

MATH-141
Fall 2025
Exam II Worksheet
October 10

Name: _____

Pledge: _____

Each question topic and point value is recorded in the tables below. Note that this exam must be completed within the 50 minutes allotted. Also, you must work without any external resources, which includes no notes, calculator, nor any equivalent software. You must show an appropriate amount of work to justify your answer for each problem. If you run out of room for a given problem, you may continue your work on the back of the page.

By writing your name and signing the pledge you are stating that you understand the rules outlining this exam.

Scoring Table

Question	Points	Score
1	10	
2	8	
3	10	
4	8	
5	10	
Total:	46	

Topics Table

Question	Topic
1	Sequences
2	Series
3	Comparison Tests
4	Ratio and Root Tests
5	Alternating Series

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1. (a) (2 points) State the ϵ - N definition of convergence for the sequence $\{a_n\}_{n=1}^{\infty}$.

- (b) (4 points) Use the ϵ - N definition of convergence to show that

$$\lim_{n \rightarrow \infty} \left(\frac{n-1}{n} \right) = 1.$$

- (c) (2 points) Use L'Hopital's rule to determine the limiting value of the sequence $\left\{ \frac{\sin(1/n)}{1/n} \right\}_{n=1}^{\infty}$.

- (d) (2 points) Use monotone sequence theorem to determine if $\left\{ 2 - \frac{1}{3^n} \right\}_{n=1}^{\infty}$ converges or diverges.

2. (a) (2 points) State the definition of a series as the limit of a sequence of partial sums.

(b) (6 points) Determine if the following series converge or diverge. If the series converges, determine its value.

• $\sum_{k=0}^{\infty} \frac{3}{2^k}$

• $\sum_{k=1}^{\infty} (-1)^{k+1}$

• $\sum_{k=2}^{\infty} \left(\frac{1}{k(k-1)} \right)$

3. (a) (4 points) Use the integral test to determine if $\sum_{k=1}^{\infty} \frac{1}{k^2+1}$ converges or diverges.

(b) (3 points) Use the direct comparison test to determine if $\sum_{k=2}^{\infty} \frac{1}{\sqrt{k-1}}$ converges or diverges.

(c) (3 points) Use the limit comparison test to determine if $\sum_{k=1}^{\infty} \frac{k^2-1}{5k^3+4k}$ converges or diverges.

4. Use the ratio or root test to determine if the following series converge or diverge.

(a) (4 points) $\sum_{k=1}^{\infty} \left(\frac{5k+3}{2k-1} \right)^k$

(b) (4 points) $\sum_{k=1}^{\infty} \frac{3^k}{k!}$

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5. Determine if the following alternating series converge or diverge. If the series converges, determine if the convergence is absolute or conditional.

(a) (5 points) $\sum_{k=1}^{\infty} (-1)^{k+1} \frac{1}{k!}$

(b) (5 points) $\sum_{k=1}^{\infty} (-1)^k \frac{1}{\ln(k+1)}$