

Review for Final Exam

MATH 230, FALL 2006

THE FINAL EXAM IS SCHEDULED ON 12/18/2006 12:20 PM - 2:10PM

This is a comprehensive exam, you should consult your previous midterm review sheets for highlights of Sections 13.1-16.6

Important skills for sections 16.7 - 17.9

Section 16.7 - 16.8: Triple Integrals

- Evaluate triple integrals in rectangular coordinates (Fubini's theorem).
- Recognize the solid from an iterated integral.
- Find the volume of a solid using the triple integral $\iiint_E dV$.
- Change from rectangular coordinates to cylindrical coordinates in a triple integral.
- Change from rectangular coordinates to spherical coordinates in a triple integral.
- Change the order of integration.

Section 16.9: Change of Variables in Multiple Integrals

- Find the image of a planar region under the given transformation.
- Find the preimage under a given transformation.
- Find the Jacobian of a given transformation.
- Choose an appropriate transformation and evaluate the integral.

Section 17.1: Vector Fields

- Definitions of vector field, conservative vector field, potential function.
- Find the gradient vector field of a scalar function f

Section 17.2: Line integrals

- Find parametrizations of line segments and other simple piecewise smooth curves
- Evaluate the line integral of a scalar function (or a vector field) along a curve C with parametrization $\mathbf{r}(t) = \langle x(t), y(t), z(t) \rangle, a \leq t \leq b$.
- Evaluate a line integral with respect to *arc length*.
- Evaluate a line integral with respect to dx, dy, dz .
- Find the work done by a force field in moving a particle along some curve (i.e., the line integral with respect to arc length of the tangential component of the force).

Section 17.3: Fundamental Theorem for Line integrals

- Determine whether or not a vector field is *conservative* by using the test, if it can be applied.
- Find the *potential function* of a conservative vector field.
- Evaluate the line integral using the *fundamental theorem for line integrals*.
- Show that a line integral $\int_C \mathbf{F} \cdot d\mathbf{r}$ is *independent of path* by showing the vector field \mathbf{F} is conservative.

Section 17.4: Green's Theorem

- Determine the orientation of a simple closed curve.
- Use Green's Theorem to evaluate the line integral along a given curve (with positive/negative orientation).
- Use Green's Theorem to evaluate a double integral.
- Use Green's Theorem to compute the area of the planar region enclosed by a simple closed curve.

Section 17.5: Curl and Divergence

- Find the *curl* of a vector field.
- Find the *divergence* of a vector field.
- Determine whether an expression is meaningful (refer to ex.17.5.12).
- Determine whether or not a vector field defined on all of \mathbb{R}^3 is *conservative*.
- Find the potential function of a conservative vector field.
- Determine whether or not a vector field is *irrotational*.
- Determine whether or not a vector field is *incompressible*.
- Vector forms of Green's Theorem.

Section 17.6: Parametric Surfaces and their Areas

- Find parametric equations (or vector equation) for a surface.
- Identify a surface by its parametric equations.
- Find the tangent plane to a parametric surface (a surface with parametric representation).
- Find the area of a smooth parametric surface S .
- Find the surface area of the graph of a function.
- Surfaces of revolution.

Section 17.7: Surface Integrals

- Determine the orientation of a surface.
- Evaluate the *surface integral* of a scalar function over a surface S .
- Find the flux of a given vector field across a given surface

Section 17.8: Stokes' Theorem

- Use Stokes' Theorem to evaluate $\iint_S \operatorname{curl} \mathbf{F} \cdot d\mathbf{S}$.
- Use Stokes' Theorem to evaluate $\int_C \mathbf{F} \cdot d\mathbf{r}$.

Section 17.9: Divergence Theorem

- Use Divergence Theorem to calculate the surface integral $\iint_S \mathbf{F} \cdot d\mathbf{S}$.