DO NOT WRITE ABOVE THIS LINE!!

MATH 210 Exam 2

October 31, 2019

Directions. Fill in each of the lines below. Then read the directions that follow before beginning the exam. YOU MAY NOT OPEN THE EXAM UNTIL TOLD TO DO SO BY YOUR INSTRUCTOR.

- All of your work must fit within the boxes. Nothing outside of the box will be graded!

Name (print) _____

netid _____ **UIN** _____

- A solution for one problem may not go on another page.
- Show all your work. Unjustified answers are not correct. Make clear what your final answer is.
- Have your student ID ready to be checked when submitting your exam.

Check next to your instructor's name (and lecture time, if applicable):

Abramov 11AM		Sparber 2PM		Einstein 1PM	
Sparber 1PM		Kobotis 8AM		Lear 10AM	
Hamdan 4PM		Dai 11AM		Pourarian 1PM	
Greenblatt 12PM		Kashcheyeva 3PM		Chow 10AM	
Pourarian 3PM		Einstein 2PM		Whyte 12PM	
Shulman 9AM		Lear 9AM		Switala 2PM	
Michelen 2PM		Datta 1PM		Hamdan 5PM	
Chu 11AM		Switala 9AM		Protsak 10AM	
Datta 2PM					

Write solution only inside the box

1. **(15 pt)** Consider the function $f(x, y) = \ln(2x + y^2 - 2)$.

a. Find $D_{\langle \frac{1}{\sqrt{2}}, \frac{-1}{\sqrt{2}} \rangle} f(1, -1)$.

b. Compute the unit vector that gives the direction of fastest increase at the point $(1, -1)$.

c. Find the rate of change in the direction of fastest increase at the point $(1, -1)$.

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Write solution only inside the box

2. **(15 pt)** Consider the surface with equation:

$$x^3 + 2y^2 - z^4 + 7 = 0$$

a. Find a function $f(x, y, z)$ so that the above surface is a level surface for the function f.

b. Find a non-zero vector perpendicular (normal) to the given surface at the point $(1, 2, -2)$.

c. Find the equation of the tangent plane to the given surface at the point $(1, 2, -2)$.

Write solution only inside the box

3. **(10 pt)** Find and classify the critical points of $f(x, y) = x^3 - 3xy + y^3$ as to whether each one of them is a local minimum, a local maximum or a saddle point.

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Write solution only inside the box

4. **(10 pt)** Use the method of Lagrange multipliers in order to find the minimum and the maximum of the function $f(x, y) = x - 3y$ on the circle $x^2 + y^2 = 4$.

Write solution only inside the box

5. **(10 pt)** Compute the double integral:

$$\iint_{[0,1]\times[1,e]} 3x^2 + 2x \ln y \, dA$$

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Write solution only inside the box

6. **(15 pt)** Consider the iterated integral $\int_0^1 \int_{\sqrt{y}}^1 e^{x^3}\, dx\, dy$.

a. Sketch the region of integration.

b. Change the order of integration with the appropriate adjustments of the limits of integration.

c. Compute the resulting integral.

Write solution only inside the box

7. **(10 pt)** Compute the double integral $\iint_D \sqrt{x^2+y^2}\, dA$ where D is the part of the **unit disc** that lies in the **first quadrant**.

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8. **(15 pt)** Compute the integral:

$$\int_0^1 \int_0^{1-x} \int_0^{1-x-y} 1 \, dz \, dy \, dx$$