

# Core Mathematics C4 For Edexcel Advanced Level

## Paper L

**Time: 1 hour 30 minutes**

### *Instructions and Information*

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Candidates may use any calculator EXCEPT those with the facility for symbolic algebra, differentiation and/or integration.

Full marks may be obtained for answers to ALL questions.

The booklet 'Mathematical Formulae and Statistical Tables', available from Edexcel, may be used.

When a calculator is used, the answer should be given to an appropriate degree of accuracy.

### *Advice to Candidates*

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You must show sufficient working to make your methods clear to an examiner.  
Answers without working may gain no credit.

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1. Solve the differential equation

$$\frac{dy}{dx} = 2xy,$$

given that  $y = e$  when  $x = 1$ . Give your solution in the form  $y = f(x)$ . (4)

Sketch the graph of  $y = f(x)$ . (2)

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2.

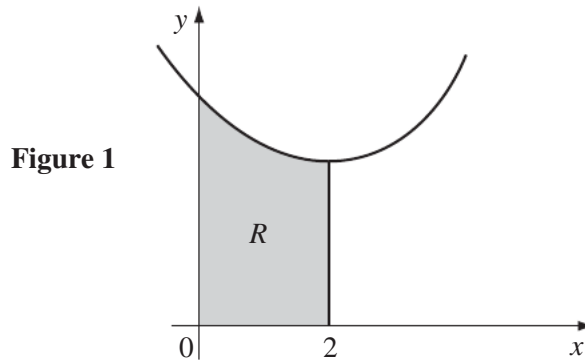


Figure 1 shows a sketch of the curve with parametric equations

$$x = t + 2, \quad y = t^2 + 1$$

The region  $R$  is bounded by the curve and the lines  $y = 0$ ,  $x = 0$  and  $x = 2$ .

When  $R$  is rotated through  $360^\circ$  about the  $x$ -axis the volume generated is  $V$ .

(a) Show that  $V = \pi \int_{t=-2}^{t=0} (t^2 + 1)^2 dt$  (5)

(b) Find the exact value of  $V$ . (2)

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3.

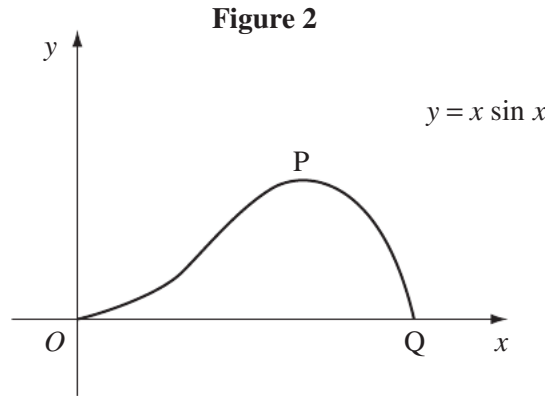


Figure 2 shows a sketch of part of the graph  $y = x \sin x$ .

The curve meets the  $x$ -axis at  $O$  and at  $Q$  and has a turning point at  $P$ .

- (a) Write down the coordinates of  $Q$ . (1)
- (b) Find an expression for the gradient of the curve and show that  $x$  coordinate of  $P$  lies between 2.02 and 2.04 radians. (4)
- (c) Find the area enclosed by the curve and the  $x$ -axis between  $O$  and  $Q$ . (4)
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4. (a) Show that  $17\left(1 - \frac{1}{17^2}\right)^{\frac{1}{2}} = n\sqrt{2}$ , (3)

where  $n$  is an integer, whose value is to be stated.

(b) Expand  $(1 - x)^{\frac{1}{2}}$  as a series of ascending powers of  $x$ , up to and including the term in  $x^2$ . (2)

(c) Use the first *two* terms of the expansion of  $\left(1 - \frac{1}{17^2}\right)^{\frac{1}{2}}$  to show that an approximate value of  $\sqrt{2}$  is  $\frac{577}{408}$ . (5)

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5. (a) Find  $\int x \cos kx \, dx$ , where  $k$  is a constant. (4)

(b) Show that  $\int_0^{\frac{\pi}{4}} x \cos 2x \, dx = \frac{1}{8}(\pi - 2)$ . (4)

(c) Evaluate  $\int_0^{\frac{\pi}{4}} 2x \cos^2 x \, dx$ , giving your answer in terms of  $\pi$ . (4)

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6. Referred to an origin  $O$ , the points  $A$  and  $B$  have position vectors

$$\begin{pmatrix} 1 \\ -1 \\ -5 \end{pmatrix} \quad \text{and} \quad \begin{pmatrix} 4 \\ 5 \\ 7 \end{pmatrix} \text{ respectively.}$$

(a) Find an equation of the line  $AB$ . (2)

(b) Show that the point  $P$  with position vector  $\begin{pmatrix} 2 \\ 1 \\ -1 \end{pmatrix}$  lies on  $AB$ . (2)

(c) Show that  $OP$  is perpendicular to  $AB$ . (2)

(d) Find the position vector of point  $Q$ , which lies on  $AB$ , such that  $|\vec{OQ}| = |\vec{OA}|$ . (4)

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7. The equation of a curve is

$$y - x^2 + xy = 8$$

(a) Find an expression for  $\frac{dy}{dx}$  in terms of  $x$  and  $y$ . (4)

(b) Find the gradient of the curve at the point  $(1, 4\frac{1}{2})$ . (1)

(c) Find the coordinates of the stationary points on the curve. (5)

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8.

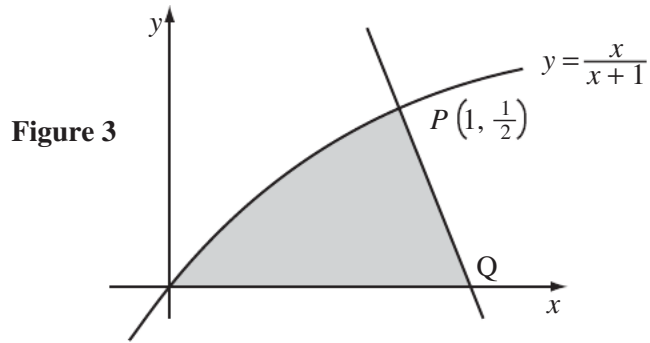


Figure 3 shows a sketch of the curve  $y = \frac{x}{x+1}$ . The normal to the curve at  $P\left(1, \frac{1}{2}\right)$  crosses the  $x$ -axis at the point  $Q$ .

(a) Find the equation of the line  $PQ$ . (3)

(b) Find the area of the shaded region bounded by the curve, the  $x$ -axis and the line  $PQ$ . (8)

**END**

**TOTAL 75 MARKS**