Recall:

1. **Definition:** An **alternating series** is one whose terms alternate in sign. That is, a series of the form $c_1 - c_2 + c_3 - \cdots$ where c_i is positive.

2. **Alternating Series Test:** Consider the alternating series $c_1 - c_2 + c_3 - \cdots = \displaystyle\sum_{k=1}^{\infty}(-1)^{k+1}c_k$ where $c_k \geq 0$.

   If $\lim\limits_{k\to\infty} c_k = 0$, then the series converges and its limit lies between any two consecutive partial sums.

   That is, if the series converges to S, then S lies between S_n and S_{n+1} for any n.

3. A series converges **absolutely** if $\sum |a_k|$ converges; it converges **conditionally** if $\sum a_k$ converges but $\sum |a_k|$ diverges.

Do the following series converge condititonally, converge absolutely, or diverge?

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

2. $\displaystyle\sum_{i=2}^{\infty}(-1)^{i}\frac{1}{i(\ln(i))^8}$

3. $\displaystyle\sum_{k=1}^{\infty}(-1)^{k+1}\frac{k^2}{k^2+1}$

4. $\displaystyle\sum_{k=1}^{\infty}\frac{\cos(k)}{k^4+1}$