Core Mathematics C4 For Edexcel Advanced Level

Paper C
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. (*a*) Express y, where $y = \dfrac{5x + 7}{(x + 1)(x + 2)}$, in partial fractions

(3)

(*b*) Hence find the value of $\dfrac{\mathrm{d}^2y}{\mathrm{d}x^2}$ when $x = 1$.

(3)

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2. Water is flowing into a container at a constant rate of 24 $\text{cm}^3 s^{-1}$. When the depth of water in the container is h cm the volume, V cm^3, of water in the container is given by $V = 36h^2$.

Find the rate at which the depth of water is increasing when $h = 2$.

(5)

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3. (*a*) Expand $(1 + 2x)^{-\frac{1}{2}}$ in ascending powers of x, up to and including the term in x^3, simplifying the coefficients.

(4)

(*b*) State the set of values of x for which the expansion is valid.

(1)

(*c*) In the expansion of

$$(1 + ax)(1 + 2x)^{-\frac{1}{2}},$$

the coefficient of x is 3. Find the value of the constant a and find the coefficient of x^3.

(4)

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4. The parametric equations of a curve are

$$x = 2\theta + \sin\theta, \quad y = \cos\theta, \quad 0 \leq \theta \leq 2\pi.$$

(*a*) Show that the equation of the tangent to the curve, where $\theta = \dfrac{\pi}{2}$, is $2y + x = \pi + 1$.

(4)

(*b*) Find the coordinates of the stationary points on the curve.

(4)

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5. (i) Use the trapezium rule with 3 trapeziums to find the value of

$$\int_0^3 \ln(1+\sin x)\mathrm{d}x,$$

giving your answer to 3 significant figures. **(5)**

(ii) Hence find $\int_0^3 \ln(1+\sin x)^5\mathrm{d}x$ correct to 2 significant figures. **(2)**

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6. The number of fish N in a pond is given by the formula

$$N = Ae^{-kt},$$

where t is the time in days measured from a time when $N = 5000$.

(a) Write down the value of A. **(2)**

(b) Given that $N = 4000$ when $t = 4$, show that $k = \frac{1}{4}\ln\frac{5}{4}$. **(4)**

(c) Find the value of N when $t = 8$. **(3)**

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7. (a) Factorise $\left(x^2 - 4x + 3\right)$ and hence express $\dfrac{2x}{x^2 - 4x + 3}$ in partial fractions. **(3)**

(b) Solve the differential equation

$$\frac{\mathrm{d}y}{\mathrm{d}x} = \frac{2xy}{x^2 - 4x + 3},$$

given that $y = \frac{1}{3}$ when $x = 4$. Give your answer in the form $y = \mathrm{f}(x)$. **(6)**

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8. (*a*) The line l passes through the points with coordinates (1, 6, 1) and (4, 0, −8). Find a vector equation for the line l.

(2)

(*b*) The line m has equation $r = \begin{pmatrix} 4 \\ 8 \\ -4 \end{pmatrix} + \mu \begin{pmatrix} 1 \\ 2 \\ -1 \end{pmatrix}$ and intersects the line l. Find the coordinates of the point of intersection of l and m.

(4)

(*c*) The line n has direction $\begin{pmatrix} 5 \\ k \\ 5 \end{pmatrix}$, where k is a constant. The angle between m and n is 60°. Find the positive value of k.

(3)

9.

Figure 1

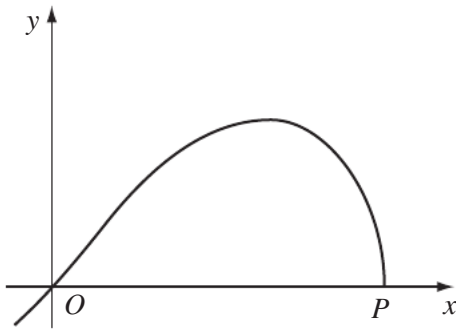

Figure 1 shows a sketch of the graph of $y = 2x\sqrt{1-4x}$. The curve meets the x-axis at the origin and the point P.

(*a*) Write down the coordinates of P.

(1)

(*b*) Show that the coordinates of the turning point on the curve are $\left(\frac{1}{6}, \frac{1}{3\sqrt{3}}\right)$

(5)

(*c*) Use the substitution $u = 1 - 4x$ to find the area enclosed by the curve and the x-axis.

(7)

END **TOTAL 75 MARKS**