Math 152 - Exam 3 - Spring 2004

You may use calculators for this exam. Do all your work on the sheets provided, not this problem sheet. Please use only one side of a sheet for your response, but be sure to show your work. Please put your name on each sheet and circle the final answer to each problem. Point values are in parentheses.

Honor Statement: By signing this statement I agree that I will not discuss any aspects of the material covered on this exam with any other individual until after 6:00PM on the day of the exam. Additionally, if anyone approaches me before 6:00PM requesting any information about the exam, I will report this individual's action to Dr. Gross.

Signature: _____ Section #: _____

You may find the following formulas useful:

$$\int \frac{f'(x)}{f(x)}\, dx = \ln(f(x)) + C \qquad \int f'(g(x))\, g'(x)\, dx = f(g(x)) + C$$

$$\int f'(x)\, e^{f(x)}\, dx = e^{f(x)} + C \qquad \int f'(x)\, f(x)^n\, dx = \frac{f(x)^{n+1}}{n+1} + C$$

1. Find the area under the curve $y = \dfrac{1}{x+1}$ between x = 0 and x = 1. (12 pts).

2. Find the volume of the solid of revolution generated by revolving the curve $y = x^{1/3}$ about the x-axis for $1 \le x \le 8$. (12 pts.)

3. Find the following (12 pts. each):

(a) $\displaystyle\int \frac{4}{x^2 + 2x - 3}\, dx$

(b) $\displaystyle\int_1^2 x \ln(x)\, dx$

(c) $\displaystyle\int_2^7 \frac{x-1}{\sqrt{x+2}}\, dx$

(d) $\displaystyle\int \frac{x}{1+x^2}\, dx$

4. A silo in the shape of an upright cylinder has radius 5 m and is 15 m high. It is full of grain which has density $120\ kg/m^3$. How much work is done in pumping out all the grain over the top of the silo? (12 pts.)

5. A lake is 25 m deep. The density of phytoplankton in the lake is

$$\rho(x) = 10\ x\ (\ 25 - x\ )$$

where x is the depth and $\rho(x)$ is the number of phytoplankton per m^3 in a standard 1 m^2 water column.

(a) At what depth is the phytoplankton desnity the highest? (8 pts.)

(b) Find A(D) = the total number of phytoplankton individuals in the water column down to depth D? (8 pts.)