Spring 2017 Math 211 Final Exam Topics

The exam will take place 2-5pm on Thursday, May 11 in Mudd 205. 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 function 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:
    - $\varepsilon-\delta$ 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 for double integrals

- 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. Skip any problems on past exams on topics we aren't covering on our current final exam.