

# Quiz 11: Section 10.1, Problem 21

---

Determine the limit of the following sequence. If the sequence diverges, give appropriate justification.

$$a_n = \frac{(-1)^n n^2 + n}{4n^2 + 1}$$

---

We start by multiplying both the numerator and the denominator by  $\frac{1}{n^2}$ :

$$\begin{aligned} \lim_{n \rightarrow \infty} \frac{(-1)^n n^2 + n}{4n^2 + 1} &= \lim_{n \rightarrow \infty} \frac{(-1)^n n^2 + n \frac{1}{n^2}}{4n^2 + 1 \frac{1}{n^2}} \\ &= \lim_{n \rightarrow \infty} \frac{(-1)^n + \frac{1}{n}}{4 + \frac{1}{n^2}} \\ &= \frac{1}{4} \lim_{n \rightarrow \infty} (-1)^n \end{aligned}$$

Since  $\lim_{n \rightarrow \infty} (-1)^n$  diverges due to oscillation, then the original series diverges, also.