MATH 1272
Midterm I
Professor Bramson
October 6, 2011

Name:_____

T.A.:_____

INSTRUCTIONS: There are 100 points possible on the exam. Do as many problems as you can. Answers must be in the boxes provided to be counted. Show your work in the space provided below each problem - outside the boxes. If you need extra space, state where the work is being done. Also, be sure to justify your answers. Note that some formulas are given on page 7. Page 6 is provided as scratch; be sure your exam has all 7 pages. **NO CALCULATORS** are permitted. GOOD LUCK!

1. (10 pts) Which substitution should one try for $\int (\sin x \cos x)^5 \, dx$? (No justification is required.)

(A) $u = \sin x$

(B) $u = \tan x$

(C) $u = \sec x$

(D) $u = \sqrt{1 - x^2}$

(E) $u = \frac{1}{1+x^2}$

(F) $u = \tan x + \sec x$

(G) $\sin^2 x = \frac{1-\cos 2x}{2}$, $\cos^2 x = \frac{1+\cos 2x}{2}$

2. (10 pts) Which substitution from Problem 1 should one try for $\int (\sin x \cos x)^6 \, dx$? (No justification is required.)

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3. (10 pts) Compute $\int e^{\sqrt{3x}}\,dx$.

4. (10 pts) Compute $\int \frac{1}{1+\sin u}\,du$.

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5. (10 pts) Compute $\int \frac{1}{(t^2+1)^2}dt$.

6. (15 pts) Apply the Midpoint Rule to approximate $\int_2^{10} \frac{e^x}{x}\,dx$ using $n = 4$. Write your answer as a sum of exponential functions.

As $n \to \infty$, how quickly does the error in the Midpoint Rule go to 0, in terms of a power of n? (You don't need to give the other coefficients.)

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7.(a) (15 pts) Find the arc length from $x = 0$ to $x = \pi/4$ for the curve $y = \log(\cos x)$. Write the answer as an integral whose integrand is in a simple form. (Square roots are not allowed.)

7.(b) (5 pts) Solve the above integral.

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8. (15 pts) Which of the following is true for

$$\int_3^\infty \frac{x\log^2(x+1)}{x^2-1}\,dx?$$

(A) The limit exists and it is finite.

(B) The limit exists and it is ∞.

(C) The limit exists and it is $-\infty$.

(D) The limit does not exist.

Explain your answer *carefully*, stating all results that you are using.

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SOME FORMULAS

$$\sin(A+B) = \sin A \cos B + \cos A \sin B$$

$$\cos(A+B) = \cos A \cos B - \sin A \sin B$$

$$\sin^2(A/2) = (1-\cos A)/2$$

$$\cos^2(A/2) = (1+\cos A)/2$$

$$\sin A \cos B = \tfrac{1}{2}[\sin(A-B) + \sin(A+B)]$$

$$\sin A \sin B = \tfrac{1}{2}[\cos(A-B) - \cos(A+B)]$$

$$\cos A \cos B = \tfrac{1}{2}[\cos(A-B) + \cos(A+B)]$$

$$\sec^2 x = \tan^2 x + 1$$

$$\csc^2 x = \cot^2 x + 1$$