Exam 2 Outline (Motivating Questions)

10.8 Lagrange Multipliers

- What geometric condition enables us to optimize a function $f = f(x, y)$ subject to a constraint given by $k = g(x, y)$, where k is a constant?
- How can we exploit this geometric condition to find the extreme values of a function subject to a constraint?

11.1 Double Integrals

- What is a double Riemann sum?
- How is the double integral of a continuous function $f = f(x, y)$ defined?
- What are two things the double integral of a function can tell us?

11.2 Iterated Integrals

- How do we evaluate a double integral over a rectangle as an iterated integral, and why does this process work?

11.3 Double integrals over general regions

- How do we define a double integral over a non-rectangular region?
- What general form does an iterated integral over a non-rectangular region have?

11.4 Applications of double integrals

- If we have a mass density function for a lamina (thin plate), how does a double integral determine the mass of the lamina?
- How may a double integral be used to find the area between two curves?
- Given a mass density function on a lamina, how can we find the lamina's center of mass?

11.5 Double integrals in polar coordinates

- What are the polar coordinates of a point in two-space?
- How do we convert between polar coordinates and rectangular coordinates?
- What is the area element in polar coordinates?
- How do we convert a double integral in rectangular coordinates to a double integral in polar coordinates?

11.7 Triple integrals

- How are a triple Riemann sum and the corresponding triple integral of a continuous function $f = f(x, y, z)$ defined?
- What are two things the triple integral of a function can tell us?

11.8 Triple integrals in Cylindrical and Spherical coordinates

- What are the cylindrical coordinates of a point, and how are they related to Cartesian coordinates?

- What is the volume element in cylindrical coordinates? How does this inform us about evaluating a triple integral as an iterated integral in cylindrical coordinates?
- What are the spherical coordinates of a point, and how are they related to Cartesian coordinates?
- What is the volume element in spherical coordinates? How does this inform us about evaluating a triple integral as an iterated integral in spherical coordinates?

9.6: Vector-Valued Functions

- What is a vector-valued function? What do we mean by the graph of a vector-valued function?
- What is a parameterization of a curve in $\mathbb{R}^2$? In $\mathbb{R}^3$?
- What can the parameterization of a curve tell us?

9.7: Derivatives and Integrals of Vector-Valued Functions

- What do we mean by the derivative of a vector-valued function and how do we calculate it?
- What does the derivative of a vector-valued function measure?
- What do we mean by the integral of a vector-valued function and how do we compute it?

Exam 2 Outline (Important Concepts and Formulas)

- Method of Lagrange Multipliers
- Interpretation of λ in a Lagrange multipliers question
- Determining if a solution to Lagrange multipliers question is min or max
- Double Integrals (numerically)
- Double integrals over rectangles
- Double integrals over general regions
- Computing double integrals
- Polar coordinates
- dA in polar coordinates
- Polar to Cartesian and vice-versa
- Mass, area, and center of mass computations in 2-D
- Triple integrals over cuboids
- Triple integrals over general regions
- Computing triple integrals
- Cylindrical Coordinates
- dV in cylindrical coordinates
- Cartesian to Cylindrical coordinate conversions (and vice-versa)
- Spherical Coordinates
- dV in spherical coordinates
- Cartesian to Spherical coordinates conversions (and vice-versa)
- Vector-valued functions
- Plots of vector-valued functions
- Forms of vector-valued functions
- Derivatives of vector-valued functions
- Interpretations of derivatives/integrals of vector-valued functions
- Integrals of vector-valued functions
- Standard parameterizations
  - Lines
  - (general) circles
  - Unit Circle
  - Graphs of functions of the form $y = f(x)$
- Derivatives of vector-valued functions
- Interpretations of first, second derivatives of a vector-valued function
- Integrals of vector-valued functions