1. [10 points each] Determine if the following series are convergent or divergent.

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

(c) \[ \sum_{n=1}^{\infty} \frac{2n}{2n^3 + 1} \]
2. [10 points] Determine if the following series is absolutely convergent, conditionally convergent or divergent.

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

3. [5 points] If we use the fifth partial sum as an estimate for the following convergent series, give an error estimate and indicate whether the fifth partial sum is an over-estimate or under-estimate.

\[ \sum_{n=1}^{\infty} (-1)^{n+1} \frac{n^2}{n^3 + 4} \]
4. [10 points] Find the sum of the following convergent series,
\[ \sum_{n=1}^{\infty} \frac{(-3)^{n-1}}{2^{3n}}. \]

5. [5 points] If \( \lim_{n \to \infty} a_n = 0 \), then \( \sum a_n \) is convergent. True or false? Justify your answer.
6. [5 points] 0.999\ldots = 1. **True or false?** Justify your answer.

7. [5 points] If the sequence \( \{a_n\} \) is decreasing and \( a_n > 0 \) for all \( n \), then the sequence \( \{a_n\} \) is convergent. **True or false?** Justify your answer.
8. [10 points] Show that the series \( \sum_{n=1}^{\infty} \frac{n^n}{(2n)!} \) is convergent.
9. [10 points] Find the radius of convergence and interval of convergence of the series:

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