Math 1351-008 | Exam III-B | April 6, 2007

Make Up (S-Z)

Answer the problems on **separate** paper. You do <u>not</u> need to rewrite the problem statements on your answer sheets. Do your own work. Show **all relevant steps** which lead to your solutions. Attach this question sheet to the front of your answer sheets.

1. Consider the function $c(t) = \dfrac{0.12t}{t^2+t+2}$. This function models the concentration of a drug in the blood stream t hours after injection of the drug.

   a. (9 pts) Construct a linearization for the function at $t = 4$.
   b. (3 pts) Use the linearization constructed in step a. to estimate the change in concentration over the time period from 4 hours after injection to 5 hours after injection.

2. (15 pts) Using calculus, find the absolute maximum and absolute minimum values of $f(x) = 3x^4 + 4x^3 - 36x^2 + 70$ on the interval [-4,1].

3. (45 pts) Consider the function f given below. (Its derivatives f' and f'' are denoted by *fp* and *fpp*, resp.) Find and identify each of the following (if they exist) – *show your work on your answer sheets, but record your solutions to parts a. through m. on the back of this page*.

   a. domain of f
   b. intercepts of f
   c. vertical asymptotes to the graph of f
   d. horizontal asymptotes to the graph of f
   e. critical numbers of f
   f. intervals on which the graph of f is increasing
   g. intervals on which the graph of f is decreasing
   h. local maximum points of the graph of f
   i. local minimum points of the graph of f
   j. 2nd order critical numbers of f
   k. intervals on which the graph of f is concave up
   l. intervals on which the graph of f is concave down
   m. inflection points of the graph of f

$$f := \frac{(2x-8)^2}{(x+4)^2} - 1$$

$$fp := \frac{64(x-4)}{(x+4)^3}$$

$$fpp := -\frac{128(x-8)}{(x+4)^4}$$

   Then, incorporate all of the above information into a sketch the graph of f.

4. (30 pts) Using algebraic/calculus techniques, find the following limits (if they exist):

   a. $\displaystyle\lim_{x\to\infty} \frac{x^3 + 2\sqrt{x} - 1}{3x^3 - 4x + 1}$ b. $\displaystyle\lim_{x\to 0} \frac{x \sin x}{1 - \cos x}$ c. $\displaystyle\lim_{x\to 0} \frac{2x + \sin x}{2x - \cos x}$

   d. $\displaystyle\lim_{x\to\infty} x^2 e^{-x}$ e. $\displaystyle\lim_{x\to\infty} (x+1)^{1/(x+1)}$

Extra Credit: Using the rules developed in class for differentiation, correctly derive the formulas given in Problem 3 for f' and f'' (2 pts and 3 pts, resp.).

Solution Space for Problem 3

	Problem Statement	Problem Solution
a	domain of f	
b	intercepts of f	
c	vertical asymptotes to the graph of f	
d	horizontal asymptotes to the graph of f	
e	critical numbers of f	
f	intervals on which the graph of f is increasing	
g	intervals on which the graph of f is decreasing	
h	local maximum points of the graph of f	
i	local minimum points of the graph of f	
j	2^{nd} order critical numbers of f	
k	intervals on which the graph of f is concave up	
l	intervals on which the graph of f is concave down	
m	inflection points of the graph of f	