

MAT 127 : Calculus C

Spring 2006

Instructor: Ibrahim Unal

Review Problems

Sequences & Series

03/16/2006

Problem 1. Evaluate the following limits.

$$\begin{array}{lllll}
 1) \lim_{n \rightarrow \infty} \frac{n^2 + 4n - 7}{n^3 + 5} & 2) \lim_{n \rightarrow \infty} \arctan(n!) & 3) \lim_{n \rightarrow \infty} (-1)^n \cos\left(\frac{1}{n^2}\right) & 4) \lim_{n \rightarrow \infty} \frac{n^4}{n!} & 5) \lim_{n \rightarrow \infty} \frac{\cos^2(n)}{n!} \\
 6) \lim_{n \rightarrow \infty} \frac{(-3)^n}{2^{2n}} & 7) \lim_{n \rightarrow \infty} 1 + \left(\frac{-2}{\pi}\right)^n & 8) \lim_{n \rightarrow \infty} \sqrt{n+2} - \sqrt{n} & 9) \lim_{n \rightarrow \infty} \ln(n+1) - \ln(n) & 10) \lim_{n \rightarrow \infty} \frac{\ln(n)}{n} \\
 11) \lim_{n \rightarrow \infty} (-1)^n \frac{n^3 + 5n + 4}{n^2 + 4} & 12) \lim_{n \rightarrow \infty} n^2 \sin\left(\frac{1}{n}\right) & & &
 \end{array}$$

Problem 2. Give examples for each of the following if possible.

- a) An increasing and convergent sequence
- b) A bounded and divergent sequence
- c) A decreasing, bounded and divergent sequence
- d) An oscillating and convergent sequence

Problem 3. Determine whether the following series convergent or divergent. If it is convergent, calculate the sum.

$$\begin{array}{llll}
 1) \sum_{i=1}^{\infty} \arctan(n) & 2) \sum_{i=1}^{\infty} \ln(n+1) - \ln(n) & 3) \sum_{i=1}^{\infty} \frac{1}{n(n+2)} & 4) \sum_{i=1}^{\infty} \left(\frac{3}{2^{n-1}} + \frac{5}{2^{2n}}\right) \\
 5) 1 - \frac{3}{4} + \frac{3}{16} - \frac{3}{64} + \dots
 \end{array}$$

Problem 4. Determine whether the following series are convergent or divergent. State the tests that you use with reasons.

$$\begin{array}{llllll}
 1) \sum_{i=2}^{\infty} \frac{1}{n \ln(n)} & 2) \sum_{i=1}^{\infty} n e^{-n^2} & 3) \sum_{i=1}^{\infty} \frac{\ln(n)}{n^2} & 4) \sum_{i=1}^{\infty} \frac{\cos^2(n)}{n\sqrt{n}} & 5) \sum_{i=1}^{\infty} \frac{1}{3^n + n^2} & 6) \sum_{i=1}^{\infty} \frac{n^2 + 2n + 1}{3n^4 + 5n^3 - 8n + 9} \\
 7) \sum_{i=1}^{\infty} \frac{n^2 + 5^n}{3^n} & 8) \sum_{i=2}^{\infty} \frac{1}{n^4 - n} & 9) \sum_{i=2}^{\infty} \sin\left(\frac{1}{n}\right) & 10) \sum_{i=1}^{\infty} \frac{n}{n+1} & &
 \end{array}$$

Also check the following web pages to see some other questions with solutions .

<http://archives.math.utk.edu/visual.calculus/6/series.14/index.html>

<http://archives.math.utk.edu/visual.calculus/6/series.17/index.html>