**Math 152 - Exam 3 - Spring 2005**

**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:

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

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

1. Find the area under the curve $y = x^2 + 1$ and above the curve $y = x$ between x = 0 and x = 1. (12 pts).

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

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

(*a*) $\int \frac{6}{(x-1)(x+2)}\,dx$

(*b*) $\int_0^2 x\,e^x\,dx$

(*c*) $\int_0^3 \frac{x}{\sqrt{x+1}}\,dx$

(*d*) $\int \frac{x^4}{(1+x^5)^3}\,dx$

4. Spiderman must save a group of people trapped in a cable-car hanging on a strong steel cable 50 meters below the edge of a bridge. The cable car and the people together weigh 2000 kg. The steel cable weighs 4 kg per meter. Spiderman is standing on the bridge (14 pts.)

(a) How much work does Spiderman have to do to lift the cable-car the 50 meters to the edge of the bridge?

(b) How much less work would Spiderman have to do if the steel cable snapped at the cable-car and Spiderman quickly sent down some spidersilk (which has negligible weight) to wrap around the cable-car, and used the spidersilk to raise the car the 50 meters?

5. Haddock (a fish) live up to 50 meters deep in a certain part of the ocean. The density of haddock is

$$\rho(x) = \frac{1}{10}\, x\,(\,50 - x\,)$$

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

(a) At what depth is the haddock density the highest and what is the density there? (5 pts.)

(b) Find H(x) = the total number of haddock in the water column down to depth x? (9 pts.)