

STEP III, 2007, Q2

- 2 (i) Show that $1.3.5.7. \dots .(2n - 1) = \frac{(2n)!}{2^n n!}$ and that, for $|x| < \frac{1}{4}$,

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

- (ii) By differentiating the above result, deduce that

$$\sum_{n=1}^{\infty} \frac{(2n)!}{n!(n-1)!} \left(\frac{6}{25}\right)^n = 60.$$

- (iii) Show that

$$\sum_{n=1}^{\infty} \frac{2^{n+1}(2n)!}{3^{2n}(n+1)!n!} = 1.$$



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