

d) For which value of C will the volume found in c) be equal to 1? (Please do not "simplify" your answer!)

C =

- (12) 2. a) Find $\int x^2 \sin(x^3) dx$. b) Find $\int x^3 \sin(x^2) dx$.
- (10) 3. Suppose n is a positive integer, and f is the function $f(x) = nx^{(n^2)}$. For example, if $n = 5, f(x) = 5x^{25}$.

a) What is the <u>largest value</u> of f on the unit interval, [0, 1]? Your answer will depend on n. What happens to this value as $n \to \infty$?

b) What is the <u>average value</u> of f on the unit interval, [0, 1]? Your answer will depend on n. What happens to this value as $n \to \infty$?

c) The asymptotic behavior of the answers to a) and b) are different as $n \to \infty$. Briefly explain why this is possible. You may refer to graphs of functions if that is helpful but give simple sketches to illustrate your explanation.

(15) 4. A right circular cone has vertex down and is 10 feet tall with base radius 5 feet. The cone is filled with a fluid having varying density. The density varies linearly with distance to the top. Here "varies linearly" means the quantities are related by an equation of at most degree 1. At the top of the cone, the density is 80 lbs/ft³, and at the bottom the density is 120 lbs/ft³. How much work in ft-lbs is needed to pump out all the fluid to the top of the cone? (Please do not "simplify" your answer!)

Oblique and sideways views of the cone are shown to the right.



1

(12) 5. Verify that
$$\int_0^1 \frac{1}{\sqrt{9x^2 + 16}} \, dx = \frac{1}{3} \ln 2.$$

(10) 6. Find
$$\int \frac{1+x+x^2}{x(x+1)^2} dx$$
.

(12) 7. Verify that
$$\int_0^{\pi/3} 3(\cos x)^2 - (\cos x)^3 dx = \frac{\pi}{2}$$
Hint Do them separately!

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(13) 8. Here
$$f(x) = \frac{1}{1+x^2}$$
.

a) Write the <u>Trapezoid Rule approximation</u> for $\int_{1}^{5} f(x) dx$ with n = 4 subintervals. No arithmetic needs to be done, *but* all function evaluations should be performed (therefore an expression like f(3) should not appear in the final answer).

b) Compute f''(x). Find some overestimate of |f''(x)| if x is in the interval [1,5]. (Please do not "simplify" your answer!)

Comment You are *not* asked for the "best possible" estimate. Get some number with some justification. Realize that $MAX(\frac{TOP}{BOTTOM}) \leq \frac{MAX(TOP)}{MIN(BOTTOM)}$.

c) The true value (to 5 decimal places) of $\int_{1}^{5} f(x) dx$ is .58800. Find N so that the <u>Trapezoid Rule approximation</u> for the integral is within .001 of the true value. (Please do *not* "simplify" your answer!)

First Exam for Math 152H

October 8, 2009

NAME _____

Do all problems, in any order. Show your work. An answer alone may not receive full credit.

> No texts, notes, or calculators other than the formula sheet may be used on this exam.

Problem Number	Possible Points	Points Earned:
1	16	
2	12	
3	10	
4	15	
5	12	
6	10	
7	12	
8	13	
Total Points Earned:		

Find exact values of standard functions such as e^0 and $\sin(\frac{\pi}{2})$. Otherwise do NOT "simplify" your numerical answers!