# Quiz 18

(a) $\sum_{n=1}^{\infty} \frac{n^2}{(5)^n}$ : Ratio: $\lim_{n\to\infty} \left| \frac{\frac{(n+1)^2}{(5)^{n+1}}}{\frac{n^2}{5^n}} \right| =$

$\lim_{n\to\infty} \left(\frac{n+1}{n}\right)^2 \cdot \frac{1}{5} = \frac{1}{5} < 1 \Rightarrow$ Series converges absolutely by Ratio test.

($\frac{n+1}{n} \to 1$)

(b) $\sum_{n=2}^{\infty} \left(\frac{4n}{5n-3}\right)^n$ Root: $\lim_{n\to\infty} \sqrt[n]{\left(\frac{4n}{5n-3}\right)^n}$

$= \lim_{n\to\infty} \left(\left(\frac{4n}{5n-3}\right)^n\right)^{1/n} = \lim_{n\to\infty} \frac{4n}{5n-3} = \frac{4}{5} < 1 \Rightarrow$

Series converges absolutely by Root test.

(c) $\sum_{n=1}^{\infty} \frac{n!}{8^n}$ Ratio: $\lim_{n\to\infty} \left| \frac{\frac{(n+1)!}{8^{n+1}}}{\frac{n!}{8^n}} \right| =$

$\lim_{n\to\infty} \frac{(n+1)!}{n!} \frac{8^n}{8^{n+1}} = \lim_{n\to\infty} \frac{n+1}{8} = +\infty > 1,$

$\therefore$ Series diverges by ratio test.