Assignment #20

Due on Wednesday, November 28, 2007

Read Chapter 4 on *Differential Forms,* pp. 77–110, in Bressoud.

Read Section 5.4 on *Multiple Integrals,* pp. 120–134, in Bressoud.

Do the following problems

1. Let P and Q denote C^1 scalar fields defined in some open region, D, or $\mathbb{R}^2$, and define the 1–form
$$\omega = P\mathrm{d}y - Q\mathrm{d}x.$$
   (a) Compute the differential, $\mathrm{d}\omega$, of ω.

   (b) Recall that the integral $\displaystyle\int_C \omega$, where C is a simple closed curve in D, gives the flux of the field
$$F = P\,\widehat{i} + Q\,\widehat{j}$$
   across the curve C.
   What does the Fundamental Theorem of Calculus,
$$\int_T \mathrm{d}\omega = \int_{\partial T} \omega,$$
   where T is a positively oriented triangle in D, say about the divergence of F and its flux across the boundary of T?

2. Consider the iterated integral
$$\int_0^1 \int_y^1 e^{-x^2}\, \mathrm{d}x\mathrm{d}y.$$
   (a) Identify the region of integration, R, for this integral and sketch it.

   (b) Change the order of integration in the iterated integral and evaluate the double integral
$$\int_R e^{-x^2}\, \mathrm{d}x\mathrm{d}y.$$

3. Exercise 2 on page 135 in the text.

4. Exercise 3 on page 135 in the text.

5. Exercise 4 on page 135 in the text.