

Fall 2015 Math 211 Final Exam Topics

The exam will take place 2-5pm on Sunday, December 20. 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 and normal 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:
 - ϵ - δ 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
 - Computing mass and center of mass

- 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). There are also past years' exams available at <https://www.amherst.edu/academiclife/departments/mathematics/mathfinals>. Skip any problems on past exams on topics we aren't covering on our current final exam.