

Past paper practice : Summations FP1

1. Show that

$$\sum_{r=1}^n (2r - 1)^2 = \frac{1}{3}n(2n + 1)(2n - 1) \quad [5]$$

2. (i) Show that

$$\frac{1}{r!} - \frac{1}{(r+1)!} = \frac{r}{(r+1)!} \quad [1]$$

(ii) Hence find the sum of the first n terms of the series

$$\frac{1}{2!} + \frac{2}{3!} + \dots + \frac{r}{(r+1)!} + \dots \quad [3]$$

3. Show that

$$\frac{1}{r^2} - \frac{1}{(r+1)^2} = \frac{2r+1}{r^2(r+1)^2} \quad [1]$$

(ii) Hence find the sum of the first n terms of the series

$$\frac{3}{1^2 \cdot 2^2} + \frac{5}{2^2 \cdot 3^2} + \frac{7}{3^2 \cdot 4^2} + \dots + \frac{2r+1}{r^2(r+1)^2} + \dots \quad [3]$$

(iii) Show that the series is convergent and state the sum to infinity. [2]