Name: _____

**Due Jan 28 2004**

Student No.: _____

ASSIGNMENT #2 **Mathematics 2000** WINTER 2004

1. Find the limit of the sequence.

   a) $\lim_{n\to\infty} n \sin \frac{1}{2n}$ b) $\lim_{n\to\infty} 2n \sin \frac{3}{n}$

   c) $\lim_{n\to\infty} \left(1+\frac{2}{n}\right)^{3n}$ d) $\lim_{n\to\infty} \left(\frac{n}{n+5}\right)^{-n}$.

2. Find the sum of the geometric series

   a) $\sum_{n=0}^{\infty} \left(\frac{1}{\pi}\right)^n$ b) $\sum_{n=1}^{\infty} \left(\frac{1}{\pi}\right)^n$ c) $\sum_{n=2}^{\infty} \left(\frac{1}{\pi}\right)^n$

   d) $\sum_{n=0}^{\infty} (-0.4)^n + (0.4)^n$ e) $\sum_{n=0}^{\infty} \frac{1}{3^{n/3}}$ f) $\sum_{n=1}^{\infty} (\frac{5^n}{6^{n-1}})$.

3. Express the repeating decimal as a geometric series and write its sum as the ratio of two integers.

   (a) 0.234234234234...

   (b) 1.2343434343434...

4. Find the sum by telescoping

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

   (b) $\frac{1}{3\cdot 5} + \frac{1}{5\cdot 7} + \frac{1}{7\cdot 9} + \frac{1}{9\cdot 11} + \cdots$

5. Explain why the following series are divergent. Find first 3 partial sum for each of the series.

   a) $\sum_{n=3}^{\infty} \ln\left(\frac{n-1}{n}\right)$ b) $\sum_{n=1}^{\infty} \frac{n-1}{n+1}$ c) $\sum_{n=1}^{\infty} \frac{2}{3n}$

   d) $\sum_{n=0}^{\infty} \left(\frac{5}{4}\right)^n$ e) $\sum_{n=1}^{\infty} \frac{2^n}{n^3}$ f) $\sum_{n=1}^{\infty} n \sin \frac{\pi}{n}$

6. **Bonus problem**

   Find the sum.

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

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

   (c) $\sum_{n=1}^{\infty} \frac{1}{n(n+1)(n+2)(n+3)...(n+k)}$, where $k \geq 3$.