Problem 1. Determine whether each sequence converges or diverges. If converges, find the limit.

a. $a_n = 1 - 0.2^n$ *b.* $a_n = \frac{3^{n+2}}{5^n}$ *c.* $a_n = \frac{(-1)^{n+1}n}{n+\sqrt{n}}$

d. $a_n = \cos\left({}^{n}\!/_{2}\right)$ *e.* $a_n = \frac{e^n+e^{-n}}{e^{2n}-1}$ *f.* $a_n = \frac{\ln(n)}{\ln(2n)}$

g. $a_n = \frac{n!}{2^n}$ *h.* $a_n = \frac{(-3)^n}{n!}$ *i.* $a_n = \frac{\sin(2n)}{1+\sqrt{n}}$

Problem 2. Determine whether the sequence is increasing, decreasing or not monotonic. Is the sequence bounded?

a. $a_n = (-2)^{n+1}$ *b.* $a_n = \frac{1}{2n+1}$ *c.* $a_n = \frac{2n-3}{3n+4}$

d. $a_n = ne^{-n}$ *e.* $a_n = n(-1)^n$ *f.* $a_n = \frac{n}{n^2+1}$

Problem 3. Determine whether the following series are convergent or divergent by expressing S_n as a telescoping sum. If it is convergent, find its sum.

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

c. $\sum_{n=2}^{\infty} \frac{2}{n^3-n}$ *d.* $\sum_{n=1}^{\infty} \frac{3}{n(n+1)}$

Problem 4. Use the Integral Test to determine whether the following series are convergent or divergent.

a. $\sum_{n=1}^{\infty} \frac{1}{\sqrt[5]{n}}$ *b.* $\sum_{n=3}^{\infty} n^{-0.9999}$ *c.* $\sum_{n=1}^{\infty} n^2 e^{-n^3}$

d. $1 + \frac{1}{2\sqrt{2}} + \frac{1}{3\sqrt{3}} + \frac{1}{4\sqrt{4}} + \frac{1}{5\sqrt{5}} + \ldots$ *e.* $\sum_{n=2}^{\infty} \frac{1}{n\ln(n)}$ *f.* $\sum_{n=3}^{\infty} \frac{n^2}{e^n}$