MATH 1271 Spring 2014, Midterm #1
Handout date: Thursday 27 February 2014
Instructor: Scot Adams

PRINT YOUR NAME:

PRINT YOUR X.500 ID:

PRINT YOUR TA'S NAME:

WHAT RECITATION SECTION ARE YOU IN?

Closed book, closed notes, no calculators/PDAs; no reference materials of any kind. Turn off all handheld devices, including cell phones.

Show work; a correct answer, by itself, may be insufficient for credit. Arithmetic need not be simplified, unless the problem requests it.

I. Multiple choice

A. (5 pts) (no partial credit) Which is the intuitive definition of $\lim_{x \to -\infty} (f(x)) = \infty$? Circle one of the following answers:

(a) If $f(x)$ is very positive, then x is very negative.

(b) If $f(x)$ is very negative, then x is very positive.

(c) If x is very positive, then $f(x)$ is very negative.

(d) If x is very negative, then $f(x)$ is very positive.

(e) NONE OF THE ABOVE

B. (5 pts) (no partial credit) Compute $\left[\dfrac{d}{dx}\right] \left[\dfrac{e^x}{x^4 - 8x}\right]$. Circle one of the following answers:

(a) $\dfrac{(x^4 - 8x)(e^x) - (e^x)(4x^3 - 8)}{(x^4 - 8x)^2}$

(b) $\dfrac{(e^x)(4x^3 - 8) - (x^4 - 8x)(e^x)}{(x^4 - 8x)^2}$

(c) $\dfrac{e^x}{4x^3 - 8}$

(d) $\dfrac{xe^{x-1}}{4x^3 - 8}$

(e) NONE OF THE ABOVE

C. (5 pts) (no partial credit) Compute $\triangle(x^3 - x^2)$. Circle one of the following answers:

(a) $3x^2 - 2x$

(b) $3x^2(\triangle x) + 3x(\triangle x)^2 + (\triangle x)^3 - 2x(\triangle x) - (\triangle x)^2$

(c) $3x^2 + 3x(\triangle x) + (\triangle x)^2 - 2x - (\triangle x)$

(d) $(3x^2 - 2x)(\triangle x)$

(e) NONE OF THE ABOVE

D. (5 pts) (no partial credit) Compute $[d/dx][2e^3 + 5\sin x]$. Circle one of the following answers:

    (a) $6e^2 + 5\cos x$

    (b) $6e^3 + 5\cos x$

    (c) $5\cos x$

    (d) $-5\cos x$

    (e) NONE OF THE ABOVE

E. (5 pts) (no partial credit) Let $g(x) = [8 - 3x]\left[\dfrac{x-5}{x-5}\right]$. What is the largest $\delta > 0$ such that $0 < |x - 5| < \delta \quad \Rightarrow \quad |(g(x)) + 7| < 0.6$? Circle one of the following answers:

    (a) 0.3

    (b) -0.3

    (c) 1.8

    (d) -0.2

    (e) NONE OF THE ABOVE

F. (5 pts) (no partial credit) Let $f(t) = \cot^2 t$. Compute $f'(\pi/4)$.
(Hint: $f(t) = (\cot t)(\cot t)$.) Circle one of the following answers:

    (a) $-\sqrt{2}/2$

    (b) -4

    (c) -1

    (d) 1

    (e) NONE OF THE ABOVE

II. True or false (no partial credit):

a. (5 pts) Let f and g be any two functions such that $f'(4) = 10$ and $g'(5) = 20$. Then $(f + g)'(9) = 30$.

b. (5 pts) $\dfrac{d}{dx}\left[\dfrac{\sin x}{x^2}\right] = \dfrac{\cos x}{2x}$.

c. (5 pts) $\lim\limits_{x \to 0} \dfrac{1 - \cos x}{x} = 1$.

d. (5 pts) If P is any polynomial of degree 3 and Q is any polynomial of degree 4, then $\lim\limits_{x \to -\infty}\left[\dfrac{P(x)}{Q(x)}\right] = 0$.

e. (5 pts) If f and g are both differentiable at 3, then $f^2 - fg$ is also differentiable at 3.

III. Computations. Show work. Unless otherwise specified, answers must be exactly correct, but can be left in any form easily calculated on a standard calculator.

1. (10 pts) Compute $\dfrac{d}{dx}\left[\dfrac{(2x^2 - 8x)(\sec x)}{5 - e^x}\right]$.

2. (10 pts) Compute $\displaystyle\lim_{x \to 0} \left[\frac{(\sin(2x))(\cos(3x))(3x^5 - 2x^4 - 4x^2)}{(\sec(4x))(\tan^3 x)} \right]$.

3. Let $f(x) = 3x^5 - 5x^3 + e^7$.

a. (5 pts) Find all $a \in \mathbb{R}$ such that the graph of f has a horizontal tangent line at $(a, f(a))$.

b. (5 pts) Find all the maximal intervals on which f' is negative.

4. Let $y = x^3 + 2x$. Then $\triangle y = ax^2(\triangle x) + bx(\triangle x)^2 + c(\triangle x)^3 + k(\triangle x)$, for some real numbers a, b, c, k.

a. (5 pts) Compute a, b, c and k.

b. (5 pts) Assuming $\triangle x \neq 0$, compute $\dfrac{\triangle y}{\triangle x}$.

c. (5 pts) Compute $\displaystyle \lim_{\triangle x \to 0} \frac{\triangle y}{\triangle x}$.