



*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.
  8. Do not use l'Hôpital's Rule anywhere on this exam.
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**DO NOT TURN OVER UNTIL INSTRUCTED TO DO SO**

**Question Zero:**

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.

(This exam is worth 25 points.)

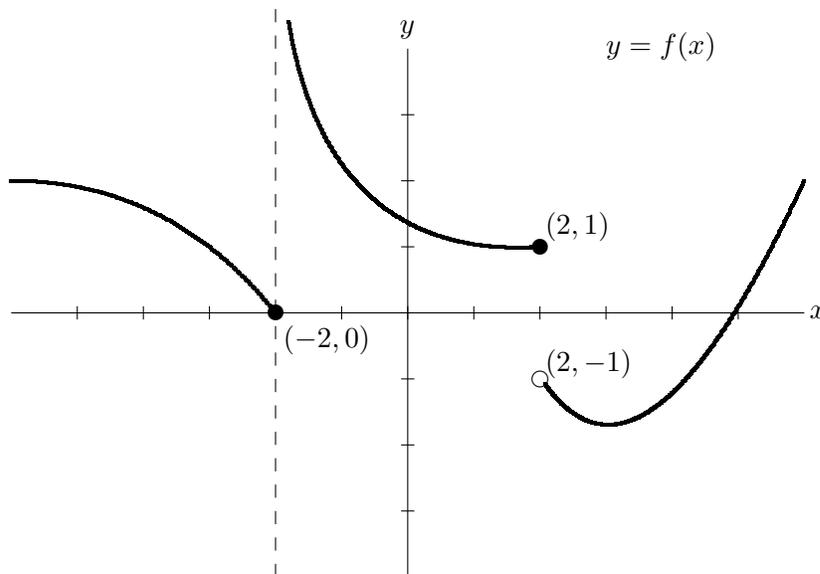
1. (6 points) Compute the following limits or state why they do not exist:

(a)  $\lim_{\theta \rightarrow 0} \frac{\tan(2\theta)}{\theta}$

(b)  $\lim_{\theta \rightarrow 0} \frac{\sin(5\theta) \tan(7\theta) \cos(9\theta)}{\theta^2}$

**Note:** You may use (without proof) the fact that  $\lim_{x \rightarrow 0} \frac{\sin(x)}{x} = 1$ .

2. (6 points) A function  $f$  has the graph given below:



- (a) Compute  $\lim_{x \rightarrow 2^+} f(x)$  or explain why it does not exist.
- (b) Compute  $\lim_{x \rightarrow 2^-} f(x)$  or explain why it does not exist.
- (c) Is  $f$  left continuous at  $x = 2$ ? Justify your answer.
- (d) Is  $f$  right continuous at  $x = 2$ ? Justify your answer.
- (e) Is  $f$  continuous at  $x = 2$ ? Justify your answer.
- (f) At  $x = -2$ , is  $f$  left continuous, right continuous, both, or neither?
3. (6 points) Differentiate each of the following functions. You may use any correct method. **Simplify** your answer as much as possible.

(a)  $f(x) = xe^x$       (b)  $g(t) = \frac{t^2 + 5}{t + 3}$       (c)  $h(x) = e^2$

4. (6 points) Let  $f(x) = \frac{1}{\sqrt{x}}$ . Compute  $f'(4)$  using the **limit definition** of the derivative.