3 **(a)** Use standard results from the list of formulae (MF19) to show that

$$\sum_{r=1}^{n}(r+1)(r+2)(r+3) = \tfrac{1}{4}n\left(n^3 + bn^2 + cn + d\right),$$

where b, c and d are integers to be determined. [3]

(b) Express $\dfrac{2}{(r+1)(r+2)(r+3)}$ in partial fractions and hence use the method of differences to find

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

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