5. **In this question you must show all stages of your working.**
Solutions relying entirely on calculator technology are not acceptable.

(a) Express $1 + \dfrac{2}{2r+5}$ as a single fraction in simplest form.

(1)

(b) Hence use the method of differences to determine an expression for

$$\sum_{r=1}^{n} \log_3\left(1 + \frac{2}{2r+5}\right)$$

giving the answer in the form $\log_3(\mathrm{f}(n))$ where f is a function to be found.

(3)

(c) Hence determine the value of n for which

$$\sum_{r=n+2}^{10n} \log_3\left(1 + \frac{2}{2r+5}\right) = 2$$

(4)

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Question 5 continued

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Question 5 continued

(Total for Question 5 is 8 marks)