1 **(a)** Use standard results from the list of formulae (MF19) to find $\sum_{r=1}^{n}\left(8r^3+12r^2+4r+3\right)$ in terms of n, simplifying your answer. [3]

(b) Show that

$$\frac{1}{r^4} - \frac{1}{(r+1)^4} = \frac{4r^3 + 6r^2 + 4r + 1}{r^4(r+1)^4}$$

and hence use the method of differences to find $\displaystyle\sum_{r=1}^{n} \frac{4r^3 + 6r^2 + 4r + 1}{r^4(r+1)^4}$. [5]

(c) Deduce the value of $\displaystyle\sum_{r=1}^{\infty} \frac{4r^3 + 6r^2 + 4r + 1}{r^4(r+1)^4}$. [1]