MATH 1B FIRST MIDTERM

SEPTEMBER 20, 2002

2050 Valley LSB H. Wu

Your Name: _____

Your TA's Name: _____

Instructions

(1). Check that you have all 8 pages of this exam booklet.

(2). *Write your name on every other sheet.* (DO IT NOW.)

(3). Be sure to show all your steps.

(4). *You may not use any fact that has not been covered in the course to do the exam.*

EXAM SCORES					
	Max	Score		Max	Score
I(a)(b)	25		II	15	
I(c)	15		III	10	
I(d)-(f)	25				
TOTAL			%		

You may make use the following table of integrals.

Table of Integration Formulas Constants of integration have been omitted.

1. $\int x^n dx = \frac{x^{n+1}}{n+1} \quad (n \neq -1)$
2. $\int \frac{1}{x} dx = \ln|x|$
3. $\int e^x dx = e^x$
4. $\int a^x dx = \frac{a^x}{\ln a}$
5. $\int \sin x \, dx = -\cos x$
6. $\int \cos x \, dx = \sin x$
7. $\int \sec^2 x \, dx = \tan x$
8. $\int \csc^2 x \, dx = -\cot x$
9. $\int \sec x \tan x \, dx = \sec x$
10. $\int \csc x \cot x \, dx = -\csc x$
11. $\int \sec x \, dx = \ln|\sec x + \tan x|$
12. $\int \csc x \, dx = \ln|\csc x - \cot x|$
13. $\int \tan x \, dx = \ln|\sec x|$
14. $\int \cot x \, dx = \ln|\sin x|$
15. $\int \sinh x \, dx = \cosh x$
16. $\int \cosh x \, dx = \sinh x$
17. $\int \frac{dx}{x^2 + a^2} = \frac{1}{a} \tan^{-1}\left(\frac{x}{a}\right)$
18. $\int \frac{dx}{\sqrt{a^2 - x^2}} = \sin^{-1}\left(\frac{x}{a}\right)$
*19. $\int \frac{dx}{x^2 - a^2} = \frac{1}{2a} \ln\left|\frac{x-a}{x+a}\right|$
*20. $\int \frac{dx}{\sqrt{x^2 \pm a^2}} = \ln|x + \sqrt{x^2 \pm a^2}|$

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I. (40%) Show all the intermediate steps in your calculations:

(a) (15%) $\int \sin^2 x \cos^2 x \, dx =$

(b) (10%) $\int_0^\infty \frac{4\,dx}{4x^2+1} =$

(c) (15%) If a is a positive constant, $\int x^3\sqrt{a^2+x^2}\,dx =$

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(d) (15%) $\int \frac{4\,dx}{4+e^{2x}} =$

(e) (10%) $\int_0^1 \cos^{-1} x \, dx =$

(f) (10%) Write each of the following rational functions as the sum of a polynomial and partial fractions, but do not try to determine the numerical values of the coefficients in the latter:

$\frac{2x^5 - x - 1}{x^4 + 6x + 9} =$

$\frac{65x^3 + 28x - 47}{(x^2 - 5)(x^2 - 4x + 12)}$

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(II) (15%) Let f be a function defined on an interval $[a, b]$ and let the fourth derivative $f^{(4)}$ of f satisfy $|f^{(4)}(x)| \leq K$ for $a \leq x \leq b$. If E_s is the error involved in using Simpson's rule with n subdivisions (n being even), then it is known that

$$|E_s| \leq \frac{K(b-a)^5}{180n^4}$$

(a) Suppose f is a function defined on $[0, 4]$ so that $|f^{(4)}(x)| \leq 1$ for all x in $[0, 4]$, and so that $f(0) = 2$, $f(1) = 1$, $f(2) = -1.3$, $f(3) = -3.6$, and $f(4) = -3.3$. Use the given data and Simpson's rule to approximate $\int_0^4 f(x)\,dx$ to one decimal place.

(b) Estimate the error of this approximation to *two* decimal places.

(c) What is the range of possible values of $\int_0^4 f(x)\,dx$ according to (a) and (b) above?

III (a) (5%) Write down a function whose derivative is $e^{\sin x}$.

(b) (5%) This problem will be graded strictly on your HQ (honesty quotient).

On average, how many hours altogether do you spend on Math 1B each week?

Of these hours, how many are spent on *reading* the Stewart text (apart from doing the homework problems)?