Mathematics 181 – B **Fall 2007**

Exam 2

October 9, 2007

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Name

Technology used:____ Directions:

- Be sure to include in-line citations every time you use technology.
- Include a careful sketch of any graph obtained by technology in solving a problem.
- **Only write on one side of each page.**

Do all of the following problems

1. Evaluate any **three** (3) of the following.

   (a) $\int \frac{1}{x^2} e^{1/x} \sec\left(2 + e^{1/x}\right) \tan\left(2 + e^{1/x}\right)\ dx$

   (b) $\int \frac{1}{x} \sin^2\left(\ln(x)\right)\ dx$

   (c) $\int_{\ln(4)}^{\ln(9)} e^{x/2}\ dx$

   (d) $\frac{d}{dx} \int_{e^{x^2}}^{2} \frac{1}{\sqrt{t}}\ dt$

2. The base of a solid is the region bounded by the graphs of $y = \sec(x)$, $y = 0$, $x = 0$ and $x = \pi/4$. The cross sections perpendicular to the x-axis are **semi**circles . Find the volume.

3. A solid of revolution is formed when the region bounded by the curves $x = y^2$ and $x = 6 - y$ is rotated about the line $y = 4$. Use the method of cylindrical shells to find the volume.

4. Find the length of the parametrized curve $x = \frac{t^3}{6} + \frac{1}{2t}$, $y = t$, from $t = 2$ to $t = 3$.

5. Solve the separable differentiable equation

$$\sqrt{x}\frac{dy}{dx} = e^{y+\sqrt{x}},\ x > 0.$$

6. Do **one** of the following.

   (a) A wire in the shape of a semicircle of radius 7 has a density function $\delta(\theta) = 2\sin(\theta)\ \frac{\mathrm{g}}{\mathrm{cm}}$ that varies with the parameter angle θ. Use our three step process to set up a definite integral whose numerical value is the total mass (measured in grams) of the wire. Do not evaluate the integral. Use the parametric equations $x = 7\cos(\theta)$, $y = 7\sin(\theta)$, $0 \le \theta \le \pi$ where length is measured in centimeters.

   (b) Empirical evidence indicates that the power dissipation in a hurricane is proportional to three things: the cube of the wind speed, the frictional drag from the surface area at the base of the hurricane and the surface air density. Assume that the wind velocity $V(r)$ depends only on the distance, r, from the center of the Hurricane and denote the outer radius of the hurricane by R, the surface drag coefficient by C_d, and the surface air density by ρ.Use this information and our three-step process to build a definite integral that represents the total power dissipation.