

Follow the instructions for each question and show enough of your work so that I can follow your thought process. If I can't read your work or answer, you will receive little or no credit!

For problems 1 and 2 determine if the following sequences diverge or converge.

1. $a_n = \frac{\tan^{-1} n}{n}$

2. $a_n = \frac{\ln n}{e^n}$

For problems 3 - 5, find the sum of the series.

3.
$$\sum_{n=1}^{\infty} \left[\sin \left(\frac{\pi}{n^2} \right) - \sin \left(\frac{\pi}{(n+1)^2} \right) \right]$$

4.
$$\sum_{n=1}^{\infty} \frac{(-2)^{n+1}}{e^n}$$

5.
$$\sum_{n=1}^{\infty} \frac{\pi^n}{10^{n+2}}$$

For problems 6 - 13 determine if the following series converge or diverge. Don't forget to state which test you are using.

6.
$$\sum_{n=1}^{\infty} \frac{n^2}{n^3 + 1}$$

7.
$$\sum_{n=2}^{\infty} \frac{1}{n(\ln n)^2}$$

8.
$$\sum_{n=1}^{\infty} \frac{n^2 \cos(n\pi)}{2^n}$$

9. $\sum_{n=1}^{\infty} (-1)^n n e^{-n}$

10. $\sum_{n=1}^{\infty} \frac{n^n}{n!}$

11. $\sum_{n=1}^{\infty} \frac{2^{n^2}}{n!}$

12. $\sum_{n=1}^{\infty} \frac{4n^3 + 2}{7n^3 + 3n^2 + 8}$

13. $\sum_{n=1}^{\infty} \frac{n^8 - 7n^2 + 2}{\pi n^8 + 3}$

14. Consider the following sum $\sum_{n=1}^{\infty} a_n$ and let s_n be the n^{th} partial sum of the series. Suppose

$$s_n = 3 - n2^{-n}$$

Find a_n and compute the sum of the series, i.e. compute $\sum_{n=1}^{\infty} a_n$