MATH 126 C & D
Exam II
November 24, 2009

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 five 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 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.

• Turn your cell phone OFF and put it AWAY for the duration of the exam.

• There are multiple versions of this exam. Save yourself the hassle of a hearing before the Faculty Council on Academic Conduct: do not cheat.

GOOD LUCK!
1. (10 points) Suppose a particle moves with position vector

\[ \mathbf{r}(t) = t^2 \mathbf{i} + (e^{t^2} - 3t) \mathbf{j} + \left( \frac{1}{2} t^2 + 4t \right) \mathbf{k}. \]

(a) Compute the tangential and normal components of the particle’s acceleration vector at \( t = 2 \).

(b) Find the equation of the normal plane to \( \mathbf{r}(t) \) at \( t = 2 \).
2. (10 points) Let \( f(x, y) = e^{-xy} \cos y \).

(a) Compute \( f_{yx}(x, y) \).

(b) Find the equation of the plane tangent to \( f(x, y) \) at \((\pi, 0)\).

(c) Use linear approximation to approximate \( f(3.15, 0.001) \). (Give an exact answer and a decimal approximation, giving at least four digits after the decimal.)
3. (10 points) Let \( g(x, y) = \frac{1}{2} x^2 + xy - 3x + \frac{1}{3} y^3 - 3y \).

   (a) Find and classify all critical points of \( g(x, y) \).

(b) What is the smallest value of the function \( g(x, 0) \)?
4. (10 points) Evaluate the integral

$$
\int_0^{\sqrt{\pi/2}} \int_x^{\sqrt{\pi/2}} \cos(y^2) \, dy \, dx.
$$
5. (10 points) Evaluate the integral

\[ \int \int_D \frac{y e^x}{(x^2 + y^2)^{3/2}} \, dA, \]

where \( D = \{(x, y) : x^2 + y^2 \leq 9, x \geq 0, y \geq 0\} \).