

Name: _____

Printed (as registered on Blackboard)

USC ID #

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Instructions:

- Do not open this exam until you are told to begin. You will have 50 minutes for the exam.
 - **Show all your work.** Unless explicitly stated otherwise in a particular question, if there is no work supporting your answer, you will not receive credit for the problem.
 - If you need more space for a problem, there is a blank page at the end of the exam.
 - You are allowed to have one page of notes, 8.5" \times 11", hand written on both sides. No collaboration is allowed. No calculators or electronic devices are allowed. *Turn off your cell phone.*
 - Cheating will result in a zero on this exam and the student will be reported to the Office of Academic Integrity.
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Question	Points
1	15
2	20
3	20
4	20
5	25
Total:	100

1. (15 points) Consider the sequence $a_k = \frac{\ln k}{5^{k-1}}$ for $k \geq 2$.
- (a) Write out the first 3 terms of the sequence explicitly.

(b) Compute $\lim_{k \rightarrow \infty} a_k$.

(c) Compute $\lim_{k \rightarrow \infty} \frac{a_{k+1}}{a_k}$.

2. (20 points) Evaluate the following limits, including $\pm\infty$ or “Does Not Exist.”

(a) $\lim_{x \rightarrow 0} \frac{\tan^{-1}(3x)}{e^{5x} - 1}$.

(b) $\lim_{x \rightarrow \infty} \left(1 - \frac{4}{x^2}\right)^{x^2}$.

3. (20 points) Let $A > 0$ be a constant. Evaluate the following integral:

$$\int \frac{x^2}{(\sqrt{A^2 - x^2})^3} dx.$$

4. (20 points) Evaluate the following integral:

$$\int \frac{5x^3 + 4x^2 - 18x + 30}{x^2(x^2 + 6)} dx$$

5. (25 points)

- (a) Evaluate the following improper integral: $\int_0^e x^7 \ln(x) dx$. *Carefully justify any limit computations that arise.*

- (b) Determine if the following improper integral converges or diverges: $\int_{129}^{\infty} \frac{x^2 + 1 + \cos x}{\sqrt{x^5 - x - 1}} dx$.
Be sure to clearly state any test(s) you use.

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