CALCULUS I (1021)

Final Exam

Department of Computer Science and Engineering
National Sun Yat-sen University

January 15, 2014, 13:20 $\sim$ 15:30

NAME: _____ Student ID No.: _____

Instructor: _____

General instructions:

1. Do not open this exam until you are told to begin.
2. This exam has 7 pages including this cover. There are 5 questions.
3. Do not separate the pages of the exam. If any pages do become separated, write your name on them and point them out to your instructor when you turn in the exam.
4. Please read the instructions for each individual problem carefully. One of the skills being tested on this exam is your ability to interpret questions, so instructors will not answer questions about exam problems during the exam.
5. Show an appropriate amount of work for each problem so that the graders can see not only the answer but also how you obtained it. Include units in your answers where appropriate.
6. No calculator is allowed.
7. Do NOT use pencils but black or blue ball pens for your answers.
8. If you use graphs or tables to obtain an answer, be certain to provide an explanation and sketch of the graph to show how you arrived at your solution.
9. Please turn off all cell phones and pagers and remove all headphones.

Problem	1	2	3	4	5	**Total**
Points	40	20	15	10	15	100
Score						

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Some useful trigonometric identities

1. $\sin^2 x = \dfrac{1 - \cos 2x}{2}$
2. $\cos^2 x = \dfrac{1 + \cos 2x}{2}$
3. $\sin u \sin v = \dfrac{1}{2}[\cos(u - v) - \cos(u + v)]$
4. $\cos u \cos v = \dfrac{1}{2}[\cos(u - v) + \cos(u + v)]$
5. $\sin u \cos v = \dfrac{1}{2}[\sin(u + v) + \sin(u - v)]$
6. $\cos u \sin v = \dfrac{1}{2}[\sin(u + v) - \sin(u - v)]$

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1. (40%) Short answer. (4% for each, NO PARTIAL CREDIT!) Mark your answer as "diverge" if the improper integral is either ∞ or $-\infty$.

(1) Find the integral $\int \frac{2x^3 - 5x^2 + 4x - 4}{x^2 - x}\, dx =$ _____ .

(2) Find the integral $\int_1^0 x(x^2+1)^3\, dx =$ _____ .

(3) Evaluate the integral $\int_{-1}^2 \frac{1}{x^3}\, dx =$ _____ .

(4) Evaluate the integral $\int \frac{e^{2x} + 2e^x + 1}{e^x}\, dx =$ _____ .

(5) Evaluate the integral $\int_0^1 \frac{x}{1+e^{x^2}}\, dx =$ _____ .

(6) Find the integral $\int \frac{4x}{e^x}\, dx =$ _____ .

(7) Evaluate the integral $\int_0^4 x\sqrt{4-x}\, dx =$ _____ .

(8) Find the integral $\int_0^3 xe^{x/2}\, dx =$ _____ .

(9) $F(x) = \int_0^x t\cos t\ dt\ , F'(x) =$ _____ .

(10) Evaluate the integral $\int \sec(2-x)\tan(2-x)\, dx =$ _____ .

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2. (20%) Evaluate the integrals of the following problems. (5% for each)

(1) $\int_0^\infty xe^{-x/4}\,dx =$ _____ .

(2) $\int \dfrac{4x-2}{3(x-1)^2}\,dx =$ _____ .

(3) $\int e^{2x}\sin x\,dx =$ _____ .

(4) $\int \tan x\,dx =$ _____ .

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3. (15%) Fine the area of the surface generated by revolving the curve:

$y = \dfrac{x^3}{6} + \dfrac{1}{2x}$, $1 \leq x \leq 2$, about the x-axis.

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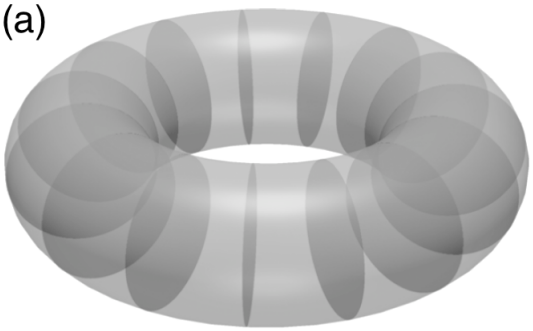
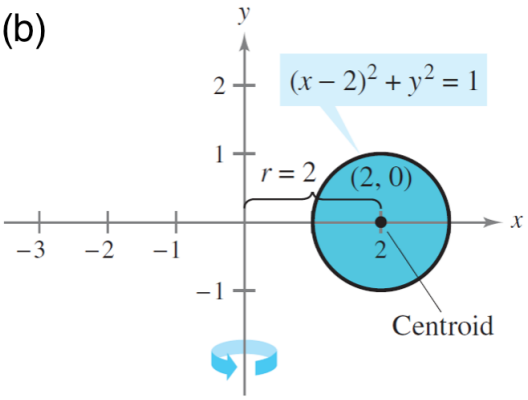
4. (10%) Find the volume of the torus shown in Figure (a), which was formed by revolving the circular region bounded by $(x-2)^2+y^2=1$ about the y-axis, as shown in Figure (b). [hint: let $(x-2)=\sin\theta$]

(a)



Torus

(b)



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5. (15%) Solve the differential equation: $(1 + x^2)y' - 2xy = 0$.

(End of this exam!)
Have a nice vacation!