IIITDM KANCHEEPURAM

MA1000 Calculus
Problem Set 2

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1. For what value of r, if any, does the series $1+2r+r^2+2r^3+r^4+2r^5+r^6+\ldots$ converge? Find the sum of the series when it converges.

2. Test the convergence of the following series:

   (a) $\displaystyle\sum_{n=1}^{\infty}\frac{(3/2)^n}{n^5}$.

   (b) $\displaystyle\sum_{n=1}^{\infty}\frac{n5^n}{(2n+3)\ln(n+1)}$.

   (c) (i) $\displaystyle\sum_{n=2}^{\infty}\frac{1}{n(\log n)^p}$; (ii) $\displaystyle\sum_{n=3}^{\infty}\frac{1}{n\log n(\log\log n)^p}$ (p any number).

   (d) $\displaystyle\sum\frac{1}{n^p}\cos\left(\frac{1}{n}\right)$ (p any number).

   (e) $\dfrac{1\cdot 2}{3^2\cdot 4^2}+\dfrac{3\cdot 4}{5^2\cdot 6^2}+\dfrac{5\cdot 6}{7^2\cdot 8^2}+\ldots.$

   (f) $\left(\dfrac{2^2}{1^2}-\dfrac{2}{1}\right)^{-1}+\left(\dfrac{3^3}{2^3}-\dfrac{3}{2}\right)^{-2}+\left(\dfrac{4^4}{3^4}-\dfrac{4}{3}\right)^{-3}+\ldots.$

   (g) $\displaystyle\sum\frac{1}{n^2+n}$.

   (h) $\displaystyle\sum\frac{1}{(1+\sqrt{n})^{3/2}}$.

   (i) $\displaystyle\sum_{n=2}^{\infty}\frac{1}{(\log n)^p}$ (p any number).

   (j) (i) $\displaystyle\sum\frac{(-1)^{n+1}}{n^2}$; (ii) $\displaystyle\sum\frac{(-1)^{n+1}}{n}$; (iii) $\displaystyle\sum\frac{(-1)^{n+1}}{\sqrt{n}}$.

   (k) $\displaystyle\sum_{n=1}^{\infty}\frac{n^2-1}{n^2+1}x^n$ (x any number).

3. If $\sum a_n$ is a convergent series of positive terms, examine the convergence of the series $\displaystyle\sum\sqrt{a_n a_{n+1}}$.