
Determine if the following series converge absolutely, converge conditionally, or diverge. Give complete justification, and state which test or tests you are using.

1. \( \sum_{n=2}^{\infty} \frac{(-1)^{n+1} \ln n}{\sqrt{n}} \).

2. \( \sum_{n=1}^{\infty} \frac{1 \cdot 3 \cdot 5 \cdots (2n-1)}{2 \cdot 5 \cdot 8 \cdots (3n-1)} \).

3. \( \sum_{n=1}^{\infty} \frac{n!}{e^n} \).

4. You are given that \( \sum c_n(-3)^n \) converges, and that \( \sum c_n5^n \) diverges.
   a) What are the possible values of the radius of convergence of the power series \( \sum c_n x^n \)?

   What can you say about the convergence/divergence of the following series?
   b) \( \sum c_n(-6)^n \)
   c) \( \sum c_n2^n \)
   d) \( \sum c_n4^n \)
   e) \( \sum c_n(-5)^n \)
Use the ratio test to determine the radius of convergence. Then determine the interval of convergence.

5. \[ \sum_{n=1}^{\infty} \frac{n^2 x^{2n}}{(2n)!}. \]

6. \[ \sum_{n=1}^{\infty} (-1)^n \frac{(x - 3)^n}{n \cdot 5^n}. \]

7. \[ \sum_{n=1}^{\infty} (-1)^n \frac{(x - 3)^{2n}}{n \cdot 5^n}. \]

8. \[ \sum_{n=1}^{\infty} \frac{x^n}{e^{n^2}} \] (the root test is also a good option for this one).