

## Assignment #15

Due on Wednesday, November 5, 2008

Read Section 3.1 on *The Calculus of Curves*, pp. 53–65, in Bressoud.

Read Section 5.2 on *Line Integrals*, pp. 113–119, in Bressoud.

Do the following problems

1. Consider a portion of a helix,  $C$ , parametrized by the path

$$\sigma(t) = (\cos t, t, \sin t) \quad \text{for } 0 \leq t \leq \pi.$$

Let  $f(x, y, z) = x^2 + y^2 + z^2$  for all  $(x, y, z) \in \mathbb{R}^3$ . Evaluate  $\int_C f$ .

2. Let  $f(x, y) = y$  for all  $(x, y) \in \mathbb{R}^2$ . For each of the following curves,  $C$ , in the plane, evaluate  $\int_C f$ .

- (a)  $C$  is the segment along the  $x$  axis from  $(0, 0)$  to  $(1, 0)$ .
- (b)  $C$  is the segment along the  $y$  axis from  $(0, 0)$  to  $(0, 1)$ .
- (c)  $C$  is the unit circle in  $\mathbb{R}^2$ .

3. Exercise 10 on page 120 in the text.
4. Exercise 12 on page 120 in the text.
5. Let  $f$  be a real valued function which is  $C^1$  in an open interval containing the closed and bounded interval  $[a, b]$ . Define  $C$  to be the portion of the graph of  $f$  over  $[a, b]$ ; that is,

$$C = \{(x, y) \in \mathbb{R}^2 \mid y = f(x), a \leq x \leq b\}.$$

- (a) Give a parametrization for  $C$  and compute the arc length,  $\ell(C)$ , of  $C$ .
- (b) Compute the arc length along the graph of  $y = \ln x$  from  $x = 1$  to  $x = 2$ .  
*Note:* In order to do part (b), you'll need to remember, or review, everything you learned about evaluating integrals in your single variable Calculus courses.