4:

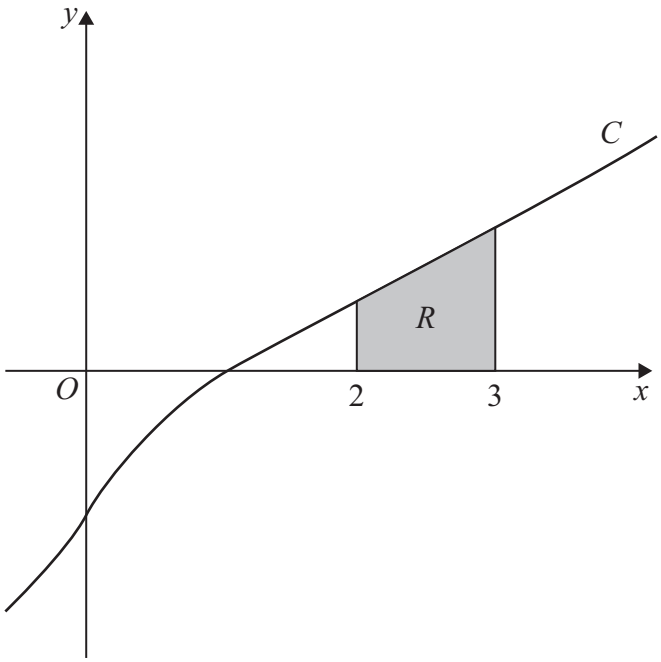

Figure 1

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

Figure 1 shows a sketch of part of the curve C with equation $y = \mathrm{g}(x)$ where

$$\mathrm{g}(x) = \frac{3x^3 - 5x^2 + 7x - 5}{x^2 + 1}$$

Given that

$$\frac{3x^3 - 5x^2 + 7x - 5}{x^2 + 1} \equiv Ax + B + \frac{Cx + D}{x^2 + 1}$$

(a) (i) find the values of the constants A, B and C

(ii) show that $D = 0$

(4)

The finite region R, shown shaded in Figure 1, is bounded by C, the x-axis and the lines with equations $x = 2$ and $x = 3$

(b) Find the exact area of region R using algebraic integration.
Give the answer in the form $\alpha + \ln\beta$ where α and β are constants to be found.

(4)

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Question 4 continued

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Question 4 continued

(Total for Question 4 is 8 marks)

5: **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

$$y = 5\cos 2x - 12\sin 2x \qquad -\pi < x < \pi$$

The point A with x coordinate $\frac{\pi}{3}$ lies on C.

(a) Use algebraic differentiation to find the gradient of the tangent to C at A.
Give the answer in simplest form.

(3)

(b) Express $5\cos 2x - 12\sin 2x$ in the form

$$R\cos(2x + \alpha)$$

where $R > 0$ and $0 < \alpha < \frac{\pi}{2}$

Find the exact value of R and find the value of α to 3 decimal places.

(3)

A point P lies on C.

Given that the gradient of the tangent to C at P is 6

(c) find the greatest possible value for the x coordinate of P.
Give the answer to 2 decimal places.

(4)

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