

Topics for Exam 2**1. Differentiability**

- 1.1 Definition of differentiability
- 1.2 The derivative as a linear approximation
- 1.3 Derivatives of vector valued functions
- 1.4 Derivatives of scalar fields
 - i. The gradient
 - ii. Partial derivatives
 - iii. Directional derivatives
- 1.5 Derivatives of paths
 - i. Differentiable paths
 - ii. Tangent line to a path
 - iii. C^1 curves and parametrizations
 - iv. Simple C^1 curves.
 - v. Piecewise C^1 simple curves
 - vi. Simple closed curves
 - vii. Arclength of a curve; arclength parameter
- 1.6 The chain rule
 - i. Directional derivatives of scalar fields
 - ii. The Jacobian matrix of a differentiable function
 - iii. The derivative of a composition of functions

2. Integrals on Curves

- 2.1 Path integrals
- 2.2 Line integrals
- 2.3 Flux across a closed curve

3. The Fundamental Theorem of Calculus

- 3.1 Line integrals of gradient fields
- 3.2 The divergence theorem
- 3.3 The Fundamental Theorem of Calculus
- 3.4 Double integrals

Relevant sections in the online class notes: 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 5.1, 5.2, 5.3, 5.4 and 5.7.

Relevant assignments: 8, 9, 10, 11, 12, 13, 14, 15 and 16.

Important concepts: differentiability, the derivative map, partial derivatives, gradient of a scalar field, C^1 curves, piecewise C^1 curves, simple curves, simple closed curves, parametrizations, re-parametrizations, arclength, path integral, line integral, flux, divergence of a vector field, and double integrals.

Important skills: know how to show whether a function is differentiable or not; know how to compute partial derivatives, gradients and directional derivative of scalar fields; know how to compute derivatives of differentiable paths; know how to compute the derivative map (or Jacobian matrix) of a differentiable vector-valued function; know how to apply the chain rule; know how to evaluate the arclength of C^1 curves; know how to evaluate path integrals; know how to evaluate line integrals; know how to compute flux across a simple closed curve; know how to compute the divergence of a vector field; know how to apply the divergence theorem; know how to evaluate double integrals; know how to apply the fundamental theorem of Calculus.