

# Core Mathematics C4                      For Edexcel Advanced Level

## Paper C

**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. (a) Express  $y$ , where  $y = \frac{5x + 7}{(x + 1)(x + 2)}$ , in partial fractions (3)

(b) Hence find the value of  $\frac{d^2y}{dx^2}$  when  $x = 1$ . (3)

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

$$\int_0^3 \ln(1 + \sin x) dx,$$

giving your answer to 3 significant figures.

(5)

- (ii) Hence find  $\int_0^3 \ln(1 + \sin x)^5 dx$  correct to 2 significant figures.

(2)

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)

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

(3)

- (b) Solve the differential equation

$$\frac{dy}{dx} = \frac{2xy}{x^2 - 4x + 3},$$

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

(6)

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  $60^\circ$ . Find the positive value of  $k$ . (3)
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9.

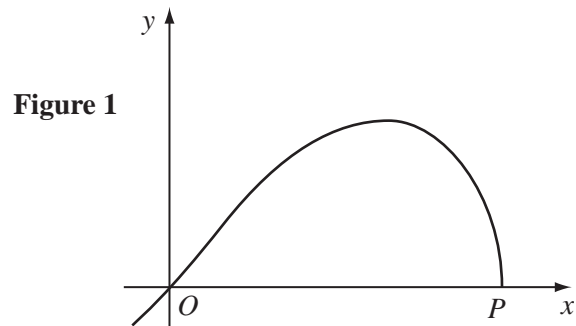


Figure 1 shows a sketch of the graph of  $y = 2x\sqrt{1-4x}$ . The curve meets the  $x$ -axis at the origin and the point  $P$ .

- (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)
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END

TOTAL 75 MARKS