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

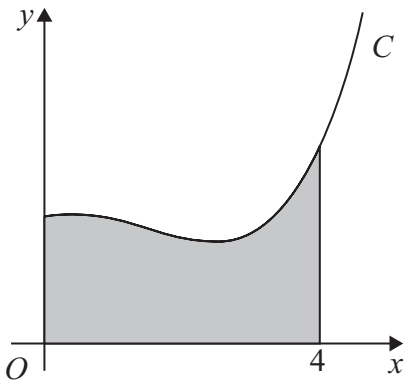


Figure 1

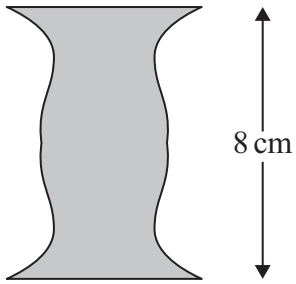


Figure 2

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

$$y = \cos x + \frac{1}{5}e^{x}$$

The finite region, shown shaded in Figure 1, is bounded by C, the y-axis, the x-axis and the line with equation $x = 4$

The region is rotated through 2π radians about the x-axis to form a solid S.

(a) Show that the exact volume of S is given by

$$\pi \int_0^4 \left(A + B\cos 2x + Ce^{x}\cos x + De^{2x} \right) dx$$

where A, B, C and D are constants to be found.

(4)

(b) Find $\int e^{x}\cos x \, dx$

(4)

Figure 2 represents a paperweight formed by joining two of these solids together.
The paperweight is 8 cm high.

(c) Using the answers to parts (a) and (b), find, by algebraic integration, the volume of the paperweight, giving your answer to 2 significant figures.

(4)

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Question 9 continued

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Question 9 continued

(Total for Question 9 is 12 marks)

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

Use proof by contradiction to show that for all angles x, where $90° < x < 180°$

$$\left| \frac{\cos 2x}{\cos x - \sin x} \right| < 1$$

(4)

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