

Answer the questions in the spaces provided. If you run out of room for an answer, continue on the back of the page.

Student's Name: \_\_\_\_\_

Instructor's name: \_\_\_\_\_

Do the following series converge or diverge?

1.

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

$$\begin{aligned} L &= \lim_{n \rightarrow \infty} \left| \frac{a_{n+1}}{a_n} \right| = \lim_{n \rightarrow \infty} \left| a_{n+1} \frac{1}{a_n} \right| = \lim_{n \rightarrow \infty} \left| \frac{3^{1-2(n+1)}}{(n+1)^2 + 1} \frac{n^2 + 1}{3^{1-2n}} \right| \\ &= \lim_{n \rightarrow \infty} \left| \frac{3^{-1-2n}}{(n+1)^2 + 1} \frac{n^2 + 1}{3^{1-2n}} \right| = \lim_{n \rightarrow \infty} \left| \frac{1}{(n+1)^2 + 1} \frac{n^2 + 1}{3^2} \right| = \lim_{n \rightarrow \infty} \left| \frac{n^2 + 1}{9[(n+1)^2 + 1]} \right| = \frac{1}{9} \end{aligned}$$

We can see that  $L = \frac{1}{9} < 1$  thus by the Ratio Test the series converges.