



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. You may use one page of notes, but no books or other assistance during this exam.
4. Read each question carefully, and answer each question completely.
5. 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.
6. Show all of your work. No credit will be given for unsupported answers, even if correct.
7. Turn in your exam paper with your Blue Book.

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. (3 points) Compute $\frac{dy}{dx}$ if $y = \tan(2x)$.

2. Let $f(x) = x^3$.

- (a) (5 points) Find the linearization of the function f at the point $a = 2$.
- (b) (1 point) Use part (a) to estimate the value of 2.1^3 .
- (c) (2 points) Write an expression for the percentage error for your approximation in (b). (You do not need to compute it.)

3. Let $g(x) = x^2e^{-x}$. The **second derivative** of g is $g''(x) = (2 - x^2)e^{-x}$.

- (a) (4 points) Compute $g'(x)$, the **first derivative** of g .
- (b) (4 points) Over which interval or intervals is g decreasing?
- (c) (4 points) Over which interval or intervals is g concave up?

4. (7 points) Define a function h according to the following rule:

$$h(x) = \begin{cases} \frac{1 - \cos(3x)}{x^2} & \text{if } x \neq 0, \\ 3/2 & \text{if } x = 0. \end{cases}$$

Is h continuous at $x = 0$? Justify your answer.

5. (9 points) Use implicit differentiation to find the slope of the tangent line at $(1, 1)$ to the curve

$$\frac{\pi}{4} + \ln(2 - x^2) = \arctan(y^3).$$

(This exam is worth 40 points.)