MATH 2400: CALCULUS 3

5:15 - 6:45 pm, Mon. Oct. 19, 2015

MIDTERM 2

I have neither given nor received aid on this exam.

Name:____

Check one below !

- ◯ **001** Bulin .... (9am)
- ◯ **002** Molcho .... (10am)
- ◯ **003** Ih .... (11am)
- ◯ **004** Spina .... (12pm)
- ◯ **005** Spina .... (1pm)
- ◯ **006** Preston .... (2pm)
- ◯ **007** Preston .... (3pm)
- ◯ **008** Chhay .... (9am)
- ◯ **009** Walter .... (11am)

If you have a question raise your hand and remain seated. In order to receive full credit your answer must be **complete**, **logical**, **legible**, and **correct**. Show all of your work, and give adequate explanations. No shown work even with the correct final answer, no points ! Only one answer to each problem ! In case of two different answers to one problem, the lower score will be chosen !

DO NOT WRITE IN THIS BOX!

Problem	Points	Score
1	16 pts	
2	17 pts	
3	17 pts	
4	17 pts	
5	16 pts	
6	17 pts	
TOTAL	100 pts	

1. (16 points) Suppose that

$$f(x,y) = x^3 + 6x^2y + axy^2 + by^3,$$

for some constants a and b. Then find a and b such that

$$\frac{\partial^2 f}{\partial x^2} + \frac{\partial^2 f}{\partial y^2} = 0$$

for every (x, y).

(Note that this equation can also be equivalently written as $f_{xx} + f_{yy} = 0$.)

2. (17 points) Consider the hyperbolic paraboloid surface given by the equation

$$z = 2x^2 - 3y^2.$$

(a) **(12 points)** In what (unit) direction does z have its maximum rate of change at the point $(2, 1)$?

(b) **(5 points)** What is the maximum rate of change in the direction in (a) ?

3. (17 points) Find and classify the critical points (local maxima, local minima, or saddle points) of

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

4. (17 points) Find the tangent plane to the surface defined by the equation

$$x^2z + yz = 1$$

at the point $(1, 1, \frac{1}{2})$.

5. (16 points) Let

$$z = f(x, y), \quad x = u^2 - v^3, \quad y = u + 2v^2.$$

Suppose that f is a differentiable function of x and y, and that

$$\left.\frac{\partial z}{\partial x}\right|_{(x,y)=(-7,9)} = -2 \qquad \text{and} \qquad \left.\frac{\partial z}{\partial y}\right|_{(x,y)=(-7,9)} = 3.$$

Then find

$$\left.\frac{\partial z}{\partial v}\right|_{(u,v)=(1,2)}.$$

(Note that, for example, $\left.\frac{\partial z}{\partial x}\right|_{(x,y)=(-7,9)}$ (respectively $\left.\frac{\partial z}{\partial v}\right|_{(u,v)=(1,2)}$) means the value of $\frac{\partial z}{\partial x}$ at $(x, y) = (-7, 9)$ (respectively the value of $\frac{\partial z}{\partial v}$ at $(u, v) = (1, 2)$).)

6. (17 points) Let D be the region on the xy-plane that is bounded by the x-axis, the vertical line $x = 1$, and the line $y = 2x$.

(a) **(3 points)** Sketch the region D.

(b) **(14 points)** Find the double integral of $\sqrt{1 - x^2}$ over D.