Math 164: Multidimensional Calculus

Midterm II

November 17, 2016

NAME (please print legibly): _____

Your University ID Number: _____

Indicate your instructor with a check in the appropriate box:

Kleene	TR 12:30-1:45pm	
Salur	MW 3:25-4:40pm	
Gafni	TR 3:25-4:40pm	
Lee	MWF 09:00-09:50am	

- You have 75 minutes to work on this exam.
- You are responsible for checking that this exam has all 10 pages.
- No calculators, phones, electronic devices, books, notes are allowed during the exam.
- Show all work and justify all answers.
- Please sign the pledge below.

Pledge of Honesty

I affirm that I will not give or receive any unauthorized help on this exam, and that all work will be my own.

Signature: _____

QUESTION	VALUE	SCORE
1	10	
2	15	
3	10	
4	15	
5	25	
6	15	
7	10	
TOTAL	100	

1. (10 points) Consider the function

$$f(x,y,z) = \frac{2x^2}{x+z} + x^2y^2e^z - xy\sin(z) + \frac{e^{\sqrt{x+y}}}{\cos(xy)}.$$

Evaluate the third order partial derivative $f_{xyz}(1,1,0)$.

2. (15 points) Let $f(x, y)$ be given by

$$f(x, y) = 4 - \ln(xy - 9) + x^2 cos(\pi y).$$

a) Explain why $f(x, y)$ is differentiable at $(5, 2)$.

b) Find an equation for the linearization of f at the point $(5, 2)$, and use it to estimate the value of f at the point $(5.05, 1.98)$.

3. (10 points) Write an equation for the tangent plane to the surface $x^2 + 2y^2 + 3z^2 = 6$ at the point $(1, 1, 1)$.

4. (15 points) Find the directional derivative of $f(x, y) = 2x^2y^3 + 6xy$ at (1,1) in the direction of a unit vector whose angle with the positive x-axis is $\pi/6$. (Recall that $\cos(\pi/6) = \sqrt{3}/2$)

5. (25 points) **a)** Consider the function $f(x, y) = x^2y - 2xy + 2y^2 - 15y$. Find all the critical points of f and classify them as relative maxima, relative minima, or saddle points.

b) Find the extreme values of the function $f(x, y) = 3x^2 + 2y^2 - 4y$ subject to the constraint $x^2 + y^2 \leq 9$.

6. (15 points) Evaluate the integral by reversing the order of integration.

$$\int_0^8 \int_{\sqrt[3]{y}}^2 e^{x^4} dx dy$$

7. (10 points) Use polar coordinates to find the volume of the solid bounded by the paraboloids $z = 3x^2 + 3y^2$ and $z = 4 - x^2 - y^2$.

Blank page for scratch work