

Core Mathematics C4 For Edexcel Advanced Level

Paper L

Time: 1 hour 30 minutes

Instructions and Information

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

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)

2.

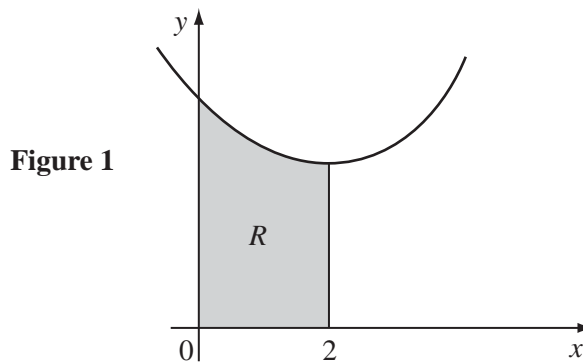


Figure 1 shows a sketch of the curve with parametric equations

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

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

When R is rotated through 360° 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)

3.

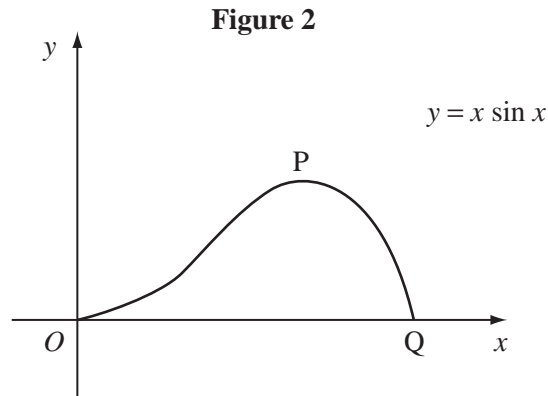


Figure 2 shows a sketch of part of the graph $y = x \sin x$.

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)
-

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)
-

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 π . (4)

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)

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)

8.

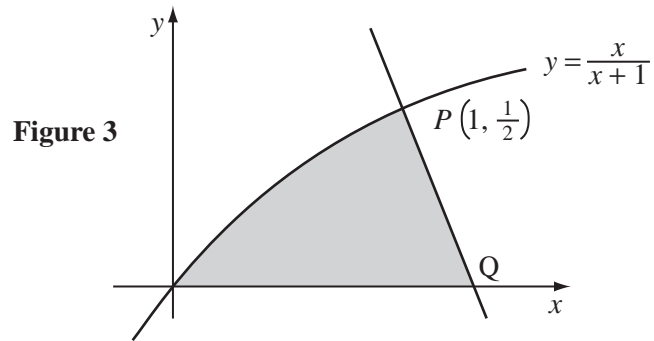


Figure 3 shows a sketch of the curve $y = \frac{x}{x+1}$. The normal to the curve at $P\left(1, \frac{1}{2}\right)$ crosses the x -axis at the point Q .

(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