MATH 126 E
Exam II
May 17, 2011

Name __________________________________________
Student ID #_________________________ Section ___________

HONOR STATEMENT
“I affirm that my work upholds the highest standards of honesty and academic integrity at the
University of Washington, and that I have neither given nor received any unauthorized assistance
on this exam.”

SIGNATURE: _________________________________

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- Your exam should consist of this cover sheet, followed by 5 problems. Check that you have
  a complete exam.
- Show all work and justify your answers.
- Unless otherwise indicated, your answers should be exact values rather than decimal approx-
  imations. (For example, $\frac{\pi}{4}$ is an exact answer and is preferable to its decimal approximation 0.7854.)
- You may use a scientific calculator and one 8.5×11-inch sheet of handwritten notes. All
  other electronic devices (including graphing calculators) are forbidden.
- The use of headphones or earbuds during the exam is not permitted.
- There are multiple versions of the exam, you have signed an honor statement, and cheating
  is a hassle for everyone involved. DO NOT CHEAT.
- Turn your cell phone OFF and put it AWAY for the duration of the exam.

GOOD LUCK!
1. (9 points) Compute the indicated partial derivative of

\[ f(x, y) = \sin\left(\frac{y^4}{\sqrt{x}}\right). \]

You do not need to simplify your answers.

(a) \( f_x(x, y) = \)

(b) \( f_y(x, y) = \)

(c) \( f_{yy}(x, y) = \)

2. (7 points) Consider the integral

\[
\int_0^1 \int_{\sqrt{x}}^{5-4x} g(x, y) \, dy \, dx.
\]

Sketch the region of integration and change the order of integration. (Note that, since you do not have a formula for \( g(x, y) \), you are not expected to compute this integral.)
3. (10 points) Use linear approximation to estimate the value of \(\frac{4.01^2}{0.99^3 + 1}\).
4. (12 points) Find all critical points of

\[ f(x, y) = 4x^3 + xy^2 + 3x^2 + y^2 + 10. \]

Determine whether each critical point gives a local maximum, a local minimum, or a saddle point.
5. (12 points) The boundary of a lamina consists of the semicircles

\[ y = \sqrt{1 - x^2} \quad \text{and} \quad y = \sqrt{25 - x^2} \]

and the portions of the x-axis that join them, as shown:

The density of the lamina at any point is inversely proportional to its distance from the origin. That is, there is a constant \( k \) such that, the density of the lamina at the point \((x, y)\) is

\[ \rho(x, y) = \frac{k}{\sqrt{x^2 + y^2}}. \]

Find the center of mass of the lamina. \[
\]
(You may use the fact that, by symmetry, the center of mass is on the y-axis.)