Math 126 - Fall 2013
Exam 2
Tuesday, November 19, 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. (13 pts)

   (a) Find all values of t at which the tangential and normal components of acceleration are equal for the curve $\mathbf{r}(t) = \langle 2t, 1 - 3t, t^2 \rangle$.

   (b) The surface area of a solid circular cylinder of radius r and height h is $S(r, h) = 2\pi r^2 + 2\pi rh$.

      i. Give the total differential for the surface area.

      ii. Estimate the surface area when $r = 2.1$ inches and $h = 9.8$ inches using the linear approximation at $(r, h) = (2, 10)$.

2. (14 pts)

(a) Use implicit differentiation to find $\dfrac{\partial z}{\partial x}$ for $z^3 - 8z - e^2 = x^2\sqrt{y} + \ln(y) - e^{xy^3} - 1$ at the point $(x, y, z) = (2, 1, 3)$.

(b) Consider $\displaystyle\int_0^8 \int_{y/4}^{\sqrt[3]{y}} 5x \, dx \, dy$. Complete the following two tasks:

- Reverse the order of integration to give the equivalent integral in the order $dy \, dx$.
- Using either order, compute the value of this double integral.

3. (10 pts) Find the area of the region outside the circle $x^2 + y^2 = \frac{1}{4}$ and inside one loop of the polar curve $r = \cos(2\theta)$.
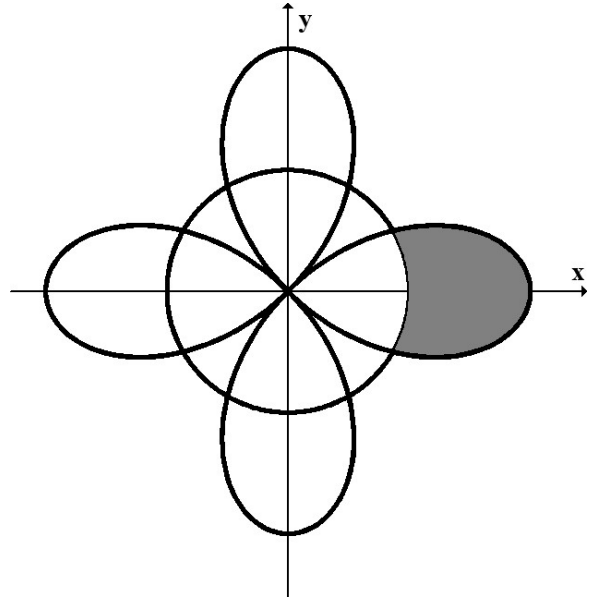
4. (13 pts) You are designing a box that does not have a top (as shown).

The volume must be 10 cubic feet.

The bottom and front are are both going to be made out of slate that costs $5.00 per square foot.

The other three sides are made of glass that costs $2.00 per square foot.

Find the minimum cost.

Verify that your critical point is a local minimum by using the second derivative test.

(To speed up your work, you do not have to give exact answers here. Instead you should give decimal values correct to two digits after the decimal).