

Name: _____ USC ID: _____ Date: _____

Signature: _____.

(By signing here, I certify that I have taken this test while refraining from cheating.)

Mid-Term 1

This exam contains 7 pages (including this cover page) and 5 problems. When the exam begins, check for missing pages. Enter all requested information on the top of this page.

You may *not* use your books, notes, or any calculator on this exam.

You are required to show your work on each problem on this exam. The following rules apply:

- You have 50 minutes to complete the exam, starting at the beginning of class.
- **Organize your work**, in a reasonably neat and coherent way, in the space provided. Work scattered all over the page without a clear ordering will receive very little credit.
- **Mysterious or unsupported answers will not receive full credit.** A correct answer, unsupported by calculations, explanation, or algebraic work will receive no credit; an incorrect answer supported by substantially correct calculations and explanations might still receive partial credit.
- If you need more space, use the back of the pages; clearly indicate when you have done this. Scratch paper appears at the end of the document.

Problem	Points	Score
1	10	
2	10	
3	10	
4	10	
5	10	
Total:	50	

Do not write in the table to the right. Good luck!^a

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1. (a) (5 points) Evaluate the following limit. If the limit does not exist, write DNE.

$$\lim_{x \rightarrow 0} \left(\frac{1}{x} - \frac{1}{x^2 + x} \right).$$

- (b) (5 points) Find all values of the constant a such that

$$\lim_{x \rightarrow 0} \frac{\sqrt{ax + 4} - 2}{x} = 1.$$

2. (10 points) Compute

$$\lim_{x \rightarrow 0} \frac{|2x - 1| - |2x + 1|}{x}.$$

If the limit does not exist, write DNE.

3. (10 points) Find the equation of all tangent lines to the curve $y = \frac{x-1}{x+1}$ that are parallel to the line $x - 2y = 2$.

4. (10 points) For the following functions, determine whether or not $f'(0)$ exists. If $f'(0)$ exists, compute its value.
- (a) f is the inverse of the natural logarithm function.
 - (b) $f(x) = x^{1/3}$.

5. (10 points) Let f be a function such that $f(1) = 2$, $f(2) = 3$, $f'(1) = 4$, $f'(2) = 5$ and $f'(3) = 6$. Define

$$F(x) = f(xf(xf(x))).$$

Find $F'(1)$.

(Scratch paper)