MATH 126B
Midterm 2
July 26, 2012

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.

• Pace yourself. You have 60 minutes to complete the exam and there are 5 problems. Try not to spend more than 15 minutes on each problem.

• Unless otherwise indicated, show all your work and justify your answers.

• Unless otherwise indicated, your answers should be exact values rather than decimal approximations. (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!
Problem 1. For a function $u(x, y)$, its Laplacian is defined by

$$\Delta u = u_{xx} + u_{yy}.$$ 

Calculate $\Delta u$ for $u(x, y) = e^x \cos y$. Simplify as much as possible.
Problem 2. Find the moment of inertia about the origin for the lamina

\[ D = \{ x^2 + y^2 \leq a^2, \ x \geq 0 \} \]

with \( \rho(x, y) = \rho = \text{const.} \).
Problem 3. The same question for

\[ D = \{-a \leq x \leq a, \ -a \leq y \leq a\}. \]
Problem 4. Maximize $xyz$ under the conditions $x + y + z = 1$, $x, y, z \geq 0$. Find $x, y, z$ for which the maximum is achieved, and the value of this maximum. Do not forget to consider the boundary!
Problem 5. Find all positive $a$ such that the integral

$$\int \int_D \frac{1}{\sqrt{x^2 + y^2}} dA$$

converges (i.e. its value is less than infinity), where

$$D = \{x^2 + y^2 \geq 1\}.$$