MATH 280A — Multivariate Calculus — Fall 2012

Objectives for Exam #4

A well-prepared student for Exam #4 should be able to

- articulate a fundamental meaning for each type of integral we have studied
- state a geometric meaning of the cross product
- compute a cross product given the components of two vectors
- compute the area of a parallelogram or of a triangle given the coordinates of vertices
- determine (by either computation of geometric argument) an expression for an infinitesimal area element for a given surface in space
- evaluate a surface integral for a given function (i.e., scalar field) and a given surface in space either by a geometric argument or be setting up and evaluating an equivalent iterated integral (in two variables)
- construct and evaluate an integral to compute the area of a given surface
- construct and evaluate an integral to compute the total for some quantity given a surface and an area density along that surface
- sketch or describe a vector field plot for a given vector field in the plane or in space
- evaluate a line integral for a given vector field and given curve in the plane or in space either by a geometric argument or by setting up and valuating an equivalent definite integral (in one variable)
- interpret a line integral for a vector field in terms of either work or fluid flow
- use the component test (or the curl) to determine whether or not a given vector field is conservative (that is, has a potential function) for a given region
- find a potential function for a given conservative field
- use the Fundamental Theorem of Line Integrals to evaluate a given line integral for a vector field
- understand and articulate the connection between a vector field having a potential function, path-independence of line integrals for the vector field, and the value of line integrals for that vector field along closed curves
- evaluate a surface integral for a given vector field and a given surface in space either by a geometric argument or by setting up and evaluating an equivalent iterated integral (in two variables)
- interpret a surface integral for a vector field in terms of fluid flow
- compute the divergence of a given vector field and interpret a divergence value in terms of fluid flow
- compute the curl of a given vector field and interpret a curl vector in terms of fluid flow
- evaluate a given integral indirectly by using a fundamental theorem to trade in for an equivalent expression that is more easily evaluated
- use a fundamental theorem to relate information about the derivative of a function over a region to the integral of that function over the edge of the region