Mathematics 181 – **C** **Spring 2007**

Exam 2

February 27, 2007

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Name

Technology used: ______________________________

- **Only write on one side of each page.**
- Show all of your work. Calculators may be used for numerical calculations and answer checking only.
- Be sure to include in-line citations every time you use technology and Include a careful sketch of any graph obtained by technology in solving a problem.

Do any six (6) of the following problems

datory Problem (10 points each) Do any three (3) of the following 4 integral problems.

(a) Evaluate $\int 2x \arcsin\left(x^2\right)\ dx$

(b) Use integration by parts to establish the reduction formula: $\int (\ln(x))^n\ dx = x(\ln(x))^n - n\int (\ln(x))^{n-1}\ dx$

(c) Evaluate $\int 3\sec^4(3x)\ dx$

(d) Evaluate $\int 8\cos^3(2\theta)\sin(2\theta)\ d\theta$

Do any four (4) of the following problems.

1. (15 points) Find the length of the curve given by the equation:

$$x = \frac{y^4}{4} + \frac{1}{8y^2}, \quad 1 \le y \le 2$$

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2. (15 points) Do one of the following

   (a) Find the area of the surface generated by revolving the curve $x = y^3/3$, $0 \le y \le 1$ about the y-axis.

   (b) Find the area of the surface generated by revolving $x = \cos(t)\,,\ y = 2 + \sin(t)\,,\ 0 \le x \le 2\pi$ about the x-axis.

3. (15 points) One model for the way diseases die out when properly treated assumes that the rate dy/dt at which the number of infected people changes is proportional to the the number y. That is, the number of people cured is proportional to the number y that are infected with the disease. Starting with an initial population of $10,000$ people, suppose that in any given year the number of cases can be reduced by 25%. How long will it take to eradicate the disease, that is, reduce the number of cases to less than 1?

4. (15 points) Solve the separable differential equation

$$\frac{dy}{dx} = \frac{e^{2x-y}}{e^{x+y}}$$

5. (15 points) A thin plate of density $\delta(x) = 4/\sqrt{x}$ covers the region between the curve $1/\sqrt{x}$ and the x-axis from $x = 1$ to $x = 16$. Find the x coordinate, $\bar{x}$, of the center of mass.