

EXAM 2
Math 2423
3-26-04

Name _____

Row _____

Instructions *Work all of the following problems in the space provided. If there is not enough room, you may write on the back sides of the pages. Give thorough explanations to receive full credit.*

1. (14 points)

a) Give the definition of the number e .

b) Prove that $\frac{d}{dx}(e^x) = e^x$.

2. (10 points) If $y = \ln(1 + xe^{(x^2)})$, find $\frac{dy}{dx}$.

3. (28 points) Find the indefinite integral, showing all work:

a) $\int \frac{\sec^2 x}{\tan x + 2} dx$

b) $\int \frac{e^x}{\sqrt{e^x + 1}} dx$

c) $\int \frac{e^{1/x}}{x^2} dx$

d) $\int \frac{(\ln x)^{10}}{x} dx$

4. *(16 points)* Find the volume of the solid obtained by rotating the shaded region in the diagram around the line $y = 1$.
5. *(16 points)* Find the volume of the solid obtained by rotating the shaded region in the diagram around the y -axis.

6. (*16 points*) A cylindrical tank has radius 5 meters and is 20 meters tall, and is filled with water to a height of 7 meters (see diagram). Find the work required to pump all the water to the top of the tank. (The density of water is 1000 kg/m^3 ; use $g = 10 \text{ m/s}^2$ for gravitational acceleration.)