MATH 222 (Lectures 1,2, and 4) Fall 2015
Midterm 1

Name: _____ Student ID#: _____

Circle your TA's name from the following list.

Carolyn Abbott	Tejas Bhojraj	Zachary Carter	Mohamed Abou Dbai	Ed Dewey
Jale Dinler	Di Fang	Bingyang Hu	Canberk Irimagzi	Chris Janjigian
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Jaeun Park	Adrian Tovar Lopez	Polly Yu		

	Problem 1	Problem 2	Problem 3	Problem 4	Problem 5	Problem 6	Problem 7
Score							

Instructions

- Write neatly on this exam. If you need extra paper, let us know.
- On Problems 1, 2, and 3, only the answer will be graded.
- On Problems 4, 5, 6, and 7 you must show your work and we will grade the work and your justification, and not just the final answer.
- Each problem worth either 14 or 15 points.
- No calculators, books, or notes (except for those notes on your 3 inch by 5 inch notecard.)
- Please simplify any formula involving a trigonometric function and an inverse trigonometric function. For example, please write $\cos(\arcsin x) = \sqrt{1-x^2}$. Note that we have provided some formulas on the next page to help with this.

Formulas

You may freely quote any algebraic or trigonometric identity, as well as well as any of the following formulas or minor variants of those formulas.

- $\cos(\arcsin x) = \sqrt{1-x^2}$
- $\sec(\arctan x) = \sqrt{1+x^2}$.
- $\tan(\operatorname{arcsec} x) = \sqrt{x^2-1}$.
- $\int x^n dx = \begin{cases} \frac{x^{n+1}}{n+1} + C & \text{when } n \neq -1 \\ \ln|x| + C & \text{when } n = -1 \end{cases}$
- $\int e^x dx = e^x + C$
- $\int \cos x dx = \sin x + C$
- $\int \sin x dx = -\cos x + C$
- $\int \tan x dx = -\ln|\cos x| + C$
- $\int \cot x dx = \ln|\sin x| + C$
- $\int \sec x dx = \ln|\sec x + \tan x| + C$.
- $\int \csc x dx = -\ln|\csc x + \cot x| + C$.
- $\int \frac{1}{1+x^2} dx = \arctan(x) + C$.

1. For each statement below, CIRCLE true or false.

(a)		(b)		(c)		(d)		(e)	
True	False	True	False	True	False	True	False	True	False

(a) If $\frac{x}{7} = \cos\theta$ then $\tan\theta = \frac{\sqrt{49-x^2}}{x}$.

(b) $\int 3\sin^2(\theta)d\theta = \frac{\sin^3\theta}{\cos\theta} + C$

(c) $\frac{1+\sin(x)}{x^3} \geq \frac{1}{x^3}$ for all $x \geq 1$.

(d) $\int_2^\infty \frac{1}{x^2-9}dx$ is a finite number.

(e) $\int_3^\infty \frac{x-\sqrt{x}}{3x^3+11}dx$ is a finite number.

2. On this page, only the answer will be graded.

   (a) Compute $\int \sin^2(x) - \cos^2(x)dx$.

   (b) Compute $\int \frac{4}{(x-1)(3x+1)}dx$.

   (c) Compute $\int_{-3}^{\infty} \frac{1}{x^2+6x+10}dx$.

3. On this page, only the answer will be graded.
   (a) Find a positive number A such that $\int_{100}^{\infty} \frac{1}{x^2+73x-5} dx < A$.
   (b) Compute $\int xe^{7x+1} dx$.
   (c) Compute $\int \frac{1}{\sqrt{2x-x^2}} dx$.

4. Compute $\int_1^\infty \frac{4x+3}{x(2x+1)(2x+3)}dx$ or explain why the integral does not exist. (You may freely use the formula $\frac{4x+3}{x(2x+1)(2x+3)} = \frac{1}{x} - \frac{1}{2x+1} - \frac{1}{2x+3}$.)

5. Compute $\int (z + e^z) \sin(3z) dz$.

6. Compute $\int e^{-x}\sqrt{4-e^{2x}}dx$.

7. (a) For $n = 0, 1, \ldots$ let $I_n = \int x^n e^{13x+2} dx$. Derive a reduction formula for I_n.

   (b) Let $J_n = \int x^5 (\ln x)^n dx$ for $n \geq 0$. This satisfies the reduction formula $J_n = (\ln x)^n \frac{x^6}{6} - \frac{n}{6} J_{n-1}$ for $n \geq 1$. Compute J_2.

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