DO NOT WRITE ABOVE THIS LINE!!

MATH 210 Exam 2

November 1, 2018

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!

- 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:

Abramov		Hachtman		Kobotis	
Dai		Hamdan		Lukina	
Datta		Heard		Pourarian	
Freitag		Jones		Rosendal	
Greenblatt		Kashcheyeva		Sparber	
				Townsend	

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

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

(a) Find the tangent plane to the graph of $f(x, y)$ at $(1, 2, 5)$.

(b) Use linear approximation and your answer to part a) to estimate $f(1.2, 2.1)$.

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

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

For each critical point, use the second derivative test to classify it as either a local minimum, a local maximum, or a saddle point.

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3. **(10 pt)** Use the method of Lagrange multipliers to find maximum and minimum values of

$$f(x, y) = x^2 + y^2 - 2x + 4y + 5$$

subject to the constraint

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

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4. **(15 pt)** Compute the integral of $f(x, y) = x$ over the region R bounded by the parabolas

$$y = x(3 - x) \text{ and } y = x(x - 3).$$

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5. **(10 pt)** Consider the integral

$$\int_0^1 \int_y^1 \cos(x^2)\, dx\, dy.$$

(a) Sketch the region of integration.

(b) Change the order of integration in the integral.

(c) Evaluate the integral from (b).

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6. **(10 pt)** Compute the double integral $\iint_R e^{x^2+y^2}\, dA$ where R is the disc of radius 2 centered at $(0,0)$ by changing to polar coordinates.

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7. **(10pt)** Write down an iterated integral for the triple integral $\iiint_D x\,dV$, where D is the tetrahedron formed by the coordinate planes and the plane $x + 2y + 2z = 4$. **DO NOT** evaluate the integral.

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

$$\int_0^2 \int_0^{\sqrt{4-x^2}} \int_0^y x \, dz \, dy \, dx$$

by changing to cylindrical coordinates.