4:

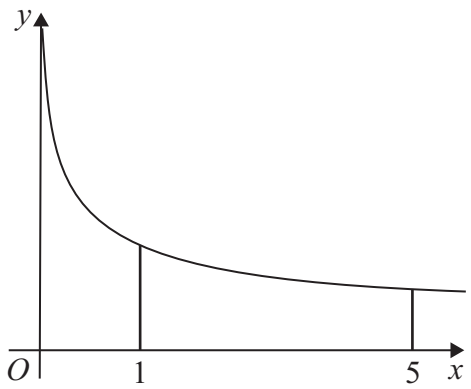

Figure 1

Figure 1 shows a sketch of part of the curve with equation

$$y = \log_3(x + 1) - \log_3 x$$

The point $P(a, 4)$ lies on the curve.

(a) Find the exact value of the constant a.

(*Solutions relying on calculator technology are not acceptable.*)

(4)

(b) Use the trapezium rule with 4 strips of equal width to estimate the value of

$$\int_1^5 \left(\log_3(x + 1) - \log_3 x\right) \mathrm{d}x$$

giving the answer in the form $\log_3 k$, where k is a constant to be found.

(4)

(c) Explain how the trapezium rule could be used to obtain a more accurate estimate for

$$\int_1^5 \left(\log_3(x + 1) - \log_3 x\right) \mathrm{d}x$$

(1)

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Question 4 continued

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Question 4 continued

(Total for Question 4 is 9 marks)

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

The sequence $u_1, u_2, u_3, \ldots$ is defined by

$$u_{n+1} = 1 - \frac{1}{u_n}$$

$$u_1 = 4$$

(a) Show that this is a periodic sequence of order 3

(3)

(b) Find the value of

$$\sum_{n=1}^{180} \left(5n + 3 + u_n\right)$$

(4)

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