Name _____

MATH 121B Calculus and Analytic Geometry I Spring 2004 Exam #5

Instructions: You can work on the problems in any order. Please use just one side of each page and clearly number the problems. You do not need to write answers on the question sheet.

This exam is a tool to help me (and you) assess how well you are learning the course material. As such, you should report enough written detail for me to understand how you are thinking about each problem.

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1. For each of the following, give a definition equivalent to that used in the text or in class.

   (a) *definite integral of the function f for the interval $[a, b]$.* (8 points)

   (b) *antiderivative of the function f* (8 points)

2. (a) State the First Fundamental Theorem of Calculus. Include the hypotheses and conclusion. (8 points)

   (b) State the Second Fundamental Theorem of Calculus. Include the hypotheses and conclusion. (8 points)

   (c) Briefly explain what the Fundamental Theorems tell us about the relationship between differentiation and integration. (4 points)

3. Compute the exact value of $\displaystyle\int_0^3 x^2\,dx$ using the limit of a Riemann sum (*not* using the First Fundamental Theorem of Calculus). (12 points)

4. Approximate the value of $\displaystyle\int_1^2 \sin(x^2)\,dx$ using 5 terms and inputs of your own choice. (10 points)

5. Evaluate each of the following definite integrals. (8 points each)

   (a) $\displaystyle\int_{\pi/2}^{\pi} \cos x\,dx$ (b) $\displaystyle\int_{-2}^{3} \left(6u^2 - 4u + 3\right) du$ (c) $\displaystyle\int_0^2 \left(x - e^x\right) dx$

6. Water flows into a lake at a rate given by $7\sqrt{t}$ gallons per hour. Determine how much water flows into the lake during the interval from $t = 4$ to $t = 25$. (10 points)

7. Find the derivative of $\displaystyle\int_0^x e^{\sin t}\,dt$ with respect to x. (8 points)