This review, produced by the CLAS Teaching Center, contains a collection of questions which are representative of the type you may encounter on the exam. Other resources made available by the Teaching Center include:

- Walk-In tutoring at Broward Hall
- Private-Appointment, one-on-one tutoring at Broward Hall
- Walk-In tutoring in LIT 215
- Supplemental Instruction
- Video resources for Math and Science classes at UF
- Written exam reviews and copies of previous exams

The teaching center is located in the basement of Broward Hall:

![Map of University of Florida campus](image)

Walk-In hours for MAC2312 are:

- Sunday 6-9PM, Monday 2:30-4:45PM, Tuesday 3:30-7PM, Wednesday 12:30-4:30PM, Thursday 5-7PM, and Friday 1-3PM.

You can learn more about the services offered by the teaching center by visiting [https://teachingcenter.ufl.edu/](https://teachingcenter.ufl.edu/)
1. Determine whether or not each of the following sequences converge. If the sequence does converge, find its limit. Otherwise, explain why the sequence fails to converge.

(a) \( \left\{ \frac{1}{n^2} \right\} \) \( n \geq 0 \)

(b) \( \left\{ \sin^n \left( \frac{\pi}{7} \right) \right\} \) \( n \geq 0 \)

(c) \( \left\{ \left( \frac{1}{4} + 3 \right)^n \right\} \) \( n \geq 1 \)

(d) \( \left\{ \tan^{-1} \left( \frac{3n^2 + 1}{n!} \right) \right\} \) \( n \geq 1 \)

(e) \( \left\{ \frac{1 \cdot 3 \cdot 5 \cdots (2n - 1)}{(2n)!} \right\} \) \( n \geq 2 \)

(f) \( a_1 = \sqrt{2}, a_2 = \sqrt{2\sqrt{2}}, a_3 = \sqrt{2\sqrt{2\sqrt{2}}}, \ldots \)

2. Let \( S_N = \sum_{n=1}^{N} a_n \). Express \( S_{105} - S_{100} \) in closed form (no ellipses or \( \sum \)s).

3. Explore the convergence of the series

(a) \( \sum_{n=1}^{\infty} \left( \frac{1}{4} + \frac{3}{4} \right)^n \)

(b) \( \sum_{n=1}^{\infty} \left[ \left( \frac{1}{4} \right)^n + \left( \frac{3}{4} \right)^n \right] \)

4. Use the fact that \( \frac{1}{3} = 0.33333333 \ldots \) to express \( \frac{2}{3} \) as a geometric series with \( r = \frac{1}{10} \).

5. Give two examples of infinite series which pass the test for divergence, but still fail to converge.

6. Consider the series \( S = \sum_{n=1}^{\infty} \frac{n}{(n + 1)!} \), and it’s sequence of partial sums, \( S_N = \sum_{n=1}^{N} \frac{n}{(n + 1)!} \).

(a) Calculate \( S_1, S_2, S_3, \) and \( S_4 \).

(b) Can you guess what \( S_5 \) is?

(c) Given that \( S_N = \frac{N! - 1}{N!} \), what is the sum of the series \( S \)?
7. A right triangle $ABC$ is given with $\angle A = \theta$ and $|AC| = b$. $CD$ is drawn perpendicular to $AB$, $DE$ is drawn perpendicular to $BC$, $EF$ is perpendicular to $AB$, and the process is continued indefinitely (see the figure). Find the sum of the lengths of the perpendiculars.

That is, assuming this pattern continues forever, find the sum of the lengths of the dashed lines (in terms of $b$ and $\theta$).

8. Investigate the convergence of the series
$$\sum_{n=1}^{\infty} \ln \left(1 - \frac{1}{n+1}\right).$$
If the series converges, find its sum.

9. Find the values of $c$ for which the series
$$\sum_{n=1}^{\infty} \frac{c}{n} - \frac{1}{n+1}$$
converges.

10. Determine whether the series
$$\frac{1}{5} + \frac{1}{8} + \frac{1}{11} + \frac{1}{14} + \frac{1}{17} + \cdots$$
converges.

11. Determine whether
$$\sum_{n=1}^{\infty} \frac{n^3}{n^4 - 1}$$
converges.

12. Find all positive values of $b$ such that the series
$$\sum_{n=1}^{\infty} b^{\ln(n)}$$
converges.
13. Investigate the convergence of the series \( \sum_{n=1}^{\infty} \left( \frac{3n+1}{4-2n} \right)^{2n} \)

14. For what values of \( p \) does the series \( \sum_{n=1}^{\infty} n^p \sin \left( \frac{1}{n^2} \right) \) converge?

15. Determine whether \( \sum_{n=1}^{\infty} \frac{(-1)^n}{n \ln(n)} \) converges.

16. Find the smallest value of \( N \) so that \( |S - S_N| < 0.01 \) for the series \( S = \sum_{n=1}^{\infty} (-1)^{n-1} ne^{-n} \).

17. Determine whether the series \( \sum_{n=1}^{\infty} (-1)^n \frac{\tan^{-1}(n)}{n^2} \) converges absolutely, converges conditionally, or diverges.

18. Suppose \( \sum_{n=1}^{\infty} a_n \) converges absolutely. Is it true or false that \( \sum_{n=1}^{\infty} (-1)^n a_n \) is conditionally convergent?

19. Investigate the convergence of the series \( \sum_{n=1}^{\infty} \frac{(-1)^n (1.5)^n n!}{2 \cdot 4 \cdot 6 \cdots (2n)} \).