

Problem Set 2

Physics 104A

Due Wednesday October 6, 11:59 PM 2021

Late homework may be turned in by Wednesday October 13 for half credit

Primary topic: infinite series

1. Rank the following expressions from smallest to largest for large n : 10^n ; $n!$; $53,000,000 \times 5^n$; n^{10} ; $\sqrt{n!}/2$.
2. Do the following series converge or diverge? Give a one-sentence explanation for each. Most can be done by comparison with $A \sum 1/n$, $A \sum 1/n^2$, or $A \sum 1/2^n$. The remainder can be done with the integral test.
 - a) $\sum_{n=2}^{\infty} \frac{1}{\ln n}$
 - b) $\sum_{n=1}^{\infty} \frac{n^n}{10^n}$
 - c) $\sum_{n=1}^{\infty} \frac{1}{nn^{1/n}}$
 - d) $\sum_{n=2}^{\infty} \frac{1}{n(n-1)}$
 - e) $\sum_{n=2}^{\infty} \frac{1}{n \ln n}$
 - f) $\sum_{n=1}^{\infty} \frac{1}{n2^n}$
3. Redo problem 2 with each series an alternating series. For example, 3a) becomes $\sum_{n=2}^{\infty} \frac{(-1)^n}{\ln n}$. State whether each alternating series converges absolutely, conditionally, or not at all.
4. For what range of x are the following series convergent? Are there any values of x for which they converge conditionally? (You should give BRIEF justifications of your answers.)
 - a) $\sum_{n=0}^{\infty} \frac{x^{2n}}{2^n}$
 - b) $\sum_{n=1}^{\infty} \frac{x^{3n}}{n}$
 - c) $\sum_{n=1}^{\infty} \frac{x^n}{n^2}$
 - d) $\sum_{n=0}^{\infty} \frac{x^n}{(n!)^2}$
 - e) $\sum_{n=0}^{\infty} \frac{1}{1+x^n}$
5. Expand $f(x, y) = \sqrt{1+x+y^2}$ around $x=0, y=0$ to third order in x AND y . (That is, up to the x^3 , x^2y , xy^2 , and y^3 terms.) The calculation can be moderately ugly or really horrendous, depending on the order you do things, so do think a bit before plunging ahead!