MATH 1272
Professor Bramson, 3:35
Midterm I
February 26, 2013

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 8. Page 7 is provided as scratch; be sure your exam has all 8 pages. **NO CALCULATORS** are permitted. GOOD LUCK!

1. (10 pts) Compute $\int e^{\sqrt[3]{x}}\, dx$.

2. (10 pts) Compute $\int_{\text{space}} \int \sec 3y \, dy$. (Justify your reasoning.)

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3. (15 pts) How should you simplify $\int \frac{x^9 - 2x^7 + x^5 - x^3 + 3}{(x+3)(x^2+2x+1)(x^2+4)^2}\,dx$ using partial fractions before trying to integrate it? Do not bother to do long division or compute the constants in the numerators – just write down the correct form using the constants $A, B,$ etc., and the appropriate denominators.

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4. (15 pts) Apply the midpoint rule to approximate $\int_1^3 \frac{1}{x}\cos(x^3)\,dx$ using $n = 4$. Write your answer as a sum of cosine 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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5. (10 pts) Which substitution(s) should one try for $\int (\tan^5 u \ \sec^2 u \ du$? Only put down one answer, *making the best choice.* (No justification is required.)

(A) $u = \tan x$

(B) $u = \sec x$

(C) either $u = \tan x$ or $u = \sec x$

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

(E) $u = sec\ x \tan x$

(F) $u = \sin x$

6. (15 pts) What is $\displaystyle\int_2^\infty \frac{dx}{x^2 - 1}$? Give a precise answer. (If it has a value, compute it; if it is undefined, say so.) Carefully show your reasoning.

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7. (10 pts) What is the arc length from $x = 0$ to $x = \pi/4$, for the curve $y = \tan^3 x$? You should not compute any complicated integrals, but you need to simplify the terms within the integrand. Write down any formulas you are using.

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

$$\int_0^\infty \frac{x^3 \sin^6 x}{1+x^5}\, dx?$$

(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.

SOME FORMULAS

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

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

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

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

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

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

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

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

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