

NAME: _____

Read all of the following information before starting the exam:

- **WRITE YOUR NAME AT THE TOP OF EACH PAGE** (you will lose points otherwise)
- **DO NOT WRITE ON THE FRONT OR BACK OF THE FIRST PAGE** other than writing your name.
- Show all work and give explanations where needed. I reserve the right to take off points if I cannot see how you arrived at your answer (even if your final answer is correct).
- Use only the paper provided, your one page notes and a pen or pencil.
- Write your answer in the box provided.
- This test has 6 problems. and is worth 45 points, It is your responsibility to make sure that you have all of the pages!
- Good luck!

1	
2	
3	
4	
5	
6	
total	

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1. (9 points) Compute the limits of the following sequences. You should show all steps in detail. **Box your answers. You will lose 1 point for each un-boxed answer.**

a) $\left\{ n \ln \left(\frac{1}{n} \right) \right\}_{n=1}^{\infty}$

b) $\left\{ n - \sqrt{n^2 - 3n} \right\}_{n=4}^{\infty}$

c) $\left\{ \left(1 - \frac{2}{n} \right)^n \right\}_{n=1}^{\infty}$

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2. (9 points) Choose 3 of the following 4 infinite series and show they either converge or diverge. Make it clear which of the 4 you want graded. You should show all steps in detail. **Box your answers. You will lose 1 point for each un-boxed answer.**

a) $\sum_{k=1}^{\infty} \sin\left(\frac{1}{k}\right)$

b) $\sum_{k=1}^{\infty} \frac{k^k}{k!}$

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c) $\sum_{k=1}^{\infty} \frac{1}{k^{\cos(\frac{1}{k})}}$ Hint, $\cos(\frac{1}{k}) < 1$ for all k .

d) $\sum_{k=0}^{\infty} \ln\left(\frac{k+2}{k+1}\right)$

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3. (6 points)

a) Show that if $q > 0$ then $\lim_{k \rightarrow \infty} \frac{\ln(k)}{k^q} = 0$.

b) Explain, in a sentence or two, why part a) shows that if $q > 0$ then eventually (for large enough k) that $k^q > \ln(k)$.

c) Use the comparison test to show $\sum_{k=1}^{\infty} \frac{\ln(k)}{k^{\frac{3}{2}}}$ converges. Hint, use part b) and choose a value for q .

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4. (9 points) Let $f(x) = e^{\frac{x}{2}}$. Use a Taylor polynomial centered at 0 to estimate the value of $e^{\frac{1}{2}}$ with an error less than $\frac{1}{100}$.

5. (6 points) Use Right Riemann sums with $n = 4$ to estimate the area under the curve $f(x) = x^2$ from -1 to 2. **Box your answers. You will lose 1 point for each un-boxed answer.**

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6. (6 points) Find the interval of convergence for the following power series. **Box your answers.**
You will lose 1 point for each un-boxed answer.

1.
$$\sum_{k=1}^{\infty} \frac{(x-3)^k}{k^{\frac{3}{2}}}$$

2.
$$\sum_{k=1}^{\infty} \frac{k^k x^k}{k!}$$