

## STEP II, 2005, Q6

- 6 (i) Write down the general term in the expansion in powers of  $x$  of  $(1-x)^{-1}$ ,  $(1-x)^{-2}$  and  $(1-x)^{-3}$ , where  $|x| < 1$ .

Evaluate  $\sum_{n=1}^{\infty} n2^{-n}$  and  $\sum_{n=1}^{\infty} n^22^{-n}$ .

- (ii) Show that  $(1-x)^{-\frac{1}{2}} = \sum_{n=0}^{\infty} \frac{(2n)!}{(n!)^2} \frac{x^n}{2^{2n}}$ , for  $|x| < 1$ .

Evaluate  $\sum_{n=0}^{\infty} \frac{(2n)!}{(n!)^2 2^{2n} 3^n}$  and  $\sum_{n=1}^{\infty} \frac{n(2n)!}{(n!)^2 2^{2n} 3^n}$ .



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