MATH 264: COURSE GOALS

Vector operations:

- perform basic operations on vectors in 3D: addition, subtraction, scalar multiplication, dot product, crossproduct
- visualize addition, subtraction and scalar multiplication geometrically
- state geometric meaning of dot product and crossproduct;
- recognize and write down the equations defining lines and planes, and draw geometric information from the equations (such as a point on lines/planes, tangent and normal vectors, intersections)

Vector-valued functions of one variable:

- visualize given functions as curves in space
- find functional parametrization of given curves
- find their derivatives and interpret it as tangent vector to curve
- for function describing the motion of a particle, interpret derivatives as velocity and acceleration; solve initial value problems

Scalar-valued functions of several variable:

- visualize functions of two variables by graphs in space or level curves in the plane; visualize functions of three variables by level surfaces in space;
- recognize and graph equations for conic sections and for surfaces of revolution;
- state what it means for a limit of a function of several variables to exist.
- compute partial derivatives, gradients, directional derivatives and understand their meaning, eg with respect to direction of fastest growth and tangent planes;
- compute the gradient of a function and state its geometric significance
- solve min/max problems without or with constraints (using substitution or Lagrange multipliers for latter)
- explain why the Lagrange multiplier method works

Double and triple integrals:

- by reducing to an iterated integral;
- by changing the order of integration
- by changing from cartesian coordinates to cylindrical or spherical coordinates and vice-versa
- Use double and triple integrals to compute areas, volumes, centers of mass, etc.

Vector fields:

- visualize basic vector fields by flow lines and integral curves
- state the definition of a gradient (or conservative) vector field and how to recognize one
- compute the divergence and curl of a vector field;
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- state the physical meaning of the divergence as measuring rate of expansion/compression, and of the curl as measuring rotation.
- some rules for differentiation (include div of grad, curl of grad, gard of div, div of curl, curcl of curl); recognize permissible and nonpermissible operations;

Line integrals:

- compute line integrals such as arclength, work, circulation using parametrization of curve
- compute using the Fundamental Theorem for Gradient fields when appliccable
- state Green's theorem (2-D), apply it to examples, and use it to deduce the physical meaning of the divergence and the curl.

Last updated: June 8th, 2010.