Math 126 **Final Examination (Makeup)** **Winter 2008**

Your Name

Your Signature

Student ID #

Quiz Section

Professor's Name

TA's Name

- This exam is closed book. You may use one $8\frac{1}{2} \times 11$ sheet of handwritten notes (both sides may be used).
- Graphing calculators are not allowed. Do not share notes.
- In order to receive credit, you must show your work. Do not do computations in your head. Instead, write them out on the exam paper.
- **Place a box around YOUR FINAL ANSWER to each question.**
- If you need more room, use the backs of the pages and indicate to the reader that you have done so.
- Raise your hand if you have a question.

Problem	Total Points	Score
1	10	
2	10	
3	10	
4	10	
5	10	

Problem	Total Points	Score
6	10	
7	10	
8	10	
9	10	
10	10	
Total	100	

1. [**10 points**] Find the Taylor polynomial of degree 2 centered at $x = -1$ for the function $f(x) = x^3 + 2x + 4\cos(\pi x)$.

2. [**10 points**] Use Taylor's inequality to find n such that the Taylor polynomial of degree n centered at $x = 0$ for the function $g(x) = e^{2x}$ approximates $g(x)$ with accuracy 0.01 on the interval $[-.5, 0]$.

3. [**10 points**] Find the equation of the line of intersection of the two planes given by $x - y = 3$ and $x + 2y + 3z = 0$.

4. [**10 points**] Two elementary particles are on a collision course (that is, at some instant of time, they will be at the same location). The position of one of them is given by

$$x = 2\sin t,\ y = 2\cos t,$$

the position of the other one is

$$x = 3 - 4\sin t,\ y = 2\cos t$$

for time $t \geq 0$. Find the cosine of the angle between the velocity vectors of the two particles at the instant the particles collide.

5. [**10 points**] While driving your car on a highway, you travel at a constant speed of 100 ± 2 km/hour for 50 ± 1 seconds. **Use differentials** to estimate the uncertainty in the distance you travelled in these 50 seconds.

6. [**10 points**] A sheet of material covering the first quadrant ($x \geq 0$, $y \geq 0$) has a surface density (mass per area) given by

$$\rho(x, y) = 3e^{-2x-3y}.$$

What is the total mass of that part of the sheet enclosed by the triangular area whose vertices are located at $(1, 0)$, $(0, 0)$, $(0, 1)$?

7. [**10 points**] Evaluate

$$I = \int_1^{\ln 8} \int_0^{\ln y} e^{x+y}\, dxdy.$$

8. [**10 points**] Consider the surface

$$x^2 + y^2 + z^2 = 1$$

and let (a, b, c) be some point on the surface. Find an equation for the plane tangent to this surface at (a, b, c). **Simplify your answer as much as possible.**

9. [**10 points**] Suppose the trajectory of a particle is given by

$$\mathbf{r}(t) = \sin t\ \mathbf{i} + \cos t\ \mathbf{j} + t\ \mathbf{k}.$$

Calculate the magnitude of the normal component of the acceleration experienced by the particle at $t = 1$.

10. [**10 points**] Find nonnegative numbers x, y and z that minimize the quantity

$$M = x^2 + y^2 + z^2$$

subject to the condition

$$x^4 y^2 z = 1.$$