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MATH 152 Dr. Z. , **Practice For Make-Up Exam I: Practice A2**,

1. (10 points [5 each]) Find the following indefinite integrals

(a)

$$\int x \tan^{-1} x, dx$$

(b)

$$\int \frac{(x + 1)}{(x^3 + 3x^2 + 3x + 1)x} dx$$

2. (10 points) The base of a solid is the region inside the curve $x^4 + y^2 = 1$. Each cross section of the solid perpendicular to the y -axis is an equilateral triangle . What is the volume of the solid?

3. (10 points) Consider the curve $y = \tan^3 x$, $0 \leq x \leq \pi/3$. Set-up but do not evaluate, integral for the (a) its length (b) the area of the surface formed by rotating it about the x -axis (c) the area of the surface formed by rotating it about the y -axis .

4. (10 pts) The natural length of a certain spring is 1 foot. You need 2 pounds to keep it stretch at length of 3 feet. How much work is needed to stretch it from length 4 feet to length 7 feet.

5. (10 points, 5 each) Determine whether each of the following integrals is convergent or divergent. Evaluate those that are convergent. Be sure to explain everything.

(a)

$$\int_e^{\infty} \frac{10 \log x}{x}$$

(b)

$$\int_{10}^{\infty} \frac{x^2 + \sqrt{x} + 4}{x^4 - x + 2}$$

6. (10 pts) Find the average value of $f(x) = (1 + x^2)^2$ on the interval $0 \leq x \leq 1$. Is it larger or smaller than the average of the maximum and minimum of $f(x)$ on that interval? Draw a picture that explains this.

7. (10 pts [6 for (a) and 4 for (b)]) Let

$$I = \int_1^9 \frac{1}{x^3}$$

- (a) Use The Midpoint rule with $n = 4$ subdivisions to find an approximation.
- (b) Estimate the error.

8. (10 points, 5 each) The region R is bounded by the curves $y = \sin x$ the x -axis, and the vertical line $x = \pi/3$. Find the volume of the solid obtained by rotating R about: (a) about the x -axis (b) about the y -axis.

9. (10 pts) Solve the initial value problem

$$y' = \frac{\sec y}{\cos x} \quad ; \quad y(\pi/2) = 1 \quad .$$

10. (10 pts) A bacteria culture starts with a certain number of bacteria, and grows at a rate proportional to its size. After three hours there are nine hundred bacteria, and after six hours there are 2700 bacteria. (a) How many bacteria were there at the beginning? (b) When will there be 8100 bacteria?