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### *Tutorial on Series Concepts – Practise Problems Set*

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1. If positive term series  $\sum a_n$  converges, then examine the convergence of series  $\sum \sqrt{a_n a_{n-1}}$ .
2. For what value of  $r$ , if any, does the series:  $1 + 2r + r^2 + 2r^3 + r^4 + 2r^5 + r^6 + \dots$  converge? Find the sum of the series when it converges.
3. Test the convergence of the following series:
  - (i)  $\frac{1}{(\log 2)^p} + \frac{1}{(\log 3)^p} + \frac{1}{(\log 4)^p} + \dots$  if  $p > 0$
  - (ii)  $\frac{1 \cdot 2}{3^2 \cdot 4^2} + \frac{3 \cdot 4}{5^2 \cdot 6^2} + \frac{5 \cdot 6}{5^2 \cdot 6^2} + \dots$
  - (iii)  $\sum_{n=1}^{\infty} \frac{n^2 - 1}{n^2 + 1} x^n \quad x > 0$
  - (iv)  $\sum_{n=2}^{\infty} \frac{1}{n(\log n)^p} \quad p > 0$
  - (v)  $\left(\frac{2^2}{1^2} - \frac{2}{1}\right)^{-1} + \left(\frac{3^3}{2^3} - \frac{3}{2}\right)^{-2} + \left(\frac{4^4}{3^4} - \frac{4}{3}\right)^{-3} + \dots$
  - (vi)  $\sum_{n=1}^{\infty} \frac{1}{n^2 + n}$
  - (vii)  $u_n = \frac{1}{(1 + \sqrt{n})^{3/2}}$ , where  $u_n$  general term of series.