MATH 550 (Section 501)
Prof. Meade

University of South Carolina
Spring 2009

Exam 2
April 7, 2009

Name: ______________________
Section 501

Instructions:

1. This is a take-home exam. You are to work on it by yourself. You may not consult with any other animate object, other than Prof. Meade. Violations of this, or any other aspect of the USC Honor Code, will not be tolerated, and will be reported to the Office of Academic Integrity.
2. All solutions must be turned in no later than 11:00a.m. on Thursday, April 9, 2009.
3. There are a total of 5 problems on 5 pages. Check that your copy of the exam has all of the problems.
4. Indicate any technology (calculator, website, computer algebra system, ...) that you use. If relevant, show your input and the result obtained. Undocumented work will not receive credit.
5. You must show all of your work to receive credit for a correct answer.
6. Your answers must be written legibly in the space provided. You may use the back of a page for additional space; please indicate clearly when you do so.

Problem	Points	Score
1	21	
2	21	
3	16	
4	21	
5	21	
Total	100	

Take Your Time; Be Neat!

1. (21 points) Integrate $f(x, y, z) = xyz$ along the path $\mathbf{c}(t) = \langle e^t \cos(t), e^t \sin(t), 3\rangle$, $0 \leq t \leq 2\pi$.

2. (21 points) Compute $\int_C \sin(z)\ dx + \cos(z)\ dy - (xy)^{1/3}\ dz$ where C is the path

$$\mathbf{c}(\theta) = \left\langle \cos^3(\theta), \sin^3(\theta), \theta \right\rangle, \qquad 0 \leq \theta \leq \frac{7\pi}{2}.$$

3. (16 points)

   (a) Find a parameterization for $x^2 + y^2 + z^2 - 4x - 6y = 12$.

   (b) What is the upward unit normal vector at the point on the positive z-axis?

4. (21 points)

   (a) Find an expression (that involves an integral that is not easy to evaluate) for the surface area of $\mathbf{\Phi} : (r, \theta) \mapsto (x, y, z)$ where $x = r\cos(\theta)$, $y = 2r\sin(\theta)$, $z = r^2$, for $0 \leq r \leq 1$ and $0 \leq \theta \leq \pi$.

   (b) Describe the surface, in words (preferably, one or two short sentences).

   NOTE: You can attach a plot of the surface, but this is not sufficient.

5. (21 points) Let S be the part of the cone $z^2 = x^2 + y^2$ with z between 1 and 2 oriented by the normal pointing out of the cone. Compute $\iint_S \mathbf{F} \cdot \, d\mathbf{S}$ where $\mathbf{F}(x, y, z) = \langle x^2, y^2, z^2 \rangle$.

HINT: Do you want the upward or downward normal vector?