Name: _____

Student ID: _____

Section: _____

Instructor: _____

Math 113 (Calculus 2)
Exam 1
18-22 September 2009

Instructions:

1. Work on scratch paper will not be graded.
2. Should you have need for more space than is allotted to answer a question, use the back of the page the problem is on and indicate this fact.
3. Simplify your answers. Expressions such as $\ln(1)$, e^0, $\sin(\pi/2)$, etc. must be simplified for full credit.
4. Calculators are not allowed.

For Instructor use only.

#	Possible	Earned		#	Possible	Earned
M.C.	24			11	7	
9 a-d	24			12	7	
9 e-h	24			14	7	
10	7					
Sub	79			Sub	21	
				Total	100	

Multiple Choice (24 points). Fill in the answer to each problem on your scantron. Make sure your name, section and instructor is on your scantron.

Consider the region R between the curves $y = \sin x$ and the x-axis for $0 \leq x \leq \pi$.
For problems 1-4, choose the integral that gives the volume when the region R is rotated about:

1. the x-axis.
   (a) $\int_0^\pi \sin x \, dx$
   (b) $\pi \int_0^\pi \sin x \, dx$
   (c) $\int_0^\pi \sin^2 x \, dx$
   (d) $\pi \int_0^\pi \sin^2 x \, dx$
   (e) $2\pi \int_0^\pi \sin^2 x \, dx$
2. the y-axis.
   (a) $\int_0^\pi x \sin x \, dx$
   (b) $\pi \int_0^\pi x \sin x \, dx$
   (c) $2\pi \int_0^\pi x \sin x \, dx$
   (d) $\pi \int_0^\pi x \sin^2 x \, dx$
   (e) $2\pi \int_0^\pi x \sin^2 x \, dx$
3. the line $x = 4$
   (a) $2\pi \int_0^\pi (4 - x) \sin x \, dx$
   (b) $2\pi \int_0^\pi (x - 4) \sin x \, dx$
   (c) $\pi \int_0^\pi (4 - x) \sin x \, dx$
   (d) $\pi \int_0^\pi (x - 4) \sin x dx$
4. the line $y = -1$.
   (a) $\pi \int_0^\pi (\sin^2 x + 2 \sin x + 1) \, dx$
   (b) $\pi \int_0^\pi (\sin^2 x + 2 \sin x) \, dx$
   (c) $\pi \int_0^\pi (\sin^2 x - 2 \sin x + 1) \, dx$
   (d) $\pi \int_0^\pi (\sin^2 x - 2 \sin x)^2 \, dx$
5. The base of a solid is a disk in the $x - y$ plane with boundary curve $x^2 + y^2 = 1$. Cross-sections perpendicular to the x-axis are squares. Find the volume of the solid and round to the nearest integer.
   A. 0 B. 1 C. 2 D. 3 E. 4 F. 5 G. 6

6. The base of a solid is a disk in the $x - y$ plane with boundary curve $x^2 + y^2 = 1$. Cross-sections perpendicular to the x-axis are isosceles triangles with height equal to the base. Find the volume of the solid and round to the nearest integer.

A. 0 B. 1 C. 2 D. 3 E. 4 F. 5 G. 6

7. A heavy rope, 100 feet long, weighs 0.5 lb/ft hangs over the edge of a 120 ft high building. How many ft-lbs of work is required to pull half of the rope to the top of the building?

A. less than 1,500 B. between 1,500 and 1,800 C. between 1,800 and 2,100
D. between 2,100 and 2,400 E. more than 2,400

8. Evaluate the integral $\int_0^{\pi} t \sin t \, dt$.

A. 0 B. 1 C. 2 D. 3 E. π F. $\pi/2$ G. $\pi/3$

Short Answer. Fill in the blank with the appropriate answer. 6 points each. Only the answer will be graded. You need not show your work.

9. (48 points)

(a) If f is continuous and $\int_1^5 f(x)\,dx = 8$, then the Mean Value Theorem for Integrals promises that there a number c in $[1, 5]$ so that $f(c) =$ _____.

(b) The temperature between 6 AM and 12 Noon is given by the function $T(t) = 2t + 60$ where t is time and $6 \leq t \leq 12$. Find the average temperature. _____

(c) A force of 16 lbs is required to hold a spring that has been stretched from a natural length of 12 inches to 15 inches. How much work is done in stretching the spring from 15 inches to 18 inches? Give your answer in ft-lbs. _____

(d) Evaluate the integral $\int \ln x \, dx$. _____.

(e) Evaluate the integral $\int (\ln x)^2 \, dx$. _____.

(f) Evaluate the integral $\int x e^{-x} \, dx$. _____.

(g) Evaluate the integral $\int \sin^2 x \cos^3 x \, dx$. _____.

(h) Evaluate the integral $\int_0^{\pi} \cos^2 \theta \, d\theta$. _____.

Show your work for problems 10-13.

10. (7 points) Evaluate the integral $\int_0^{\pi} \sin^4 x \, dx$.

11. (7 points) Evaluate the integral $\int e^t \cos t \, dt$.

12. (7 points) A tank has the shape of an inverted circular cone with height 10 feet and radius 4 feet. It is filled to a height of 8 feet with oil that has density 60 lbs per cubic foot. Set up the integral to find the work needed to empty the tank by pumping all of the fluid to the top of the tank. DO NOT EVALUATE THE INTEGRAL!

13. (7 points) A bucket that weighs 4 pounds and a rope of negligible weight are used to draw water from a well that is 80 ft deep. The bucket is filled with 40 pounds of water and is lifted at constant speed, but water leaks out a hole in the bucket at a constant rate so that only 32 pounds of water are in the bucket at the top. Find the work done in pulling the bucket to the top of the well.