Math 126 Midterm #2

May 21, 2013

Name:

Section:

Instructions: This is a closed book exam. *No calculators, smartphones, tablets, computers, espresso machines, or pet chimpanzees* maybe used at any time during this exam. Please explain your answers to all questions, except for True/False questions, clearly and succinctly. Failure to explain will result in 0 points. Please do not discuss the exam with other students until after 4 PM on Tuesday.

Time allotted: 50 minutes.

The following is for use during grading.

Problem	Points	Score
1	10	
2	8	
3	12	
4	12	

1. Let's enjoy $f(x,y) = \sin(x)\cos(y)$.

   (a) Calculate the partial derivatives $f_x(a,b)$ and $f_y(a,b)$ of f at the point (a,b).

   (b) Find all critical points of f, and classify each of them according to their type: max, min, saddle point, none of the above.

2. Consider the function $f(\theta) = \cos(2\theta)$.

   (a) Draw the polar graph of $r = f(\theta)$ for $0 \leq \theta \leq 2\pi$.

   (b) Calculate the area enclosed by the curve $r = f(\theta)$.

3. A piece of cheese is thrown into a tornado and follows the path $\mathbf{f}(t) = \langle t\cos(t), t\sin(t), t\rangle$.

(a) Find the unit tangent vector as a vector function of t.

(b) Is there a value of t for which the binormal vector to the path at time t is parallel to the z-axis? Why or why not? Explain your answer clearly.

(c) Write down an integral computing the length of the cheese's path between times $t = 0$ and $t = T$.

4. Double integrals are still fun.

(a) Let R be the disk of radius r in the plane centered at the origin. Calculate

$$F(r) = \iint_R e^{-x^2-y^2}\, dA.$$

(b) Find the limit of $F(r)$ as r tends to $+\infty$.

(c) Suppose $f(x, y)$ is a function of two variables, and let R be the region of the plane contained between the curves $\ln y = x$ and $\frac{\pi-1}{\ln \pi}x + 1 = y$. Sketch R and use what you find to write

$$\iint_R f(x, y)dA$$

as an iterated integral in two ways. (I.e., find the iterated integral for both possible orders of the variables x and y.)