

## Series Mish-Mash

1. Determine whether each of the following series is absolutely convergent, conditionally convergent, or divergent. Are there any other tests that would have worked?

(a) 
$$\sum_{n=1}^{\infty} \frac{\tan^{-1} n}{n^3}$$

(b) 
$$\sum_{n=0}^{\infty} \frac{n!}{e^{n^2}}$$

(c) 
$$\sum_{n=0}^{\infty} \frac{n!}{2 \cdot 5 \cdot 8 \cdots (3n+2)}$$

(d) 
$$\sum_{n=3}^{\infty} \frac{(-1)^n}{n\sqrt{\ln n}}$$

(e) 
$$\sum_{n=0}^{\infty} \frac{1}{1+e^n}$$

(f) 
$$\sum_{n=1}^{\infty} \left( \frac{1}{n^{5/7}} - \frac{1}{(n+1)^{5/7}} \right)$$

(g) 
$$\sum_{n=1}^{\infty} (-1)^n \frac{3^n}{n^3}$$

(h) 
$$\sum_{n=1}^{\infty} \frac{(-2)^{3n}}{n^n}$$

(i) 
$$\sum_{n=1}^{\infty} \left( \frac{n+1}{n+2} \right)^{n^2+1}$$

(j) 
$$\sum_{n=1}^{\infty} \frac{\sqrt{n+1} - \sqrt{n}}{n}$$

(k) 
$$\sum_{n=1}^{\infty} (-1)^n \sqrt[n]{2}$$

(l) 
$$\sum_{n=1}^{\infty} \frac{\sqrt{n^3+3n-1}}{n^2-n+1}$$

(m) 
$$\sum_{n=1}^{\infty} \frac{\tan^{-1} n}{\ln\left(\frac{n+1}{n}\right) n^3}$$

(n) 
$$\sum_{n=1}^{\infty} \frac{(-2)^{3n+1}}{n^n}$$

(o) 
$$\sum_{n=1}^{\infty} (-1)^n \sqrt[n]{\frac{n+2}{3n-1}}$$

(p) 
$$\sum_{n=4}^{\infty} \frac{(-1)^n}{n \ln n \sqrt[3]{\ln \ln n}}$$

(q) 
$$\sum_{n=1}^{\infty} (-1)^n n e^{-n}$$

(r) 
$$\sum_{n=1}^{\infty} (-1)^n (\sqrt{n^2+n} - n)$$

(s) 
$$\sum_{n=1}^{\infty} n \sin\left(\frac{1}{3^n}\right)$$

(t) 
$$\sum_{n=1}^{\infty} \frac{(3n)!}{n^n (n!)^{2 \cdot 4^{2n}}}$$

(u) 
$$\sum_{n=1}^{\infty} (-1)^n \sin(\sqrt{n}) \cos(1 - e^{-n})$$

(v) 
$$\sum_{n=3}^{\infty} \frac{2 + \sin n}{n \ln n}$$

(w) 
$$\sum_{n=3}^{\infty} \frac{1}{3^{\ln n}}$$

(x) 
$$\sum_{n=3}^{\infty} \frac{1}{2^{\ln n}}$$

(y) 
$$\sum_{n=4}^{\infty} \frac{1}{2^{\ln \ln n}}$$

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

2. For what values of  $p$  is  $\sum \frac{(-1)^n}{n^p}$  AC? CC? D?

3. For what values of  $p$  does  $\sum \frac{\ln n}{n^p}$  converge?

4. Determine whether  $\sum \frac{(-1)^n}{n + (-1)^n}$  converges or diverges. What about  $\sum \frac{(-1)^n}{n^2 + (-1)^n}$ ?

5. Give an example of a series that can be tested using the CT but not the LCT

6. State the conditions necessary to use each of the following tests:

- Integral Test
- Comparison Test, Limit Comparison Test
- Alternating Series Test
- Root/Ratio Tests