Math 223: Multivariable Calculus
Exam 2 Review

This is a list of topics for our first exam. This list is not necessarily exhaustive, but it covers the main ideas we have seen since the first exam.

Remember that the main objective of the exam is to give you a chance to review the things we have learned in our class and to help solidify your mental connections between them. When studying, you can use homework problems, our extended problem list, and/or other problems from the textbook as practice. If there is a particular concept or area that you find challenging, you might consider focusing your attention on problems related to that topic.

To review the theory, you can look at the theorems in the book; review the online videos, notes, and homework to see how we applied the theorems; review how our various formulas were derived; and, for any of the homework problems, consider how you would justify your computational answer. I won't ask you to re-derive any of the formulas we have used, but knowing for yourself where they came from can really help to highlight the underlying concepts so that you will be able to use them in increasingly fluid and flexible ways.

- Differentiation of Multivariable Functions
  - The chain rule for the total derivative.
  - Directional derivatives: meaning/interpretation, how to compute.
  - The gradient vector: how to compute and properties/applications.
  - Tangent planes to level surfaces.
  - Parametrized curves and arc length.
  - Vector fields: definition and divergence, curl, and gradient operators. Definition of a conservative vector field.
  - Optimization
    - Degree 2 Taylor polynomials: how to compute and their relationship to the second derivative test.
    - The second derivative test for functions $f : \mathbb{R}^2 \to \mathbb{R}$.
    - Lagrange multipliers.
    - The Extreme Value Theorem: hypotheses of the theorem, what it says, how to apply it.

- Integration of Multivariable Functions
  - Double integrals: definition and interpretation, and computing iterated integrals over rectangular and general regions in $\mathbb{R}^2$.