① $-\frac{2}{3}, \frac{4}{5}, -\frac{6}{7}, \frac{8}{9}, \ldots$

$\uparrow_{n=1} \quad \uparrow_{n=2} \quad \uparrow_{n=3} \quad \uparrow_{n=4}$

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

② $c_n = \frac{3n}{\sqrt{4n^2+1}} \quad \forall n \geq 1.$

$c_n > 0$

As $n \to \infty$, $1 << n$.

then $\sqrt{4n^2+1} \to \sqrt{4n^2} = 2n$

$\therefore \lim_{n \to \infty} c_n = \frac{3}{2}$

notes

$4n^2+1 > 4n^2$

$\sqrt{4n^2+1} > \sqrt{4n^2}$

$\frac{f(n)}{\sqrt{4n^2+1}} < \frac{f(n)}{\sqrt{4n^2}}$

③ $e_n = \frac{(-1)^n}{n!}$

$$\lim_{n\to\infty} e_n = 0$$

$n \to \infty$ and $n! \to \infty$.

If you had $e_n = (-1)^n n!$, $\lim_{n\to\infty} e_n$ doesn't exist.

(will be back soon)