Q_1: Determine whether the sequence $\{a_n\}$ converges or diverges when $a_n = \frac{n-4}{4n+1}$, and if converges, find the limit.

$$\frac{\infty - 4}{4(\infty)+1} = \frac{\infty}{\infty} \text{ I.F}$$

$$\text{L.H} \quad \frac{1}{4} \rightarrow \boxed{\frac{1}{4}}$$

$$\lim_{n\to\infty} \frac{n-4}{4n+1} \text{ LH}$$

Q_2: Determining if the sequence $\{a_n\}$ converges, when

$$a_n = \frac{7n^4 - 2n^3 + 4}{2n^4 + 3n^2 + 3},$$

and if it does, find its limit.

$$\lim_{n\to\infty} \frac{7n^4 - 2n^3 + 4}{2n^4 + 3n^2 + 3} = \overbrace{\frac{\infty - \infty + 4}{\infty + \infty + 3}}^{\text{I.F}}$$

$$\text{LH} \quad \frac{28n^3 - 6n^2}{8n^3 + 6n} \quad \text{LH} \quad \frac{84n^2 - 12n}{24n^2 + 6} \quad \text{LH} \quad \frac{168n - 12}{48n}$$

$$\text{LH} \quad \frac{168}{48} = \boxed{7/2}$$

Q_3: Determine whether the sequence $\{a_n\}$ converges or diverges when $a_n = n(n-3)$, and if it converges, find the limit

$$n^2 - 3n \xrightarrow{\text{L.H}} 2n - 3$$

$$\infty - \infty = \text{I.F}$$

$$\boxed{\text{Diverges to } \infty}$$

Q_5: Determine whether the sequence $\{a_n\}$ converges or diverges when

$$a_n = n^2 e^{-5n},$$

and if it converges, find the limit.

$$\lim_{n\to\infty} n^2 e^{-5n} \rightarrow \infty^2 e^{-5\infty}$$

$$\infty \cdot 0$$

$$\text{L.H} \quad \lim_{n\to\infty} 2n \cdot -5e^{-5n} \quad \text{LH} \quad n \cdot -25n^{-5n} \quad \text{LH}$$

$$\lim_{n\to\infty} 125e^{-5n} = 0$$

Q_7: Determine if the sequence $\{a_n\}$ converges when

$$a_n = \frac{(2n+1)!}{(2n-1)!},$$

and if it converges, find the limit.

Doesn't converge; goes to infinity.

Q_8: Which of the following sequences converge?

A. $\left\{\frac{e^n + 5}{3n+4}\right\}$ $\quad \lim_{n\to\infty} \frac{e^n + 5}{3n+5} \rightarrow \frac{e^\infty + 5}{3\infty + 5} \rightarrow \frac{\infty}{\infty}$ LH

B. $\left\{\frac{5e^n}{2+e^n}\right\} \rightarrow \lim_{n\to\infty} \frac{5e^n}{2+e^n} = \frac{\infty}{\infty}$ L.H $\frac{5\cancel{e^n}}{\cancel{e^n}} \rightarrow \boxed{5}$