DO NOT WRITE ABOVE THIS LINE!!

MATH 210 Exam 2

November 2, 2017

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 on each page for each question. Nothing outside of the box will be graded! If you write outside of the box, there is a good chance that your solution will not be read and therefore not graded.

- 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:

Lukina			Steenbergen	
Hong			Kobotis	
Dai			Bona	
Sinapova			Kashcheyeva	
Heard			Riedl	
Skalit			Dumas	
Nuer				

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1. **(15pt)** Consider the function

$$f(x, y) = x^2 - y^3 + 4.$$

(a) Find an equation of the plane tangent to the graph of the function at the point $(1, 2, -3)$.

(b) Use the linear approximation to the function to estimate $f(0.95, 2.05)$. Your answer should be a single number in decimal form, or written as a reduced fraction.

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2. **(15 pt)** Find all critical points of the function

$$f(x, y) = x^2y - 2xy - 5x^2 + 10x$$

and classify them using the Second Derivative Test.

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3. **(15 pt)** Use the method of Lagrange multipliers to find the maximum and minimum values of $f(x, y) = x + y$ subject to the constraint

$$x^2 + 4y^2 = 1.$$

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4. **(15 pt)** Let R be the region in the xy-plane bounded by $y = x^2 - 2$ and $y = x$.

   (a) Sketch R.

   (b) Evaluate $\iint_R 6x \, dA$.

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5. **(15 pt)** Consider the integral

$$\int_0^2 \int_{y/2}^1 xy \, dx \, dy.$$

(a) Sketch the region of integration and change the order of integration to $dy\,dx$.

(b) Evaluate the integral. (You may use whichever order of integration you like.)

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6. **(15 pt)** Let $D = \{(x, y) \mid x \geq 0,\ y \geq 0,\ 1 \leq x^2 + y^2 \leq 4\}$.

   (a) Sketch D.

   (b) Express D in polar coordinates.

   (c) Compute $\iint_D \cos(x^2 + y^2)\, dA$.

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7. **(10 pt)** Evaluate the integral

$$\int_{-1}^{1}\int_{0}^{1}\int_{y}^{2y}(2z+x)\,dz\,dy\,dx.$$