Exam #1 **APPM 1360** **Fall 2006**

ON THE FRONT OF YOUR BLUEBOOK write: (1) your name, (2) your student ID number, (3) lecture section (4) your instructor's name, and (5) a grading table. You must work all of the problems on the exam. Show ALL of your work in your bluebook and box in your final answer. A correct answer with no relevant work may receive no credit, while an incorrect answer accompanied by some correct work may receive partial credit. Text books, class notes, and calculators are NOT permitted. A one-page crib sheet is allowed.

1. (*24 points, 6 each*) Evaluate and simplify your answers as appropriate:

$$\text{(a) } \frac{d}{dx}\ln(\cos x), \quad \text{(b) } \frac{d}{dx}(x^x), \quad \text{(c) } \int \sinh(kx)\,dx, \ k \text{ is constant}, \quad \text{(d) } \int 2\,e^{2x}\cosh(2x)\,dx$$

2. (*15 points*) Consider the following differential equation and initial condition

$$\frac{dy}{dx} = e^x(y-1)^2, \quad y(0) = \frac{1}{2}$$

(a) (*10 points*) Solve the equation with this initial condition.

(b) (*5 points*) Is the solution:
(i) increasing everywhere, (ii) decreasing everywhere or (iii) neither? Explain.

3. (*24 points, 8 each*) Consider the bounded region enclosed between $y = x^2$ and $y = x^4$ in the first quadrant. Set up, but **DO NOT** evaluate, the resulting integrals.

(a) Find the enclosed area.

(b) Revolve the region around the line $x = 1$. Use disks-washers to find the volume.

(c) Use shells to find the volume in part (b) above.

4. (*21 points, 7 each*) A curve is represented by

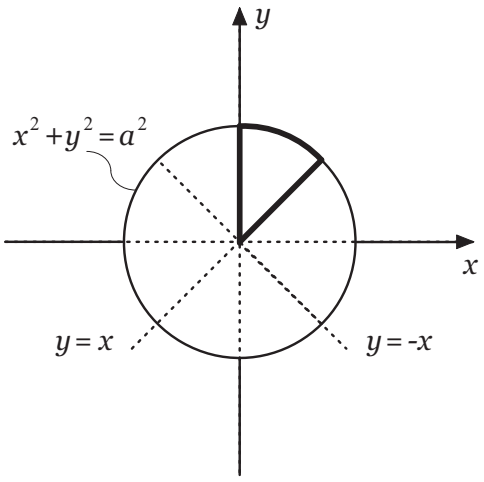
$$x = \cos(2t), \quad y = \sin^2 t$$

(a) Set up and evaluate the integral to find the length of the curve when $0 \leqslant t \leqslant \pi/4$.

(b) Draw the curve in the xy plane. *Without* performing any integration, can you find the length of the curve in part (a)? Explain.

(c) Rotate the curve around the $x-$axis. Set up, but **DO NOT** evaluate, the integral which determines the surface area.

5. (*16 points, 8 each*) After a long day studying you decide to order a pizza for dinner. Your pizza is thin, has the shape of the circle $x^2 + y^2 = a^2$, constant density, and it is cut in eight pieces by the coordinate axes and the lines $y = x$ and $y = -x$, as in the figure. Set up, but **DO NOT** evaluate, the integrals which determine the center of mass of the slice as depicted in the figure. This is the point you should hold the slice so that it will balance when you hold it!



Good Luck!!!