640:152 Calculus II, Midterm Exam #1, Spring 2012

Department of Mathematics, Rutgers University

NAME (PLEASE PRINT):

SIGNATURE:

ID #:

INSTRUCTOR: S. Beheshti

SECTION:

- **Turn off/put away all mobile phones, computers, iPods, etc.**
- There is **one** question in Part I consisting of 2 problems and **five** multiple-part questions in Part II.
- Show answers and arguments in the space provided. You may use the back of the pages also, but indicate clearly any such material that you want marked. Answers given without supporting work may receive **zero credit**.
- This is a closed book exam. No calculators. No formula sheets.

Question	Points	Score
PART I		
1	10	
PART II		
2	18	
3	18	
4	18	
5	18	
6	18	
TOTAL	100	

GOOD LUCK!

PART I

1. (a) Give the definition for $f(x) = \arctan x$, and draw a graph of the function. What are the domain and range of f?

(b) State the antiderivatives of the following functions:

$$\frac{1}{\sqrt{1-x^2}} \qquad 5^x \qquad \csc^2 x \qquad \frac{1}{7x}$$

PART II

2. The parts of this problem are not related.

   (a) Use the method of partial fractions to integrate ONE of the following integrals

$$\int \frac{x^2}{x^2-4}\,dx \qquad \text{or} \qquad \int \frac{1}{x(x^2+1)}\,dx$$

   (b) Set up an integral that expresses the area between the circles $x^2+y^2=2$ and $x^2+(y-1)^2=1$. You do *not* need to evaluate your integral.

3. The parts of this problem are not related.
   (a) Integrate $\int \sin^5 x \cos^5 x \, dx$
   (b) Show that a pyramid of height h whose base is an equilateral triangle of side s have volume $\frac{\sqrt{3}}{12} hs^2$.

4. The parts of this problem are not related.
   (a) Integrate $\int e^{2x} \sin x \, dx$
   (b) Find the total mass of a rod having length $\pi/4$ meters whose linear density is given by $\rho(x) = \tan^3 x \sec^4 x$ kg/m, for $0 \leq x \leq \pi/4$. Be sure to include units in your final answer.

5. The parts of this problem ARE related.
   (a) Integrate $\int \sin^2\theta \, \cos^2\theta \, d\theta$
   (b) Use cylindrical shells to calculate the volume of the solid obtained by rotating the graph of $y = x\sqrt{1-x^2}$ over $[0,1]$ about the y-axis.
   Hint: You may wish to use your result from part (a).

6. Integrate the following
   (a) $\int \frac{x^2}{(x^2-1)^{3/2}} dx$
   (b) $\int \sqrt{x} e^{\sqrt{x}} dx$
   (c) $\int \sinh^3 x \cosh^4 x dx$

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