Spring 2019 Math 211 Final Exam Topics

The exam will take place 2-5pm on Friday, May 17 in Mudd 206. 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
    - Arc length of a curve
    - Unit tangent and normal vectors
    - Level curves and level sets

- 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 surface area and volume

- Triple integrals:
  - Cartesian, cylindrical and spherical coordinates
  - Computing volume

- Line integrals and surface integrals:
  - Basic computation
  - Fundamental Theorem of Line Integrals
  - Properties of gradient (conservative) fields
  - Green's Theorem
  - Divergence and curl
  - Surface integrals
  - Stokes' Theorem
  - Divergence 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.