Math 162: Calculus IIA

First Midterm Exam

October 16, 2014

NAME (please print legibly): _____

Your University ID Number: _____

Indicate your instructor with a check in the box:

JJ Lee	MWF 9:00 - 9:50 AM	
Doug Ravenel	MWF 10:25 - 11:15 AM	
Geordie Richards	MW 12:30 - 1:45 PM	
Andrew Bridy	MW 4:50-6:05 PM	

- **The presence of calculators, cell phones, iPods and other electronic devices at this exam is strictly forbidden. IF YOU HAVE YOUR PHONE WITH YOU, YOU MUST TURN IT IN TO A PROCTOR BEFORE STARTING THE EXAM. FAILURE TO DO SO WILL BE TREATED AS AN ACADEMIC HONESTY VIOLATION.**
- **Show your work and justify your answers. You may not receive full credit for a correct answer if insufficient work is shown or insufficient justification is given.**
- **Put your answers in the space provided at the bottom of each page or half page.**
- **You are responsible for checking that this exam has all 10 pages.**

QUESTION	VALUE	SCORE
1	20	
2	20	
3	20	
4	20	
5	20	
TOTAL	100	

1. (20 points)

(a) Use integration by parts to express $\int x^n e^x \, dx$ in terms of $\int x^{n-1} e^x \, dx$ for $n > 0$.

ANSWER:

(b) Use the formula repeatedly to find

$$\int x^3 e^x \, dx.$$

You will not get partial credit here if the formula you are using is incorrect.

ANSWER:

2. (20 points) The half bagel problem. Consider the region between the x-axis and the semicircle $y = \sqrt{a^2 - (x-b)^2}$ with $b > a > 0$. The semicircle has radius a and center $(b, 0)$. We want to find the volume V of the solid of revolution about the y-axis.

(a) Write the integral for the volume and convert it to a trig integral using the substitution $x = b - a\cos\theta$ for $0 \leq \theta \leq \pi$.

ANSWER:

(b) Find the volume in terms of a and b.

You will not get partial credit here if the integral you are using is incorrect.

ANSWER:

3. (20 points)

(a) Let $a > 0$ be a fixed positive number. Compute the definite integral

$$\int_0^{a/\sqrt{2}} \frac{1}{(a^2 - x^2)^{3/2}}\, dx.$$

Your answer should be expressed in terms of a.

ANSWER:

(b) Find the integral

$$\int \frac{1}{\sqrt{x^2+2x+10}}\,dx.$$

ANSWER:

4. (20 points)

(a) Evaluate the integral

$$\int \frac{2x^3 + 5x^2 + x}{x^3 + x^2 - x - 1}\, dx.$$

ANSWER:

(b) Find the integral

$$\int \sin^5 x \cos^2 x \, dx.$$

ANSWER:

5. (20 points)

A spring is attached to a wall. In its resting position, the end of the spring is 1 m away from the wall. It takes 16 J of work to pull the spring so that the end is 3 m away from the wall. If the spring is brought back to rest, how much work does it then take to pull its end to 6 m away from the wall?

ANSWER: