1) Discuss whether the following sequences converge.

(a) \( a_n = \sqrt[4]{10} \)  
(b) \( a_n = \cos^n 1 \)  
(c) \( a_n = \frac{n}{n + 1} \)  
(d) \( a_n = \left( \frac{n + 1}{n} \right)^n \)  
(e) \( a_n = \frac{(2n + 1)!}{(2n)!} \)  
(f) \( a_n = \frac{\ln n}{n} \)  
(g) \( a_n = \frac{(-7)^{n+1}}{8^{n-1}} \)  
(h) \( a_n = \left( 1 - \frac{2}{n} \right)^n \)  
(i) \( a_n = \frac{(3n)!}{(3n + 1)!} \)

2) Discuss whether the following series \( \sum_{n=2}^{\infty} a_n \) converge.

(a) \( a_n = \frac{n^n}{n!} \)  
(b) \( a_n = \frac{e^n}{n!} \)  
(c) \( a_n = \left( \frac{\cos n + 1}{2^n} \right) \)  
(d) \( a_n = \frac{(-1)^{n+4}n^3}{2n^3 + 1} \)  
(e) \( a_n = \frac{(-1)^{n+4}n^3}{2n^4 - 1} \)  
(f) \( a_n = \frac{(-1)^{n+4}n^3}{2n^5 - 1} \)
3) Determine if the following series converge or diverge.

(a) \[ \sum_{n=1}^{\infty} \frac{1}{n(n+2)} \quad \text{What is the sum?} \]

(b) \[ \sum_{n=1}^{\infty} n \tan\left(\frac{1}{n^2}\right) \]

(c) \[ \sum_{n=1}^{\infty} \sqrt{n} \tan\left(\frac{1}{n^2}\right) \]

(d) \[ \sum_{n=0}^{\infty} \frac{n!}{e^{n^2}} \]

(e) \[ \sum_{n=0}^{\infty} \frac{(-1)^n n}{\sqrt{n^3+1}} \]

(f) \[ \sum_{n=1}^{\infty} (-1)^n \frac{2^n n!}{5 \cdot 8 \cdot 11 \cdots (3n+2)} \]
4) Determine if the following series converge or diverge.

(a) \[ \sum_{n=2}^{\infty} \frac{\sqrt{n + 1} - \sqrt{n - 1}}{n} \]

(b) \[ \sum_{n=2}^{\infty} \frac{\ln n}{n^2 + 3n} \]

5) Is the sequence \( \{a_n\} \) convergent? If so, what’s the limit?

(a) \( \{a_n\} \) is a monotonic and bounded sequence such that \( a_1 = 10, a_{n+1} = \frac{1}{3}(a_n + 3), 0 < a_n < 10. \)

(b) \( \sqrt{2}, \sqrt[3]{2}, \sqrt[4]{2} \ldots \)