MATH 1271 Spring 2012, Midterm #2 Handout date: Thursday 29 March 2012

PRINT YOUR NAME:

Solutions Version D

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 understand the above, and I understand that cheating has severe consequences, from a failing grade to expulsion.

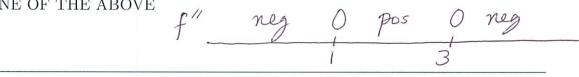
SIGN YOUR NAME:

I. Multiple choice

$$-(x^{2}-4x+3)=-(x-1)(x-3)$$

A. (5 pts) (no partial credit) Suppose $f''(x) = -x^2 + 4x - 3$. At most one of the following statements is true. If one is, circle it. Otherwise, circle "NONE OF THE ABOVE".

- (a) f is concave up on $(-\infty, -3]$, down on [-3, -1] and up on $[-1, \infty)$.
- (b) f is concave up on $(-\infty, 1]$, down on [1, 3] and up on $[3, \infty)$.
- (c)) f is concave down on $(-\infty, 1]$, up on [1, 3] and down on $[3, \infty)$.
- (d) f is concave down on $(-\infty, -3]$, up on [-3, -1] and down on $[-1, \infty)$.
- (e) NONE OF THE ABOVE



B. (5 pts) (no partial credit) Find the logarithmic derivative of $(2 + x^4)^{\cos x}$ w.r.t. x. (a)) $(-\sin x)(\ln(2+x^4)) + (\cos x)(4x^3/(2+x^4))$ (b) $(\cos x)(\ln(2+x^4))$ $\frac{d}{dx}\left(\cos x\right)\left(\ln\left(2+\chi^{2}\right)\right)$ (c) $(-\sin x)(4x^3/(2+x^4))$ (d) $(\cos x)(\ln(2+x^4)) + (-\sin x)(4x^3/(2+x^4))$ (e) NONE OF THE ABOVE

C. (5 pts) (no partial credit) Find the derivative of $(2 + x^4)^{\cos x}$ w.r.t. x.

$$(a)[(2+x^4)^{\cos x}][(-\sin x)(\ln(2+x^4)) + (\cos x)(4x^3/(2+x^4))]$$

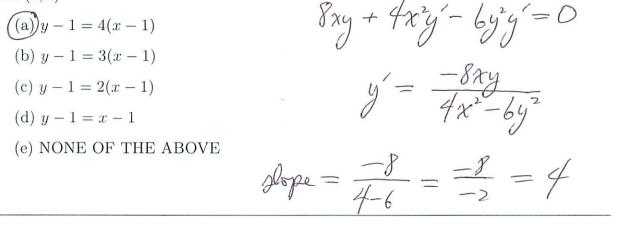
- (b) $[(2+x^4)^{\cos x}][(\cos x)(\ln(2+x^4))]$
- (c) $[(2+x^4)^{\cos x}][(-\sin x)(4x^3/(2+x^4))]$
- (d) $[(2+x^4)^{\cos x}][(\cos x)(\ln(2+x^4)) + (-\sin x)(4x^3/(2+x^4))]$
- (e) NONE OF THE ABOVE

D. (5 pts) (no partial credit) Find the logarithmic derivative of $x^2 + 7x - 8$ w.r.t. x.

(a)
$$\frac{x^2 + 7x - 8}{2x + 7}$$

(b) $\frac{2x + 7}{x^2 + 7x - 8}$
(c) $\ln(2x + 7)$
(d) $(\ln(x^2)) + 7(\ln x) - (\ln 8)$
(e) NONE OF THE ABOVE

E. (5 pts) (no partial credit) Find an equation of the tangent line to $4x^2y - 2y^3 = 2$ at the point (1, 1).



F. (5 pts) (no partial credit) Compute $[d/dx][\sin(\cos(e^x + 3))]$.

- (a) $\cos(\cos(e^x + 3))$ (b) 0 $\left[\cos\left(\cos\left(e^x + 3\right)\right)\right] \left[-\sin\left(e^x + 3\right)\right] \left[e^x\right]$
- (c) $[\cos(\cos(e^x + 3))][\cos(e^x + 3)][e^x + 3]$
- (d) $[\cos(\cos(e^x + 3))][-\sin(e^x + 3)][e^x + 3]$
- (e) NONE OF THE ABOVE

II. True or false (no partial credit):

a. (5 pts) If f is increasing on an interval I, then f' > 0 on I.

b. (5 pts) Assume that $\lim_{x \to a} [f(x)] = 0 = \lim_{x \to a} [g(x)]$. Assume also that $\lim_{x \to a} \frac{f'(x)}{g'(x)} = -\infty$. Then $\lim_{x \to a} \frac{f(x)}{g(x)} = -\infty$.

F

c. (5 pts) Every global minimum of a function $f : \mathbb{R} \to \mathbb{R}$ occurs at a critical number for f.

d. (5 pts) If f'(7) = 0 and f''(7) > 0, then f has a local maximum at 7.

e. (5 pts) If two functions have the same derivative, then they are equal.

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VERSION D

I. A, B, C

I. D, E, F

II. a,b,c,d,e

III. 1ab.

III. 2.

III. 3,4.

III. 5.

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. a. (5 pts) Compute
$$\frac{d}{dx} \left[\frac{2x^3 - 8}{7 + (\arctan(2x))} \right].$$

$$(1)$$

$$\left[7 + (\arctan(2x)) \right] \left[6x^2 \right] - \left[2x^3 - 8 \right] \left[\frac{1}{1 + (2x)^2} \right] \left[2 \right]$$

$$\left[7 + (\arctan(2x)) \right]^2$$

b. (5 pts) Compute
$$\frac{d}{dx} [(4 - \sin x)^x]$$
.

$$\frac{d}{dx} \left[\frac{d}{dx} \left[\chi \left(\ln \left(4 - \sin x \right) \right) \right] \right]$$

 $\left[\frac{4-\sin x}{4-\sin x}\right]\left(\ln \left(4-\sin x\right)+x\left(\frac{-\cos x}{4-\sin x}\right)\right]$

2. (10 pts) Using implicit differentiation, find y' = dy/dx, assuming that $(x - y^2)^5 = x$.

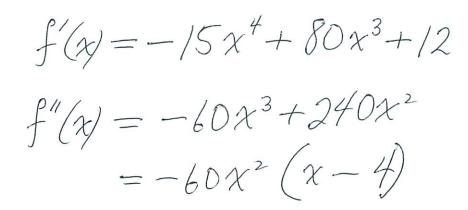
 $\left[5(x-y^{2})^{4}\right]\left[1-2yy^{2}\right] = 1$ $\int 5(x-y^2)^{47} - \int 10y(x-y^2)^{47}y' = 1$

 $y' = \frac{1 - 5(x - y^2)^4}{-10y(x - y^2)^4}$

3. (5 pts) Let $f(x) = 7x + x^5$. Then f is a one-to-one function. Let $g := f^{-1}$. Then f(1) = 8, so g(8) = 1. Compute g'(8).

$$g'(8) = \frac{1}{f'(1)} = \frac{1}{[7+5x^4]_{\chi;\to 1}} = \frac{1}{12}$$

4. (10 pts) Find the maximal intervals of concavity for $f(x) = -3x^5 + 20x^4 + 12x - 7$. For each interval, state clearly whether f is concave up or concave down on that interval.





f is concave up on (-a, 4] f is concave down on [4, a)

5. (10 pts) Compute $\lim_{x \to 1} \left[\frac{\ln x}{\cos(\pi x/2)} \right]$. 0 1/ 2'H $\lim_{\chi \to 1} \frac{1/\chi}{\left[-\sin\left(\frac{\pi \chi/2}{2}\right)\right] \left[\frac{\pi}{2}\right]}$ |1 1/1 $\left[-\sin\left(\frac{\pi}{2}\right)\right]\left[\frac{\pi}{2}\right]$ 11 $\begin{bmatrix} -1 \end{bmatrix} \begin{bmatrix} \pi/2 \end{bmatrix}$ 11 $-\frac{2}{\pi}$