Topics To Review For Final Exam

- Chapters 13 and 14: Vectors
  - Notation and Definitions
  - Arithmetic operations such as dot and cross products
  - Applications to geometry, equations for lines and planes
  - Other applications, components in different directions
  - Other applications, parametric curves, tangent and normal vectors curvature, $\overrightarrow{N}$, $\overrightarrow{B}$
  - Coordinate systems for space
- Chapter 15, functions from 2 or more variables to real numbers
  - Definitions, contour lines, level lines and surfaces, graphing
  - Partial Derivatives: Definition, how to calculate, what they tell you
  - Limits, continuity: Just having a limit for each coordinate is not enough, when mixed partial derivatives are equal
  - Differentiability, linearity, introduction of gradient field
  - Directional derivatives: Definition, how to calculate, direction of largest or smallest derivative and the derivative in that direction, gradient perpendicular to level curve, then higher dimensions
  - The chain rule, what pieces to put in
  - Tangent planes, Linear approximations (tangent plane arose in two different contexts, to level surface or to graph...)
  - Application to local/global maxima and minima: finding critical points, testing with second partials
  - Application to max/min with a constraint: Lagrange's multipliers
- Chapter 16, Integrals of functions of several variables
  - Definition for 2 variables and rectangles, using limits
  - Integral as limit exists if f continuous
  - From double integral to iterated integral, definition, existence
  - Application to volume

- Double and iterated integrals over non-rectangles: Setting up limits, evaluating, changing order
- Double integrals in polar coordinates: Why do we need "$r\,dr\,d\theta$"?
- Applications of the double integral to mass, moments, center of mass, etc.
- Application of double integral to compute surface area
- From double to triple and higher integrals: Rectangular boxes, then arbitrary regions. Setting up limits, evaluating. Applications to mass, etc.
- Triple integrals in cylindrical and spherical coordinates.

Chapter 17, Vector Calculus

- Definitions and terms: Vector and scalar fields, divergence and curl of a vector field, gradient producing a vector field from a scalar field, conservative (vector) fields and their potential (scalar) fields
- Definition of a line integral, how to compute for a parameterized curve and scalar field, applications to vector functions and specifica applications such as computing work
- The fundamental theorem for line integrals, consequent importance of a potential function, independence of path and integration to give zero on a closed curve, and when there will be a potential function and how to find it
- Green's theorem in several forms, and applications and terminology such as flux across a curve
- Surface integrals, definition and how to set up and evaluate; Flux through a surface
- (Gauss') divergence theorem, in several forms
- Stoke's theorem, including orientation of a surface (choice of normal) and its relation to orientation of the boundary