MTH142

Midterm Exam 2

November 17, 2005

NAME (please print legibly): _____

Your University ID Number: _____

Circle your instructor's name and lecture time.

Ethan Pribble	MWF 9:00 - 9:50 AM
Micah Milinovich	MW 3:25 - 4:40 PM

- **No calculators are allowed on this exam.**
- **Write legibly. Label sketches. Label and circle your answers.**
- **Show your work and justify your answers. You may not receive full credit for a correct answer if insufficient work is shown or insufficient justification is given. Do not include irrelevant work.**
- **Problems are not ordered according to difficulty. We recommend looking at all problems first and then starting with the ones that seem easiest to you.**

QUESTION	VALUE	SCORE
1	20	
2	10	
3	20	
4	10	
5	10	
6	10	
7	20	
TOTAL	100	

1. (20 points)

Evaluate the following indefinite integrals using a substitution.

(a) $\int e^{\sin x} \cos x \, dx$

(b) $\int \frac{x^3}{\sqrt{x^4 + 7}} \, dx$

(c) $\displaystyle\int \frac{\ln(7x)}{x}\,dx$

(d) $\displaystyle\int x^9\sqrt{x^5+7}\,dx$

2. (10 points)

Let R be the planar region between the curves $y = \sin x$ and $y = \cos x$ from $x = 0$ to $x = 2\pi$.

(a) Sketch the region R.

(b) Represent the area of R as a sum of definite integrals. Do NOT use absolute value in your answer. Do NOT evaluate any definite integrals.

3. (20 points)

Let S be the solid obtained by rotating the planar region bounded by the curves $x = 0$, $x = \sqrt{y}$, and $y = 4$ about the line $x = 3$.

(a) Sketch a typical cross-section of S.

(b) Write a definite integral which represents the volume of S using the definition of volume. Do NOT evaluate the definite integral.

(c) Sketch a typical cylindrical shell of S.

(d) Write a definite integral which represents the volume of S using the method of cylindrical shells. Do NOT evaluate the definite integral.

4. (10 points)

The force required to maintain a spring stretched 10 centimeters beyond its natural length is 30 Newtons.

(a) Use Hooke's Law to find the force function $F(x)$ which gives the force required to maintain the spring stretched x meters beyond its natural length.

(b) Write a definite integral which represents the work done (in Newtons) in stretching the spring from 13 centimeters to 27 centimeters beyond its natural length. Do NOT evaluate the definite integral.

5. (10 points)

A cylindrical tank has radius 3 meters and height 10 meters. The tank is filled to height 8 meters with water. The density of water is 1000 kilograms per cubic meter. Write a definite integral which represents the work done (in Newtons) lifting all the water to the top of the tank. Do NOT evaluate the definite integral.

6. (10 points)

(a) Find the average value of the function $f(x) = 5x^2$ on the interval $[0, 3]$.

(b) Find the point(s) in the interval $(0, 3)$ where f achieves its average value.

7. (20 points)

Evaluate the following indefinite integrals using integration by parts.

(a) $\int x \sin x \, dx$

(b) $\int x^9 \ln x \, dx$

(c) $\int x^2 e^x \, dx$

(d) $\int e^x \sin x \, dx$