Math 217: List of Core Skills

A student successfully completing Math 217 (Fall 2013) should:

- understand **vector functions** of one variable, their use in describing space curves (their tangent vectors, lengths), and in describing motion in space (position, velocity/speed, acceleration)
- understand **functions of several variables**, their domains, ranges, graphs, level curves/surfaces, limits, and continuity
- understand the definition, computation, and interpretation of **partial derivatives**, their relation to the tangent plane and their role in linear approximation, and the notion of differentiability of a function of several variables
- be able to use the various forms of the **chain rule** for functions of several variables
- know the **gradient** vector and its meaning, and its relation to level curves/surfaces and to directional derivatives
- be able to find local and global **maximum and minimum values** of functions of several variables, and to use the Lagrange Multiplier method in the presence of constraints, and understand the Extreme Value Theorem and its role in such problems
- understand the definition and simple applications (eg. volumes, centres of mass) of **double/triple integrals**, and be able to compute them over regions of TypeI/II(/III) as iterated integrals, possibly using change of variables (including polar, cylindrical or spherical coordinates)
- know what a **vector field** is
- know how to to compute **line integrals** of functions (with respect to arc length or one of the coordinates) and vector fields, by parameterizing the curve
- know what the **curl and divergence** of a vector field are, the basic calculus of div, grad, and curl (eg. product rules with dot or cross products, etc.), and that curl grad = 0 and div curl = 0
- know what **conservative vector fields** are, how to detect them using curl (or its 2D version $Q_x - P_y$), and the the path-independence property of their line integrals (and the fundamental theorem for line integrals)
- understand **parametric surfaces**, their normals and surface areas, and how to compute **surface integrals** of (scalar) functions and vector fields by parameterizing the surface
- understand the statements of the **theorems of Green, Stokes, and Gauss (Divergence)** and be able to use them to compute/relate line, surface, and double/triple integrals