Problem Set 7

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Problem 1: Determine whether the series is absolutely convergent, conditionally convergent, or divergent.

$(a)\ \sum_{n=2}^{\infty} \frac{(-1)^n}{\text{ln n}}$

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

$(c)\ \sum_{n=1}^{\infty} \frac{10^n}{(n+1)4^{2n+1}}$

Problem 2: Find the **radius of convergence and interval of convergence** of the series.

$(a)\ \sum_{n=0}^{\infty} \frac{(x-2)^n}{n^2+1}$

$(b)\ \sum_{n=1}^{\infty} \frac{(5x-4)^n}{n^3}$

$(c)\ \sum_{n=1}^{\infty} \frac{n}{b^n}(x-a)^n,\ b>0$

3(a) Use the **ratio test** to determine whether the series converges or diverges:

$$\sum_{n=1}^{\infty} \frac{(n+2)!}{n!\,9^n}$$

3(b) Use the **root test** to determine whether the series converges or diverges:

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

4(a): Determine whether the following series is absolutely convergent, conditionally convergent or divergent. Please state which test you are using:

$$\sum_{n=1}^{\infty} (-1)^n \frac{n}{\sqrt{4n^3+n}}$$

4(b) Determine whether the following series is absolutely convergent, conditionally convergent or divergent. Please state which test you are using:

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

5(a) Determine whether the following series is convergent or divergent. Please state which test you are using.

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

5(b) Determine whether the following series is convergent or divergent. Please state which test you are using.

$$\sum_{n=1}^{\infty} \left(\frac{1}{2} \right)^{1/n}$$

6(a) Write down the first 3 non-zero terms in the Maclaurin series for the function $f(x) = x + \cos(2x)$.

6(b) Find the first 3 non-zero terms in the Taylor series about $a = 1$ for the function $f(x) = 2 - x^2$.

7. Find the radius of convergence and interval of convergence for

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

8(a): Solve for x

$$1 + x + x^2 + x^3 + \cdots = 2$$

8(b): Find the Taylor polynomial or order 2 generated by $f(x) = \ln(x)$ about $a = 1$.