

MA 126 Closed Book/No calculators
Show all work for full credit!

NAME _____
Spring, 2010

PART 1. Part 1 consists of 8 questions. Do your work and clearly write your answer in the space provided. (6 points each)

1. Set up, **but do not evaluate**, a definite integral for the **area** of the region bounded by $y = 9 - x^2$ and $y = 6 - 2x$.

Answer: _____

2. Evaluate the improper integral, or show it diverges. $\int_0^{\infty} \frac{1}{x^2 + 1} dx$

Answer: _____

3. Determine in *in-lbs* how much work is required to stretch a spring 3 inches past its natural length if it takes a force of 10 lbs to hold the spring stretched 2 inches past its natural length.

Answer: _____

4. Evaluate the improper integral $\int_0^{\infty} x^2 e^{-x^3} dx$, or show that it diverges.

4. Which of the following integrals are improper?

A. $\int_1^2 \frac{1}{2x-1} dx$ B. $\int_0^1 \frac{1}{2x-1} dx$

Answer: _____

C. $\int_{-\infty}^{\infty} \frac{\sin x}{1+x^2} dx$ D. $\int_1^x \ln(x-1) dx$

5. Which pictured area, A or B, is given by $\int_0^1 (1-y^2) dy$?

Answer: _____

6. Find the arc length of the curve $\vec{r}(t) = \langle 2 \sin t, 3t, 2 \cos t \rangle$, $0 \leq t \leq 10$, $0 \leq t \leq \pi$.

Answer: _____

7. Find the volume of the solid generated by rotating the region bounded by the curves $y = \sqrt{x}$, $y = 0$, and $x = 1$ about the y-axis.

Answer: _____

Part 2. Part 2 consists of 5 problems worth 10 points apiece except for # 5 which is worth 12 points. Show all your work for full credit! Displaying only the final answer (even if correct) without the relevant steps is not enough.

Problem 1

Set up a definite integral in terms of one variable and which represents the area of the region enclosed by the curves $y = \sqrt{x}$, $x + y = 6$, and the x-axis. **Do not evaluate the integral.**

Problem 2

The base of a certain solid is a circular disk of diameter AB of length 10 ft. Set up a definite integral in terms of one variable representing the volume of the solid if each cross section perpendicular to AB is a square. **Do not evaluate the integral.**

Problem 3

Find the length of the curve $y = (\frac{2}{3})(x^2 + 1)^{3/2}$ from $x = 0$ to $x = 2$. **You must find the actual length here.**

Problem 4

A water tank is in the shape of a right circular cone with its vertex down. It is 10 meters in diameter at the top and 7 meters high. It is filled to a depth of 4 meters with water whose density is $1000 \frac{\text{kg}}{\text{m}^3}$.

Set up a definite integral in terms of one variable and representing the work done in emptying the tank by pumping the water to the top of the tank. **Do not evaluate the integral.** Sketch the tank and label the part that represents the variable in your integral.

Problem 5

Use the method of slicing (disk method) to set up a definite integral in terms of one variable that represent the **volume** of the solid generated by revolving the first quadrant region A about each of the given lines below. **Do not evaluate the integrals.** The region A is bounded by the curves $y = x^2$, $y = 4$, and the y-axis. It is revolved about

a. the line $y = 4$.

b. the line $x = 2$.