Name: _____

Summer 2011

Instructor: Rob Ackermann

Circle Your Discussion Section: 3:30 Yoshi   4:30 Yoshi   3:30 Rick   4:30 Rick

Math 3B Final, September 8, 2011
Version A

Instructions: Read the instructions for each question carefully. No calculators, cell phones, or other electronic devices are permitted. Show all work, or give explanations if you skip certain steps. Simplify your work within reason and remember an unsimplified correct answer is much better than a simplified wrong answer. For extra nice grading, write neatly and box your answers.

Problem	Points	Score
1	12	
2	4	
3	8	
4	12	
5	8	
Bonus	?	
Total	44	

1. Evaluate the following integrals. SHOW YOUR WORK (12 points)

   (a) $\int \sin^3 x \ dx$

   (b) $\int_1^\infty \frac{1}{\sqrt{x}} \ dx$

(c) $\displaystyle\int_1^\infty x^{-2} \ln x \; dx$ (Hint: use parts with u = ln x)

2. Write out the partial fraction decomposition for the function below. You should leave your answer in the form $\dfrac{A}{\text{stuff}} + \dfrac{B}{\text{stuff}} + \dfrac{Cx+D}{\text{stuff}} + \dots$ You do not need to find the constants A, B, etc. but the "stuff" needs to be correct (4 points).

$$\frac{x^2 - 3x + 5}{(x-2)^3 (x+2) (x^2+4)} =$$

3. Set up but DO NOT EVALUATE the integral you would take to find the following. (8 points)

(a) The work required to pump the water out of the fish tank shown (note: there is no water in the spout). Clearly label where you decided $x = 0$ is, and which direction you took to be positive. You may use that the density of water is $1,000 \ kg/m^3$.

(b) A rope 30 meters long and weighing 10 kg hangs over the side of a building. It has a basket of puppies tied to the end of it, weighing 5 kg total. Set up the integral you would take to find the work required to pull the rope to the top of the building. As above, clearly label where $x = 0$ and $x = 30$ are.

Congratulations! You are now covered in puppies.

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4. Evaluate the following integrals. (12 points)

(a) $\int \dfrac{1}{x^2 + 2x + 3} \, dx$ (Hint: You cannot factor the denominator)

(b) $\int e^{\sqrt{x}} \, dx$

5. Use your wits to solve this problem! (8 points)

(a) Find $f'(x)$ where $f(x) = \int_{-1}^{x} \sqrt{e^{-2t} - 1} \, dt$

(b) With $f(x)$ as above, find the arclength of $y = f(x)$ from $x = 0$ to $x = 4$

BONUS 1: Evaluate $\displaystyle\int \frac{1}{x^2\sqrt{x^2+4}}\, dx$

(more bonus on next page. It's easier and funner)

BONUS 2: Who would win in a fight, your instructor or your TA? Remember to show your work. (1 - 2 points)