

Figure 1

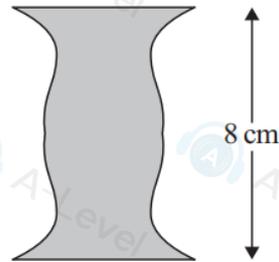


Figure 2

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

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

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)

4.

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

$$f(x) = \frac{5 + 17x - 10x^2}{x(1-x)(2x+1)} \quad x > 1$$

(a) Write $f(x)$ in the form

$$\frac{A}{x} + \frac{B}{1-x} + \frac{C}{2x+1}$$

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

(3)

(b) Hence, use algebraic integration to find the exact value of

$$\int_2^4 f(x) dx$$

Write your answer in the form $p \ln 2 + q \ln \left(\frac{3}{5}\right)$, where p and q are integers to be found.

(5)

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1.

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

Find

$$\int_0^{\frac{\pi}{6}} x \cos 3x dx$$

giving your answer in simplest form.

(5)

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