freeman, August 2003, **ISBN-13: 9781429215084**, **ISBN-10: 1429215089**.

Course Topics



- **The Geometry of Euclidean Space (1 week)**
  - 1.1 Vectors in Two- and Three-Dimensional Space
  - 1.2 The Inner Product, Length, and Distance
  - 1.3 Matrices, Determinants, and the Cross Product
  - 1.4 Cylindrical and Spherical Coordinates
  - 1.5 n-Dimensional Euclidean Space
- **Differentiation Space (2 weeks)**
  - 2.1 The Geometry of Real-Valued Functions
  - 2.2 Limits and Continuity
  - 2.3 Differentiation
  - 2.4 Introduction to Paths
  - 2.5 Properties of the Derivative
  - 2.6 Gradients and Directional Derivatives
- **Higher-Order Derivatives: Maxima and Minima (2- weeks)**
  - 3.1 Iterated Partial Derivatives
  - 3.2 Taylor's Theorem
  - 3.3 Extrema of Real-Valued Functions
  - 3.4 Constrained Extrema and Lagrange Multipliers
  - 3.5 The Implicit Function Theorem
- **Vector-Valued Functions (1+ weeks)**
  - 4.1 Acceleration and Newton's Second Law
  - 4.2 Arc Length
  - 4.3 Vector Fields
  - 4.4 Divergence and Curl
- **Double and Triple Integrals (1 week)**
  - 5.1 Introduction
  - 5.2 The Double Integral Over a Rectangle
  - 5.3 The Double Integral Over More General Regions
  - 5.4 Changing the Order of Integration
  - 5.5 The Triple Integral
- **The Change of Variables Formula and Applications of Integration (1 week)**
  - 6.1 The Geometry of Maps from $\mathbb{R}^2$ to $\mathbb{R}^2$
  - 6.2 The Change of Variables Theorem

- **Integrals (2 weeks)**
  - 7.1 The Path Integral
  - 7.2 Line Integrals
  - 7.3 Parameterized Surfaces
  - 7.4 Area of a Surface
  - 7.5 Integrals of Scalar Functions Over Surfaces
  - 7.6 Surface Integrals of Vector Functions
- **The Integral Theorems of vector Analysis (2 weeks)**
  - 8.1 Green's Theorem
  - 8.2 Stokes' Theorem
  - 8.3 Conservative Fields
  - 8.4 Gauss' Theorem