Math 250 – Spring 2003 **Name:**

**Review For Exam III** (April 23, 2003)

This exam will concentrate on section 13.1 through 14.1.

## Integration of Scalar Functions

### Single Integrals

| | |
|---|---|
| $\int_a^b 1\text{dx}$ | length of interval [a,b] |
| $\int_a^b \sqrt{1+[f'(x)]^2}\text{dx}$ | length of the curve $y = f(x)$ between $x = a$ and $x = b$ |
| $\int_a^b f(x)\text{dx}$ | area under the curve $y = f(x)$, above the x-axis, between $x = a$ and $x = b$ (provided $f(x) \geq 0$ on [a,b]) |
| $m = \int_a^b \rho(x)\text{dx}$ | total mass of wire with density function $\rho$ between $x = a$ and $x = b$ |
| $\overline{x} = \frac{\int_a^b x\rho(x)\text{dx}}{m}$ | coordinate of center of mass of wire with density function $\rho$ between $x = a$ and $x = b$ |

### Double Integrals

| | |
|---|---|
| $\int\int_R 1\text{dA}$ | area of region $R$ |
| $\int\int_R \sqrt{1+[f_x(x,y)]^2+[f_y(x,y)]^2}\text{dA}$ | surface area of the surface given by $z = f(x, y)$ over the region $R$ |
| $\int\int_R f(x,y)\text{dA}$ | volume under the surface $z = f(x, y)$, above the xy-plane, over the region $R$ (provided $f(x, y) \geq 0$ on R) |
| $m = \int\int_R \rho(x,y)\text{dA}$ | total mass of lamina with density function $\rho$ over the region $R$ |
| $\overline{x} = \frac{\int\int_R x\rho(x,y)\text{dA}}{m}$ | $x$ coordinate of center of mass of lamina with density function $\rho$ over the region $R$ |

### Triple Integrals

| | |
|---|---|
| $\int\int\int_Q 1\text{dV}$ | volume of solid region $Q$ |
| $\int\int\int_Q \sqrt{1+[f_x(x,y,z)]^2+[f_y(x,y,z)]^2+[f_z(x,y,z)]^2}\text{dV}$ | requires 4 dimensions to interpret geometrically |
| $\int\int\int_Q f(x,y,z)\text{dV}$ | requires 4 dimensions to interpret geometrically |
| $m = \int\int\int_Q \rho(x,y,z)\text{dV}$ | total mass of solid with density function $\rho$ over the region $Q$ |
| $\overline{x} = \frac{\int\int\int_Q x\rho(x,y,z)\text{dV}}{m}$ | $x$ coordinate of center of mass of solid with density function $\rho$ over the region $Q$ |

Some other things from Chapter 13 you should practice:

Doing double integrals in polar coordinates.
Setting up a triple integral.
Converting a triple integral into either cylindrical or spherical coordinates.
Computing a Jacobian.

Stuff from section 14.1:

Be able to sketch a simple vector field in $\mathbf{R}^2$.
State the definition of a conservative vector field.
Use the definition to decide whether or not a vector field is conservative.
Be able to compute divergence and curl.
Understand when you may use Theorems 14.1 and 14.2 to determine whether or not a vector field is conservative, and be able to use them when appropriate.
Problem: Let $\mathbf{F}(x, y) = \langle \frac{-y}{x^2+y^2}, \frac{x}{x^2+y^2} \rangle$.
a) Does $\frac{\partial P}{\partial y} = \frac{\partial Q}{\partial x}$?
b) Is $\mathbf{F}$ conservative?
c) Explain what is going on here.