

Name: \_\_\_\_\_  
SID: \_\_\_\_\_  
Section: \_\_\_\_\_

**Midterm Exam #1-Math 022-F '07**  
**Instructor: Devin Greene**

The exam is 50 minutes long. No calculators or notes are permitted. Show your work. You do not need to simplify your answers.

Problem #1 (10 points)

A 10 meter high monument has circular horizontal cross sections each with area  $A(x) = 10 \exp(-x^2 / 100)$ , where  $x$  is the height in meters from the ground. Write out, *but do not evaluate*, an integral representing the volume of the monument.

For Problems #2 and #3, find the volume of the described solid of revolution.

Problem #2 (10 points)

The region bounded by the curves  $x = 1$ ,  $y = 0$ , and  $y = x^3$  is rotated around the  $y$ -axis.

Problem #3 (10 points)

The region bounded by the curves  $y = 1$ ,  $y = |x - 1|^3$  is rotated around the  $x$ -axis.

Problem #4 (10 points)

A cylindrical water tank with radius 3 meters and height 10 meters is supported by metal stilts so that its base is 10 meters from the ground. Water at ground level is pumped up into the tank until it is full. How much energy does this require? Recall that water weighs 9800 newtons per cubic meter. State your answer in joules (= newton-meters).

Problem #5 (10 points)

Find the average value of the function  $f(x) = \sqrt{x}$  on the interval  $[0,100]$ .  
For which value of  $x$  in the interval does  $f(x)$  take the average value?