



*University of California, San Diego*  
*Department of Mathematics*

**Instructions**

1. Write your *Name*, *PID*, *Section*, and *Exam Version* on the front of your Blue Book.
2. No calculators or other electronic devices are allowed during this exam.
3. If you are caught talking or looking at notes, you will receive a grade of zero for this exam.
4. You may use one page of notes, but no books or other assistance during this exam.
5. Read each question carefully, and answer each question completely.
6. Write your solutions clearly in your Blue Book.
  - (a) Carefully indicate the number and letter of each question and question part.
  - (b) Present your answers in the same order they appear in the exam.
  - (c) Start each problem on a new page.
7. Show all of your work. No credit will be given for unsupported answers, even if correct.
8. Turn in your exam paper with your Blue Book.

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

(1) [5 points] Find  $y'$  if

$$y^4 + 4y - 3x^3 \sin(y) = 2x + 1.$$

(2) [6 points] Consider the function  $y(x) = 2x^3 + 3x^2 - 12x + 4$  on the interval  $[-4, 2]$ .

(a) Find all critical points of  $y(x)$  on  $[-4, 2]$ .

(b) Find the intervals of increase and decrease of  $y(x)$  on  $[-4, 2]$ .

(c) Find the absolute maximum and minimum of  $y(x)$  on  $[-4, 2]$ .

(3) [6 points]

(a) Use linear approximation to estimate  $\ln(0.9)$ , using the fact that  $\ln(1) = 0$ .

(b) Write down the most accurate phrase in your blue book:

“The correct answer to Part (a) is **less than**  $\ln(0.9)$ .”

“The correct answer to Part (a) is **greater than**  $\ln(0.9)$ .”

“The correct answer to Part (a) is **equal to**  $\ln(0.9)$ .”

(4) [12 points] Find the derivatives of the following functions.

$$(a) f(x) = \tan^{-1}(x^{1/3}) \quad (b) g(x) = 3^{x^x} \quad (c) h(x) = \frac{(3x+1)^{100}(2x-1)^{99}}{(4x-1)^{98}(5x+2)^{97}}$$