Math 164: Multidimensional Calculus

Midterm II

Nov 18, 2014 8:00-9:15 am

NAME (please print legibly): ______________________________

Your University ID Number: ______________________________

Indicate your instructor with a check in the box:

Rebecca Glover	TR	9:40-10:55 am	
Doug Haessig	MW	12:30-1:45 pm	
Sema Salur	MWF	9:00-9:50 am	

By taking this exam, you are acknowledging that the following is prohibited by the College's Honesty Policy: Obtaining an examination prior to its administration. Using unauthorized aid during an examination or having such aid visible to you during an examination. Knowingly assisting someone else during an examination or not keeping your work adequately protected from copying by another.

QUESTION	VALUE	SCORE
1	10	
2	10	
3	20	
4	15	
5	20	
6	15	
7	10	
TOTAL	100	

I affirm that I have not used, given, nor received unauthorized aid during this examination.

Signature: ______________________________

1. (10 points)

(a) Evaluate

$$\lim_{(x,y)\to(0,0)} \frac{2}{x^2 + y^2 + \sqrt{3e^{x^2} + (\cos(xy))^2 + x^2y^2}}$$

if this limit exists.

(b) Evaluate $\displaystyle\lim_{(x,y)\to(0,0)} \frac{2x^2y}{x^4 + y^2}$ if this limit exists.

2. (10 points) If resistors of R_1, R_2 and R_3 ohms are connected in parallel to make an R-ohm resistor, the value of R can be found from the equation

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}.$$

Find the value of $\dfrac{\partial R}{\partial R_2}$ when $R_1 = 30$, $R_2 = 45$, and $R_3 = 90$ ohms.

3. (20 points) Consider the function $f(x, y) = e^{-xy}$.

(a) Show that $f(x, y)$ is differentiable at $P = (1, 0)$ by explaining why the partial derivatives are continuous.

(b) Find the linearization of $f(x, y)$ at the point $P = (1, 0)$.

(c) Use the linearization from part a) to estimate $f(1.03, 0.02)$.

4. (15 points) Consider $f(x, y) = \dfrac{x^2}{2} + \dfrac{y^2}{2}$.

(a) Find the direction in which f increases most rapidly at the point $(1, 1)$.

(b) Find the direction in which f decreases most rapidly at the point $(1, 1)$.

(c) In what direction(s) does f have zero change at the point $(1, 1)$?

5. (20 points) Find all local maximum values, minimum values, and saddle points of the function

$$f(x, y) = 8 + x^3 + 8y^3 - 3xy$$

6. (15 points) Find the greatest and smallest values of $f(x, y) = xy$ on the ellipse $\frac{x^2}{8} + \frac{y^2}{2} - 1 = 0$.

7. (10 points) Find the volume of the region bounded above by the elliptical paraboloid $z = 10 + x^2 + 3y^2$ and below by the rectangle $R:\ 0 \le x \le 1,\ \ 0 \le y \le 2$.