



University of California, San Diego
Department of Mathematics

Name: _____ PID: _____

1. Write your *NAME* on every page and your *PID* in the space provided above.
 2. No calculators, tablets, phones, or other electronic devices are allowed during this exam.
 3. You may use one page of handwritten notes, but no books or other assistance during this exam.
 4. Write your solutions clearly in the spaces provided.
 5. Show all of your work; no credit will be given for unsupported answers.
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Question Zero:

- (1 points) 0. Carefully read and complete the instructions at the top of this exam sheet and any additional instructions written on the chalkboard during the exam.

NAME: _____

(8 points) 1. Compute the limit or show that it does not exist:

$$\lim_{x \rightarrow 0} \frac{\cos(2x) - \cos(3x)}{x^2}$$

NAME: _____

(7 points) 2. Suppose that f is a positive differentiable function such that $f(0) = 2$ and $f'(0) = 1$. Let

$$h(x) = \sin [2x + \ln(f(x))].$$

Compute $h'(0)$.

NAME: _____

- (8 points) 3. Find the values of x that are critical points for the given function and indicate whether each of those x values belongs to a local maximum, a local minimum, or neither of those:

$$f(x) = 3x^{2/3} + x + 2$$

NAME: _____

(8 points) 4. Find the slope of the tangent line at the point $(-1, 1)$ for the curve given by the equation

$$\arctan(x + y) = 3xy + 3$$

NAME: _____

- (8 points) 5. Suppose that f is a function which is continuous at all real numbers x , and suppose that the **second derivative** of f is

$$f''(x) = x^2(x^2 + 2x - 3)g(x),$$

where g is an unspecified continuous function for which $g(x) > 0$ for all x .

- (a) Find the interval(s) where f is concave up.
- (b) Find the x values corresponding to the inflection point(s).