4. (i) Show that $\displaystyle\sum_{r=1}^{16}\left(3 + 5r + 2^r\right) = 131\,798$

(4)

(ii) A sequence $u_1, u_2, u_3, \ldots$ is defined by

$$u_{n+1} = \frac{1}{u_n}, \quad u_1 = \frac{2}{3}$$

Find the exact value of $\displaystyle\sum_{r=1}^{100} u_r$

(3)