Series practice list

Determine whether each of the series is absolutely convergent, conditionally convergent, or divergent, using any convergence test:

(1) $\sum_{n=1}^{\infty}\left(1+\frac{1}{n}\right)2^{-n}$ (2) $\sum_{n=1}^{\infty}\sin\left(\left(\frac{2n+1}{2}\right)\pi\right)n^{-1/2}$ (3) $\sum_{n=1}^{\infty}\frac{\ln n}{n+2}$

(4) $\sum_{n=1}^{\infty}(-1)^n\ln\left(\frac{n}{3n+1}\right)$ (5) $\sum_{n=1}^{\infty}\frac{(-2)^n}{n^2}$ (6) $\sum_{n=1}^{\infty}\left(\frac{1}{9}\right)^n(2n)!$

(7) $\sum_{n=1}^{\infty}\frac{1\cdot 3\cdot 5\cdots(2n-1)}{5^n\,n!}$ (8) $\sum_{n=1}^{\infty}\frac{(-1)^n}{3n}$ (9) $\sum_{n=1}^{\infty}\left(\frac{-1}{3n}\right)^n$

(10) $\sum_{n=1}^{\infty}(-1)^n\frac{n^{2n}}{(1+2n^2)^n}$ (11) $\sum_{n=1}^{\infty}(-1)^n\frac{n}{n^4+1}$ (12) $\sum_{n=1}^{\infty}(-1)^n\frac{\ln n}{\sqrt{n}}$

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

Extra - Rogawski problems

The following problems are drawn from the J. Rogawski textbook, p585:

For each series, state a convergence test that will show whether it converges or diverges. (If you have time, write further details for application of the test.)

(43) $\sum_{n=1}^{\infty}\frac{2^n+4^n}{7^n}$ (44) $\sum_{n=1}^{\infty}\frac{n^3}{n!}$ (45) $\sum_{n=1}^{\infty}\frac{n^3}{5^n}$

(46) $\sum_{n=2}^{\infty}\frac{1}{n(\ln n)^3}$ (47) $\sum_{n=2}^{\infty}\frac{1}{\sqrt{n^3-n^2}}$ (48) $\sum_{n=1}^{\infty}\frac{n^2+4n}{3n^4+9}$

(49) $\sum_{n=1}^{\infty}n^{-0.8}$ (50) $\sum_{n=1}^{\infty}(0.8)^{-n}n^{-0.8}$ (51) $\sum_{n=1}^{\infty}4^{-2n+1}$

(52) $\sum_{n=1}^{\infty}\frac{(-1)^{n-1}}{\sqrt{n}}$ (53) $\sum_{n=1}^{\infty}\sin\frac{1}{n^2}$ (54) $\sum_{n=1}^{\infty}(-1)^n\cos\frac{1}{n}$

(55) $\sum_{n=1}^{\infty}\frac{(-2)^n}{\sqrt{n}}$ (56) $\sum_{n=1}^{\infty}\left(\frac{n}{n+12}\right)^n$