Math 323

Exam 4 Review Sheet

Section 16.9 La Grange Multipliers

• Understand the concept of optimizing a function of several variables with respect to one or more constraints.
• Memorize the statement of La Grange's Theorem and the Extension to La Grange's Theorem.
• Be able to use the method of La Grange to find the extrema of a given function relative to one or more constraints.
• Be able solve application problems using the method of La Grange.

Section 17.1 Double Integrals

• Understand the definition of a double integral over a region in the plane. You should also understand how this definition arises from looking at the limit over all Riemann sums based on refinements of inner rectangular partitions of a region in the plane.
• Understand how to use partitions and a sum of rectangular solids arising form a given partition in order to approximate the value of a double integral.
• Memorize Fubini's Theorem, and be able to apply it to evaluate a double integral by rewriting it as an iterated integral.
• Know and be able to apply the basic properties of double integrals.
• Given a description of a region in the plane R , be able to express R using the limits of integration of an iterated integral. Also, given a iterated double integral, be able to graph the region of integration.

Section 17.2 Area and Volume (Using Double Integrals)

• Be able to express the area of a region in the plane as an iterated integral. These regions could be rectangular, or could be bounded by a pair of functions in one of the two variables.
• Be able to express the volume under a given function and over a region in the plane as an iterated integral.
• Be able to find the area of a region in the plane or the volume under a given function and over a region in the plane by evaluating iterated integrals.

Section 17.3 Double Integrals in Polar Coordinates

• Understand how translate a double integral over a region in the plane into an iterated polar integral. In particular remember the differential involved: $dA = r\,dr\,d\theta$.
• Given a description of a region R in the plane, be able to set up an iterated polar integral representing the area of the region.
• Given a description of a function over a region R in the plane, be able to set up an iterated polar integral representing the volume of the solid under the function and over the region R.
• Be able to translate a rectangular iterated integral into a polar iterated integral.
• Be able to determine, based on the form of the region and/or the integrand, whether a double integral would best be evaluated using rectangular coordinates, or whether polar coordinates would be a better choice of coordinate systems.

Section 17.4 Surface Area

• Understand how represent the surface area of a surface over a region in the plane using a double integral.
• Be able to set up and evaluate iterated double integrals representing the surface area of a surface over the plane when given a description of the surface.

Section 17.5 Triple Integrals

• Understand the definition of a triple integral over a solid in space. You should also understand how this definition arises from looking at the limit over all Riemann sums based on refinements of inner rectangular partitions of a given solid.
• Memorize Fubini's Theorem for triple integrals, and be able to apply it to evaluate a triple integral by rewriting it as an iterated integral both over a rectangular solid and over more complicated solids.
• Given a description of a solid Q , be able to express Q using the limits of integration of an iterated integral. Also, given a iterated triple integral, be able to graph the solid of integration Q.
• Be able to use a triple integral to find the mass of a solid Q given a density function $\delta(x, y, z)$ for Q.

Section 17.7 Cylindrical Coordinates

• Understand the definition of cylindrical coordinates and memorize the formulas used to convert from rectangular coordinates to cylindrical coordinates and vice versa.
• Memorize the evaluation theorem for iterated integrals in cylindrical coordinates, especially the differential $dV = r\,dr\,d\theta\,dz$.
• Given an iterated integral in cylindrical coordinates, be able to graph the solid Q determined by the limits of integration.
• Given a description of a solid Q, be able to determine the limits of integration for an iterated integral in cylindrical coordinates that could be used to find the volume of Q.
• Be able to determine, based on the form of the solid Q and/or the integrand, whether a triple integral would best be evaluated using rectangular coordinates, or whether cylindrical coordinates would be a better choice of coordinate systems.
• Be able to set up and evaluate an iterated integral in cylindrical coordinates.

Section 17.8 Spherical Coordinates

• Understand the definition of spherical coordinates and memorize the formulas used to convert from rectangular coordinates to spherical coordinates and vice versa.
• Memorize the evaluation theorem for iterated integrals in cylindrical coordinates, especially the differential $dV = \rho^2 \sin\phi\,d\rho\,d\phi\,d\theta$.
• Given an iterated integral in spherical coordinates, be able to graph the solid Q determined by the limits of integration.
• Given a description of a solid Q, be able to determine the limits of integration for an iterated integral in spherical coordinates that could be used to find the volume of Q.
• Be able to determine, based on the form of the solid Q and/or the integrand, whether a triple integral would best be evaluated using rectangular coordinates, cylindrical coordinates, or spherical coordinates.
• Be able to set up and evaluate an iterated integral in spherical coordinates.