Math 126 - Spring 2013
Exam 2
May 21, 2013

Name: _____

Section: _____

Student ID Number: _____

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- There are 4 pages of questions. Make sure your exam contains all these questions.
- You are allowed to use a scientific calculator (**no graphing calculators and no calculators that have calculus capabilities**) and one **hand-written** 8.5 by 11 inch page of notes.
- You must show your work on all problems. The correct answer with no supporting work may result in no credit. **Put a box around your FINAL ANSWER for each problem and cross out any work that you don't want to be graded.** Give exact answers wherever possible.
- If you need more room, use the backs of the pages and indicate to the grader that you have done so.
- Raise your hand if you have a question.
- There may be multiple versions of the exam so if you copy off a neighbor and put down the answers from another version we will know you cheated. Any student found engaging in academic misconduct will receive a score of 0 on this exam. All suspicious behavior will be reported to the student misconduct board. In such an instance, you will be force to meet in front of a board of professors to explain your actions.
  DO NOT CHEAT OR DO ANYTHING THAT LOOKS SUSPICIOUS!
  WE WILL REPORT YOU AND YOU MAY BE EXPELLED!
- You have 50 minutes to complete the exam. Budget your time wisely.
  SPEND NO MORE THAN 10 MINUTES PER PAGE!

GOOD LUCK!

1. (12 pts) A particle is moving in such a way that it's acceleration is given by $\mathbf{a}(t) = \langle 4, \sin(t), e^t \rangle$. The initial velocity is $\mathbf{v}(0) = \langle -6, 2, 0 \rangle$ and the initial position is $\mathbf{r}(0) = \langle 0, 0, 10 \rangle$.

   (a) (5 pts) Find the curvature, κ, at time $t = 0$.

   (b) (7 pts) Find the (x, y, z) coordinates of the particle at time $t = 2$ seconds. (You can leave your answers in exact form.)

2. (The two problems below are unrelated)

(a) (8 pts) Find the linearization $L(x, y)$ of $f(x, y) = \ln(y) + e^{3x}\sqrt{xy + 4y^2}$ at $(x, y) = (0, 1)$.

(b) (8 pts) Let $f(x, y) = \dfrac{9}{x} + 3xy - y^2$. Find and classify all critical points of $f(x, y)$. (Classify using appropriate partial derivative tests).

3. (The two problems below are unrelated)

(a) (7 pts) Set up and evaluate a double integral to find the volume of the solid below the surface $z - 3x^2y = 0$ and above the triangle with vertices $(0, 0)$, $(1, 2)$, and $(0, 2)$.

(b) (7 pts) Evaluate the integral by reversing the order of integration: $\int_0^4 \int_{\sqrt{x}}^2 \frac{x}{y^5 + 1}\, dydx$.

4. (8 pts) A lamina occupies the region R in the first quadrant that is above the line $y = x$ and between the circles $x^2 + y^2 = 1$ and $x^2 + y^2 = 4$.
The density is given by $\rho(x, y) = \sqrt{x^2 + y^2}$.
Find the y-coordinate of the center of mass, $\bar{y}$. (Give your final answer as a decimal to 4 digits).