MAT 397 CAL III Josh Stangle Fall 2016

TEST 2

Your Name (please PRINT): _____

Student ID Number: _____

INSTRUCTIONS

- Fill in the above items.
- There is a total of 6 problems, for a maximum possible total value of 50 points. **Make sure you have all 7 test pages (this cover page + 6 test pages)**. You are responsible to check that your test booklet has all 7 pages. Alert a proctor if your copy is missing any pages.
- **Show all your work.** Only minimal credit will be given for answers without supporting work.
- **Write your answer in the box** at the bottom of pages 2-7.
- **Use the back of test pages if additional space is needed**, and for scratch paper.
- **No calculators or other electronic devices; no outside notes; no outside tables** are allowed on this exam. Any use of calculators or electronic devices, or outside notes is a violation of the Academic Integrity Policy.

Do not write below this line

Pb. #	Max Points	Your Score
1	10	
2	10	
3	8	
4	10	
5	10	
6	8	
Total	(56)	

1. (10 pts) Consider the function

$$f(x, y) = 2x^2 \sin(xy)$$

(a) Find the gradient of $f(x, y)$.

(b) Find the directional derivative of f in the direction $\vec{u} = \langle 1, 2 \rangle$.

(c) At the point $(2, 0)$, in what direction is the rate of change of f the largest? What is the largest rate of change at $(2, 0)$?

Answer for part (a):
Answer for part (b):
Answer for part (c):

2. (10 pts)

(a) Find the equation of the tangent plane to the surface given by

$$f(x, y) = 4x^2 + 2y^2 - 12\ln(xy)$$

at the point $(1, 1, 6)$.

(b) Use the linear approximation to estimate $f(1.1, .9)$ where f is the function from part (a).

(c) Is this a good approximation? Explain.

Answer for part (a):
Answer for part (b):
Answer for part (c):

3. (8 pts) Determine whether the following limits exist or not. If one does, find its value.

(a) $\lim_{(x,y)\to(0,0)} \dfrac{xy^4}{x^3+y^6}$.

(b) $\lim_{(x,y)\to(0,0)} \dfrac{xy}{\sqrt{x^2+y^2}}$

Answer for part (a):
Answer for part (b):

4. (10 pts) Find all the local maximums, local minimums, and saddle points of the function

$$f(x, y) = x^2y - 2x^2 - y^2$$

Answer:

5. (10 pts) Find the absolute maximum of the function $f(x, y) = 3x + 4y$ subject to the constraint $x^2 + y^2 = 25$.

Answer:

6. (8 pts) Answer the following true or false questions. If it is false, either correct the statement, provide a counter example, or state why.

(a) There exists a function $f(x, y)$ whose partial derivatives are $f_x(x, y) = 2x + y$ and $f_y(x, y) = x^2 - 1$.

(b) If $f_x(a, b)$ and $f_y(a, b)$ exist, then the tangent plane to $z = f(x, y)$ at (a, b) is a good approximation of $f(x, y)$ near (a, b).

Answer for part (a):
Answer for part (b):