Math 2130 Prelim 2 (Spring 2017)

Before the exam:
- Do not write anything on this page.
- Do not open the exam.
- Turn off your cell phone.
- Make sure your books, notes, and electronics are not visible during the exam.
- Do not wear headphones during the exam.

When you open your exam:
- Make sure your exam has all its pages. There are 5 pages, including the last, and 6 problems.
- If you believe there is a printing error, let me know right away.
- Write your name on the last page, and put a check in the box corresponding to your section.

During the exam:
- Do not talk or ask questions. If you are unsure what a question is asking, demonstrate your understanding as best you can.
- Be respectful of your fellow classmates.
- You may use the bathroom during the exam, but please ask first so I can keep track of who is out of the room at any one time.
- If you finish your exam before 2:00, you may leave early: hand your exam in at the front of the room, and do not discuss the exam directly outside the classroom. If you finish after 2:00, please remain quiet and seated until 2:15.

Notes on grading:
- Draw a box around your final solution to the problem.
- Show your work. Demonstrate that you know how to get the correct answer, not just make a lucky guess.
- Clearly cross out any work that is incorrect.
- Each problem is graded out of 3. Generally, we will be looking for three specific components of your solution, each worth a point.
- If you run out of room, continue your work on the back of the previous page. Make a note that you’ve done this, and make it clear where your work continues.
(1) Set up (but do not evaluate) iterated integrals using spherical coordinates to compute \( \int_R (z + 2y) \, dV \) for \( R \) the solid unit sphere.

(2) Convert the following integral to polar coordinates (do not evaluate it):

\[
\int_{x=0}^{x=1} \int_{y=-\sqrt{1-x^2}}^{y=\sqrt{1-x^2}} y \, dy \, dx.
\]
(3) Set up (but do not evaluate) an integral to compute \( \int_C x^2 \, ds \), where \( C \) is the counterclockwise ellipse parameterized by \( \vec{r}(t) = (2 \cos t, \sin t) \) for \( 0 \leq t \leq 2\pi \). Do not evaluate any vector operations.

(4) Evaluate the following integral. Show every step of your work. You may leave any arithmetic expressions unevaluated.

\[
\int_{x=0}^{x=1} \int_{y=x^2}^{y=1} xy^3 \, dy \, dx.
\]
(5) The function $f$ satisfies the following:

\[
\begin{align*}
    f(1, 2) &= 3 & f_x(1, 2) &= 0 & f_y(1, 2) &= 0 \\
    f_{xx}(1, 2) &= -4 & f_{xy}(1, 2) &= -2 & f_{yy}(1, 2) &= -3
\end{align*}
\]

What type of critical point is $(1, 2)$?

(6) Set up (but do not evaluate) integrals to compute the circulation of $\vec{F} = (2-y, xy)$ around the loop shown below. The dashed lines are just for reference; do not integrate along them. The arc is a portion of the unit circle, centered at the origin. Do not evaluate any vector operations.
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Name: _____________________________________________Netid: __________________________

Section (check which one applies):
☐ Discussion 1 (9:05am-9:55am)
☐ Discussion 2 (10:10am-11:00am)