1. Sequences. Find the limit of given sequences for $n \to \infty$

a) $\dfrac{n^2+5n^3}{2n^3+3\sqrt{4+n^6}}$

b) $\dfrac{2^n}{n^2}$

c) $\dfrac{n^n}{n!}$

d) $\dfrac{(n!)^2}{(2n)!}$

2. Series. Use the ratio test to find whether the following series converge or diverge

a) $\sum_{n=0}^{\infty} \dfrac{3^{2n}}{2^{3n}}$

b) $\sum_{n=0}^{\infty} \dfrac{e^n}{\sqrt{n!}}$

c) $\sum_{n=0}^{\infty} \dfrac{(n!)^3 e^{3n}}{(3n)!}$

d) $\sum_{n=0}^{\infty} \dfrac{\sqrt{(2n)!}}{n!}$

3. Series. Find the interval of convergence of each of the following power series; be sure to investigate the endpoints of the interval in each case.

a) $\sum_{n=1}^{\infty} \dfrac{x^{3n}}{n}$

b) $\sum_{n=1}^{\infty} \dfrac{(-1)^n x^n}{\sqrt{n}}$

c) $\sum_{n=1}^{\infty} \dfrac{n}{n+1} \left(\dfrac{x}{3}\right)^n$

d) $\sum_{n=1}^{\infty} \dfrac{(-1)^n x^n}{(2n)!}$

4. Series. Find the first two terms of the Maclaurin series for each of the following functions

a) $e^x \sin x$

b) $e^{\sin x}$

c) $\dfrac{x}{\sin x}$

d) $\ln(2 - e^x)$

5. Find the following limits using the Maclaurin series

a) $\lim\limits_{x \to 0} \left(\dfrac{1}{x} - \dfrac{1}{e^x-1}\right)$

b) $\lim\limits_{x \to 0} \left(\dfrac{1}{x^2} - \dfrac{\cos x}{\sin^2 x}\right)$

c) $\lim\limits_{x \to 0} \left(\csc^2 x - \dfrac{1}{x^2}\right)$

d) $\lim\limits_{x \to 0} \left(\dfrac{\ln(1+x)}{x^2} - \dfrac{1}{x}\right)$