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

(i) Given $y = \ln\left(2x^2 + 5\right)$ find $\dfrac{\mathrm{d}y}{\mathrm{d}x}$

(2)

(ii) A curve C has equation $y = \mathrm{f}(x)$ where

$$\mathrm{f}(x) = \frac{21x}{3x^2 + k} \qquad x \in \mathbb{R}$$

where k is a positive integer, $k > 1$

Given that

$$\int_1^k \mathrm{f}(x)\,\mathrm{d}x < 7\ln 8$$

find the greatest possible value of k

(5)

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Question 6 continued

(Total for Question 6 is 7 marks)

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

A curve C has equation

$$y = 2xe^{x^2+(3k-2)x}$$

where k is a constant.

Given that C has two distinct turning points, find the range of possible values of k.

(7)

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