

STEP III, 2012 Q4

4 (i) Show that

$$\sum_{n=1}^{\infty} \frac{n+1}{n!} = 2e - 1$$

and

$$\sum_{n=1}^{\infty} \frac{(n+1)^2}{n!} = 5e - 1.$$

Sum the series $\sum_{n=1}^{\infty} \frac{(2n-1)^3}{n!}$.

(ii) Sum the series $\sum_{n=0}^{\infty} \frac{(n^2+1)2^{-n}}{(n+1)(n+2)}$, giving your answer in terms of natural logarithms.



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