# 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)**

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**2.**

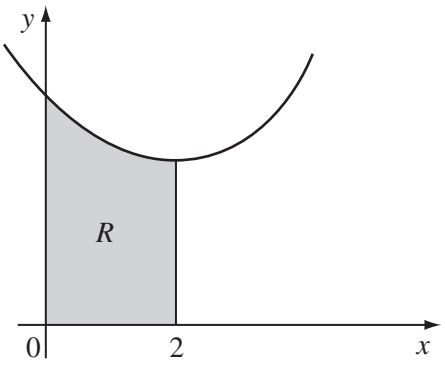


**Figure 1**

Figure 1 shows a sketch of the curve with parametric equations

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

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)**

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**3.**

**Figure 2**

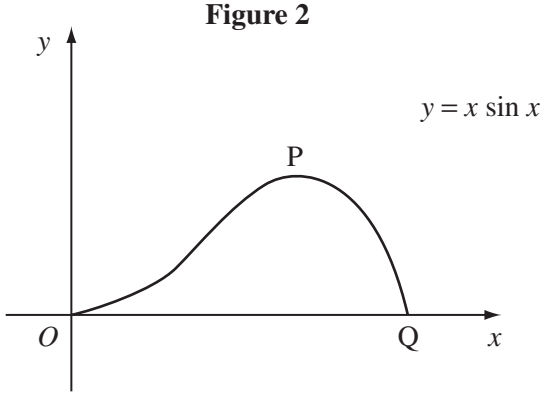


Figure 2 shows a sketch of part of the graph $y = x \sin x$.

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 $\int x \cos kx \, \mathrm{d}x$, where $k$ is a constant. **(4)**

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

(*c*) Evaluate $\int_0^{\frac{\pi}{4}} 2x \cos^2 x \, \mathrm{d}x$, 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 $\left|\overrightarrow{OQ}\right| = \left|\overrightarrow{OA}\right|$. **(4)**

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**7.** The equation of a curve is

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

(*a*) Find an expression for $\frac{\mathrm{d}y}{\mathrm{d}x}$ 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.**

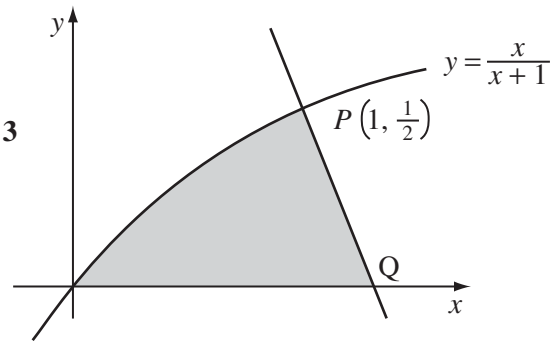


**Figure 3**

Figure 3 shows a sketch of the curve $y = \dfrac{x}{x+1}$. The normal to the curve at $P\left(1, \dfrac{1}{2}\right)$ 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)**

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**END** **TOTAL 75 MARKS**

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