MATH 126 D
Exam II
November 22, 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 4 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\( \times \)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. (12 points) Let $\mathbf{r}(t) = (\sin 3t, \ln(\sin 3t), \cos 3t)$ for $0 < t < \frac{\pi}{3}$.

(a) Find the unit tangent, unit normal, and binormal vectors at $t = \frac{\pi}{6}$.

ANSWERS:

$\mathbf{T} \left( \frac{\pi}{6} \right) = \ldots$

$\mathbf{N} \left( \frac{\pi}{6} \right) = \ldots$

$\mathbf{B} \left( \frac{\pi}{6} \right) = \ldots$

(b) Give the equation of the normal plane to $\mathbf{r}(t)$ at $t = \frac{\pi}{6}$. 


2. (13 points) Find the point(s) on the surface $x^2 = 12 + yz$ closest to the point $(0, 1, 3)$. For full credit you must show some work OR write a sentence or two to explain how you know that your answer gives the minimal distance.
3. (12 points)

(a) Calculate the iterated integral.

\[ \int_0^4 \int_0^2 xy \sqrt{x^2 + 1} \, dx \, dy. \]

(b) Sketch the region of integration and change the order of integration.

\[ \int_0^{x^2 + 1} h(x, y) \, dy \, dx. \]
4. (12 points) Compute the area of the region to the right of the x-axis, outside the circle \( r = \sin(\theta) \), and inside the cardioid \( r = 1 + \sin(\theta) \).