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Read all of the following information before starting the exam:

- **WRITE YOUR NAME AT THE TOP OF EACH PAGE (you will lose points otherwise)**
- **DO NOT WRITE ON THE FRONT OR BACK OF THE FIRST PAGE other that writing your name.**
- **Show all work and give explanations where needed. I reserve the right to take off points if I cannot see how you arrived at your answer (even if your final answer is correct).**
- **Use only the paper provided, your one page notes and a pen or pencil. If you need additional scratch paper some will be provided.**
- **Write you answer in the box provided.**
- **This test has 6 problems and is worth 55 points, It is your responsibility to make sure that you have all of the pages!**
- **Good luck!**

1	
2	
3	
4	
5	
6	
total	

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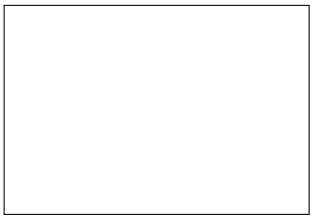
1. (*12 points*)

a) Evaluate $\int \ln(x)\, dx$ (show the derivation even if you know the integral).



b) Derive the identity $\int x^n \ln(x)\, dx \;=\; \frac{x^{n+1}\ln(x)}{n+1} - \frac{x^{n+1}}{(n+1)^2} + c$ for $x > 0$.

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c) Evaluate $\int_0^1 x^3 \ln(x^2+1)\ dx$

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2. (*10 points*)

a) Write the definition of $\int_a^b f(x)\ dx$ include as many details as you can.

b) Use the definition to derive the identity $\int_a^b cf(x)\ dx = c\int_a^b f(x)\ dx$ for f integrable on $[a, b]$. If you use any properties of summations or limits make sure to say which property.

c) It is a fact that for any two real numbers $|a + b| \leq |a| + |b|$ (the absolute value of $a + b$ is less than or equal to the absolute value of a plus the absolute value of b). Use this fact and the definition of the integral to show that $\left|\int_a^b f(x)\ dx\right| \leq \int_a^b |f(x)|\ dx$

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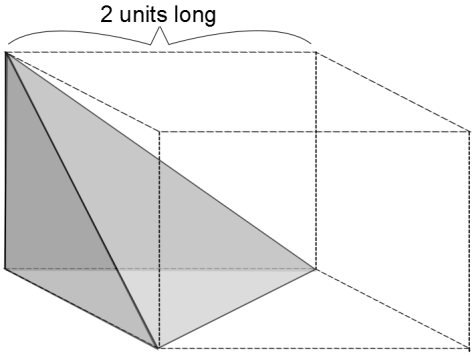
3. (*8 points*) Calculate the volume of the right triangular prism obtained when cutting the triangle out of a cube with side lengths 2 units, see picture below. Use calculus to find this volume.



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4. (*5 points*) Find the function $y(x)$ which is a solution to the differential equation $y'(x) = y(x) + 1$ with initial condition $y(0) = 2$.

5. (*12 points*) Evaluate the following.

a) $\int_0^{\frac{\pi}{2}} \sin^3(x)\cos^4(x)\ dx$

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b) $\int_{-1}^{0} \frac{x}{x-1}\ dx$

c) $\int x \sec^2(x)\ dx$