MATH 180 – Spring 2014

Final Exam

Thursday, May 8, 2014

Name (print) _____ **UIC ID** _____

By providing my signature, I pledge to abide by the University's rules concerning *academic honesty*. This includes but is not limited to using unauthorized materials (cell phones, notes, books, calculators, etc.) or receiving/giving aid from/to another person.

Signature _____

Circle your instructor:

Cabrera Dai Dumas Kobotis

London Pantic Shulman Sward

Circle your discussion section time:

8AM 9AM 10AM 11AM 12PM 1PM 2PM 3PM

(1) *Write* your name, UIC ID, and signature in the spaces provided.
(2) *Circle* your instructor's name and your discussion section time.
(3) There are **16** problems on this examination. Check to see that this copy is complete.
(4) All electronic devices are prohibited including calculators, cell phones, etc.
(5) *Show* your work. Answers without justification will receive little to no credit.

Do not write in this area.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
10	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**20**	**20**	**20**	**20**

SCORE _____ /**200**

(10 pts) **1.** Compute $\lim_{x \to +\infty} \sqrt{\frac{4x^3 - 10x}{x^3 + 2}}$ or explain why it does not exist. Justify your answer using calculus.

(10 pts) **2.** Compute $\lim_{x \to \pi} \frac{\sin x}{(x - \pi)^2}$ or explain why it does not exist.

(10 pts) **3.** Find $\frac{d}{dx}(\tan(\cos x))$. Do not simplify your answer.

(10 pts) **4.** Use implicit differentiation to find $\frac{dy}{dx}$ if $2xy + 3y^2 = 4\ln x$.

(10 pts) **5.** Find $\dfrac{d}{dx}\left(\dfrac{\sin^{-1}(e^x)}{x^2}\right)$. Do not simplify your answer.

(10 pts) **6.** Let $f(x) = |\sin x|$. Using the definition of the derivative (i.e. the limit of a difference quotient), find $f'(0)$ or show that it does not exist.

(10 pts) **7.** Compute $\int \frac{e^t}{1+e^{2t}}\,dt$.

(10 pts) **8.** Compute $\int \frac{x^2+1}{\sqrt{x^3+3x}}\,dx$.

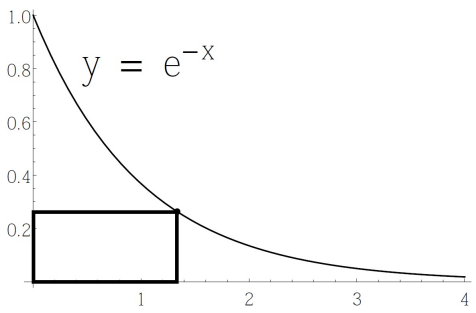
(10 pts) **9.** Compute $\int_1^3 2^x \, dx$. Write your answer as a single fraction.

(10 pts) **10.** Compute $\int_0^1 (x^3+1)^2 \, dx$. Write your answer as a single fraction.

(10 pts) **11.** Compute $\int_0^{\pi/12} 2\sec^2(3\theta)\ d\theta$. Write your answer as a single fraction.

(10 pts) **12.** Let $F(x) = \int_{\ln x}^{0} t^2 \cos t\ dt$. Find $F'(x)$.

(20 pts) **13.** A rectangle is to be formed with its lower left corner at the origin and upper right corner on the curve $y = e^{-x}$ as in the figure below. Find the maximum area of such a rectangle.



(20 pts) **14.** A certain disease has been infecting a community where the number of people P infected after t days since the beginning of the infection is modeled by

$$P(t) = 3000\left(1 + (t-1)e^{-t/10}\right).$$

(a) How many days after the beginning of the infection is the maximum number of people infected?

(b) Compute $\lim_{t\to+\infty} P(t)$. If the infection continues to follow this model, will the community ever rid itself of the disease? Explain your answer.

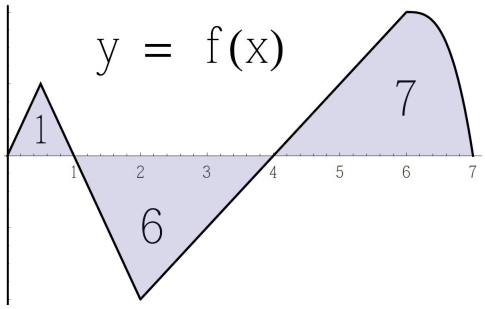
(20 pts) **15.** Consider the function $f(x) = \frac{14}{3}x^3 - 7x^2 - 28x - \frac{1}{3}$.

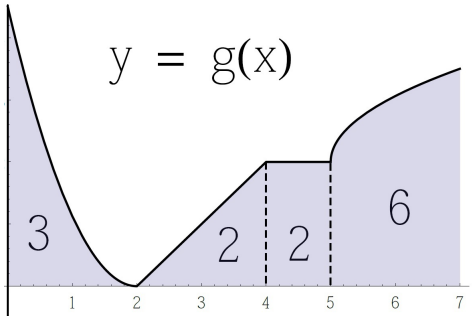
(a) Find the intervals where f is increasing and those where f is decreasing.

(b) Classify all critical points of f as local minima, local maxima, or neither.

(c) Find the intervals where f is concave up and those where f is concave down.

(20 pts) **16.** The graphs below represent two functions, $f(x)$ and $g(x)$, and the values inside the enclosed portions represent the area of that portion. Use the two graphs to answer the questions below.

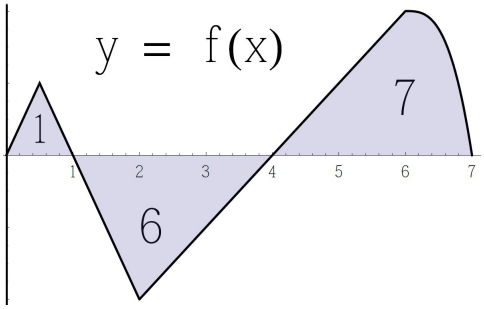


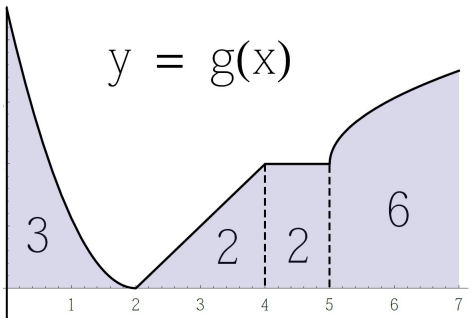


(a) Compute $\int_0^4 (2f(x) + 3g(x))\ dx$.

(b) Compute $\int_7^4 f(x)\ dx$.

Here are the two graphs again.





(c) Compute $\int_0^7 (|f(x)| + x)\ dx$, where $|f(x)|$ denotes the absolute value of f.