

**Topics for Exam 2****I. Differentiability**

1. Sufficient conditions for differentiability
  - i. Differentiability of Paths; tangent line approximation.
  - ii. Differentiability of scalar fields.
  - iii.  $C^1$  maps and differentiability.
  - iv. The Jacobian matrix
2. Differentiability of Compositions: The Chain Rule

**II. Integration**

1. Path Integrals
  - i. Arc Length
  - ii. Definition of the Path Integral
2. Line Integrals
  - i. Gradient Fields
  - ii. Flux Across Plane Curves
3. Differential Forms
  - i. Differential 1-forms
  - ii. Calculus of Differential Forms
  - iii. Evaluating 2-forms: Double Integrals
4. Fundamental Theorem of Calculus in  $\mathbb{R}^2$ 
  - i. The differential of a form
  - ii. Green's Theorem
5. The Change of Variables Theorem