PRINT YOUR NAME:

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

A. (5 pts) (no partial credit) Find the logarithmic derivative of \((2 + \sin(2x))^{\cos x}\) w.r.t. \(x\). Circle one of the following answers:

(a) \((-\sin x) \left( \frac{2 \cos(2x)}{2 + \sin(2x)} \right)\)

(b) \((\cos x)(\ln(2 + \sin(2x))) + (-\sin x) \left( \frac{2 \cos(2x)}{2 + \sin(2x)} \right)\)

(c) \((\cos x)(\ln(2 + \sin(2x)))\)

(d) \((-\sin x)(\ln(2 + \sin(2x))) + (\cos x) \left( \frac{2 \cos(2x)}{2 + \sin(2x)} \right)\)

(e) NONE OF THE ABOVE

B. (5 pts) (no partial credit) Find the derivative of \((2 + \sin(2x))^{\cos x}\) w.r.t. \(x\). Circle one of the following answers:

(a) \([ (2 + \sin(2x))^{\cos x} ]\left[ (-\sin x) \left( \frac{2 \cos(2x)}{2 + \sin(2x)} \right) \right] \)

(b) \([ (2 + \sin(2x))^{\cos x} ]\left[ (\cos x)(\ln(2 + \sin(2x))) + (-\sin x) \left( \frac{2 \cos(2x)}{2 + \sin(2x)} \right) \right] \)

(c) \([ (2 + \sin(2x))^{\cos x} ](\cos x)(\ln(2 + \sin(2x)))\)

(d) \([ (2 + \sin(2x))^{\cos x} ]\left[ (-\sin x)(\ln(2 + \sin(2x))) + (\cos x) \left( \frac{2 \cos(2x)}{2 + \sin(2x)} \right) \right] \)

(e) NONE OF THE ABOVE

C. (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 down on \((-\infty, 1]\), up on \([1, 3]\) and down on \([3, \infty)\).

(b) \(f\) is concave up on \((-\infty, 1]\), down on \([1, 3]\) and up on \([3, \infty)\).

(c) \(f\) is concave down on \((-\infty, -3]\), up on \([-3, -1]\) and down on \([-1, \infty)\).

(d) \(f\) is concave up on \((-\infty, -3]\), down on \([-3, -1]\) and up on \([-1, \infty)\).

(e) NONE OF THE ABOVE
D. (5 pts) (no partial credit) Suppose \( f'(x) = (x - 1)^2(x - 2)(x - 3)^2 \). Which of the following is a maximal interval of increase for \( f \)? Circle one of the following answers:

(a) \((-\infty, 1]\)
(b) \([1, \infty)\)
(c) \((2, \infty)\)
(d) \([2, \infty)\)
(e) NONE OF THE ABOVE

E. (5 pts) (no partial credit) Compute \( \frac{d}{dx}[\sin^2(xy)] \). Circle one of the following answers:

(a) \(2[\sin(xy)][\cos(xy)]\)
(b) \(\cos^2(xy)[y + xy']\)
(c) \(2[\sin(xy)][y + xy']\)
(d) \(2[\sin(xy)][\cos(y + xy')]\)
(e) NONE OF THE ABOVE

F. (5 pts) (no partial credit) Compute the derivative of \( \ln(x^{\arctan x}) \), with respect to \( x \), on the interval \( x > 0 \). Circle one of the following answers:

(a) \(\frac{1}{x^{\arctan x}}\)
(b) \(\frac{\ln x}{1 + x^2} + \frac{\arctan x}{x}\)
(c) \(\frac{1}{x^{\sec^2 x}}\)
(d) \(x^{\sec^2 x}\)
(e) NONE OF THE ABOVE
II. True or false (no partial credit):

a. (5 pts) If $f$ and $g$ are differentiable at a number $a$, then $fg + f + g$ is differentiable at $a$.

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

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

d. (5 pts) Assume that $\lim_{x \to 3} [f(x)] = 0 = \lim_{x \to 3} [g(x)]$. Assume also that $\lim_{x \to 3} \frac{f'(x)}{g'(x)} = 7$. Then $\lim_{x \to 3} \frac{f(x)}{g(x)} = 7$.

e. (5 pts) Assume that $\lim_{x \to 0} [f(x)] = 0 = \lim_{x \to 0} [g(x)]$. Assume also that $\lim_{x \to 0} \left[ \frac{f'(x)}{g'(x)} \right]$ does not exist. Then $\lim_{x \to 0} \left[ \frac{f(x)}{g(x)} \right]$ does not exist.

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PLEASE DO NOT WRITE BELOW THE LINE

VERSION A
I. A,B,C
I. D,E,F
II. a,b,c,d,e
III. 1,2.
III. 3.
III. 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. (5 pts) Compute \( \frac{d}{dx} \left[ \frac{e^{x^4} - 8}{5 + \sec(x^2)} \right] \). (Here \( e^{x^4} \) means \( e^{(x^4)} \).)

2. (5 pts) Compute \( \frac{d}{dx} \left[ (5 - \sin x)^{7 \arctan x} \right] \).
3. (10 pts) Find an equation for the tangent line to \( x^3 + xy + y^3 = 11 \) at (2,1).
4. (15 pts) Compute \( \lim_{x \to 0} ((\cos x) + (\sin x))^{5/x} \).
5. (10 pts) Find the global maximum and minimum value of $f(x) = x^3 - 3x^2 + 3x + 4$ on the interval $0 \leq x \leq 2$. 