CALCULUS - *for Computer Science and Engineering*

FINAL EXAM

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

January 14, 2009, 13:15~ 16:00

NAME: _____ Student ID Nr.: _____

Signature: _____ Instructor: _____

General Instructions:

1. Do not open this exam until you are told to begin.
2. This exam has 6 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 exercise 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 exercise so that the graders can see not only the answer but also how you obtained it. Include units in your answers where appropriate.
6. You may use your calculator.
7. 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.
8. Please turn off all cell phones and pagers and remove all headphones.

Problem	1	2	3	4	5	Total
Points	36	10	20	20	15	101
Score						

1. Circle True or False for each of the following problems. Circle 'True' only if the statement is always true. No explanation is necessary.

Part I: (2% for each)

True **False** (a) $\log(10^n) = n$

True **False** (b) if $7.32 = e^t$, then $t = \dfrac{7.32}{e}$

True **False** (c) $\ln(A/B) = \ln(A) + \ln(B^{-1})$

True **False** (d) $x^{10000000}$ will eventually become much larger than $e^{0.00000001x}$.

True **False** (e) The polynomial $p(x) = (x-2)^2(x-5)^4 + 2$ has two roots, a double root at x=2 and a quadruple root at x=5.

True **False** (f) Every rational function has a vertical asymptote.

True **False** (g) The function $r(x) = 3x^5 + 2x^3 + 7x + 13$ is a rational function.

True **False** (h) If $f(x) = \ln(x)$ then $f^{-1}(x) = \dfrac{1}{\ln(x)}$.

Part II: (4% for each)

True **False** (a) Suppose that f is differentiable and $f(2) = f(6)$. Then there must be at least one point $c \in (2,6)$ with $f'(c)=0$.

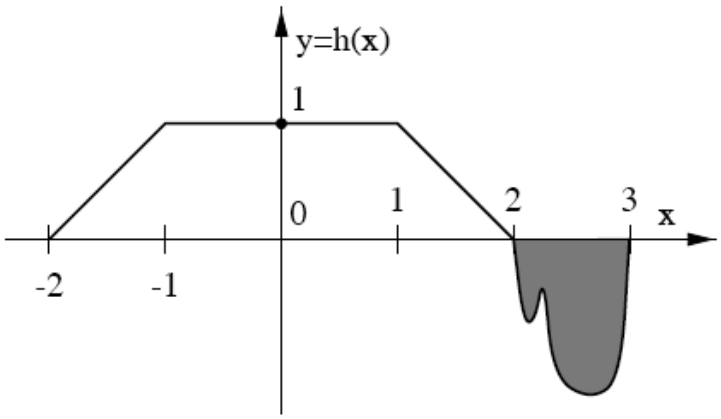
True **False** (b) Suppose that g is continuous, $g(1)=5$ and $g(5)=10$. Then the equation $g(c)=7$ must have a solution $c \in (1,5)$.

True **False** (c) If $f(x) > x$ for all x, then $\int_0^{10} f(x)dx > 5$.

True **False** (d) If $f'(x) = g'(x)$ then $f(x) = g(x)$.

True **False** (e) $\int_a^b f(x)g(x)dx = \left(\int_a^b f(x)dx\right)\left(\int_a^b g(x)dx\right)$ for any f and g.

2. (10%) Let h(x) be the function graphed below, and suppose that the shaded region has area equal to 1. Find the average value of h(x) over the interval $-2 \le x \le 3$.



ANS-- The Average Value is: _____

3. (4% for each) Compute:

(a) $\lim_{x\to\infty} \frac{x\sin(x)}{\cos(x)-1}$ = _____

(b) $\int_0^{\frac{\pi}{3}} \sin(x)dx$ = _____

(c) $\frac{d}{dx}\sin(e^x)$ = _____

(d) $\int (x^2+3x+5)dx$ = _____

(e) $\lim_{x\to\infty} \frac{3x-e^x}{8x^2+\ln x}$ = _____

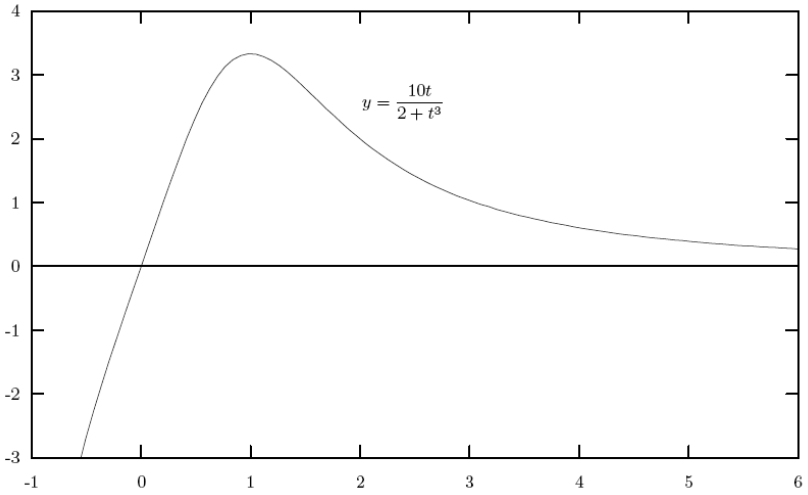
4. (5% for each) Radioactive isotopes are often characterized by their half-life. Fill each of the four blanks (i)–(iv) in the table below. Carefully show step-by-step algebra that justifies your answers to (i) and (iii), as indicated.

ISOTOPE	Half-Life (year)	Initial Amount (gram)	Amount after 1000 years (gram)	Amount after 10000 years (gram)
C^{14}	5730	3	(i) _____	(ii) _____
Ra^{226}	1620	(iii) _____	(iv) _____	0.4

Step-by-step algebra leading to your answer on (i):

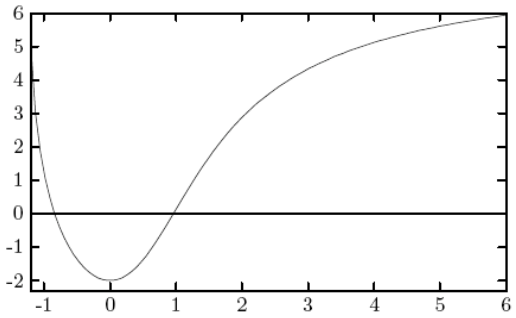
Step-by-step algebra leading to your answer on (iii):

5. (15%) Let A be the function defined by $A(x) = \int_1^x \frac{10t}{2+t^3} dt$ for $t \geq -\sqrt[3]{2}$.
This sketch might be helpful:

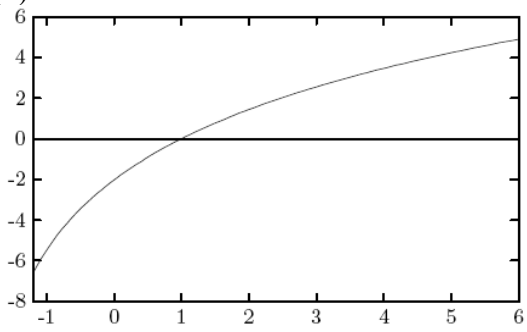


Which of the following is the graph of $y = A(x)$? **ANS:** _____

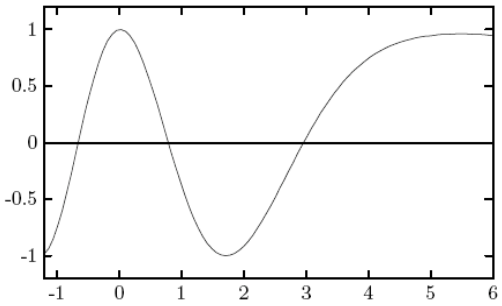
(a)



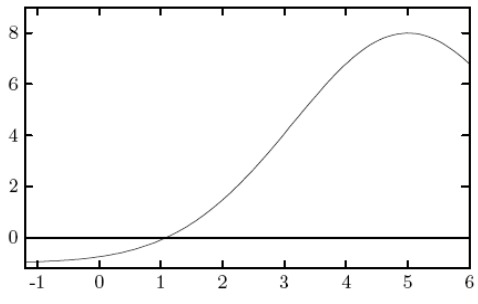
(b)



(c)



(d)



(End of this exam.)