

# Fall 2014 Math 211 Final Exam Topics

The exam will take place 2-5pm on Monday, December 15 in Chapin 201. You will not be allowed use of a calculator or any other device other than your pencil or pen and some scratch paper. Notes are also not allowed. In kindness to your fellow test-takers, please turn off all cell phones and anything else that might beep or be a distraction.

- Elementary vector analysis:
  - Dot and cross products
  - Orthogonal vectors and parallel vectors
  - Angle between vectors
  - Lines and planes
  - Parametric equations for curves, including lines and circles
  - Differentiation of vector-valued functions
  - Tangent vector to a parameterized curve
  - Velocity and acceleration
  - Arc length of a curve
  - Unit tangent, normal, and binormal vectors
  - Curvature
  
- Definitions involving functions of several variables:
  - Limits and continuity for functions of 2 variables
  - Differentiability
  - Partial derivative
  - Directional derivative
  - Gradient and its importance (points in direction of greatest increase), and its relation to level sets (gradient perpendicular to level curve or surface)
  - Tangent plane to a surface
  - Linear approximation to a functions of 2 or more variables
  
- Computations using the usual rules of differentiation (product rule, quotient rule, chain rule):
  - Partial derivatives
  - Directional derivatives
  - Gradients
  - Tangent planes and linear approximations
  
- Proofs and computations using the definition:
  - $\epsilon$ - $\delta$  proofs for limits in the plane
  - Prove when a limit does not exist
  - Prove continuity (or not) for a function of two variables at a point
  - Compute partial derivatives and directional derivatives from the definition
  
- Maxima and minima of functions of several variables:
  - Finding critical points
  - Second Derivative Test for local extrema and saddle points
  - Method of Lagrange multipliers for one constraint
  - Finding absolute max and min on a closed bounded region

- Double integrals:
  - Iterated integrals (Fubini's Theorem)
  - Cartesian and polar coordinates
  - Finding area of a region in the plane, surface area, and volume
  - Change of variables
  
- Triple integrals:
  - Cartesian, cylindrical and spherical coordinates
  - Computing volume
  
- Line integrals of scalar functions and of vector fields along a curve:
  - Basic computation
  - Fundamental Theorem of Line Integrals
  - Properties of gradient (conservative) fields
  - Green's Theorem

Review each of these topics (skim lecture notes and textbook, rework homework problems, exam review problems, and in-class exams). When you feel ready, take the practice exams posted on the course webpage. There are also past years' exams available at <https://www.amherst.edu/academiclife/departments/mathematics/mathfinals> (note that Math 211 was previously called Math 13). Skip any problems on past exams on topics we aren't covering on our current final exam.