

**Elmwood Press**  
**Core Mathematics C4**  
**Paper A**  
**(Question Paper)**

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# Core Mathematics C4 Advanced Level

# For Edexcel

## Paper A

**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. 
$$f(x) = \frac{3x}{(x-1)(x+2)}.$$

(a) Express  $f(x)$  in partial fractions. (3)

(b) Evaluate  $\int_2^3 f(x)dx.$  (4)

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2. A curve has parametric equations

$$x = 1 - t^3, \quad y = 1 + t^2.$$

(a) Find the value of the parameter  $t$  at the point  $(2, 2).$  (1)

(b) Find the equation of the tangent to the curve at  $(2, 2).$  (4)

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3.

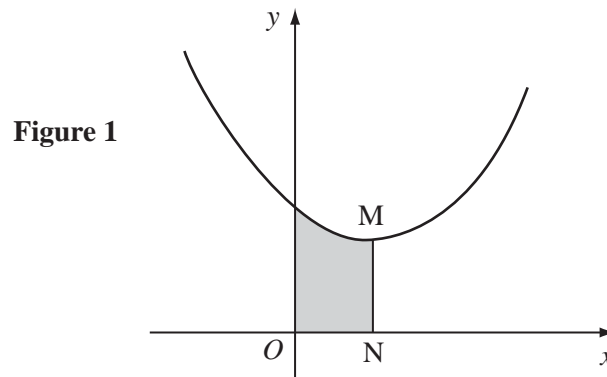


Figure 1 shows the curve with equation

$$y = e^x - 3x.$$

The minimum point on the curve is  $M$  and the line  $MN$  is parallel to the  $y$ -axis.

(a) Find the  $x$ -coordinate of  $M.$  (2)

(b) Show that the area of the shaded region can be written as

$$a - b(\ln 3)^2,$$

where the constants  $a$  and  $b$  are to be determined. (5)

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4. A curve has equation

$$4x^2 + 3y^2 - 2xy = 32.$$

(a) Find an expression for  $\frac{dy}{dx}$  in terms of  $x$  and  $y$ , simplifying your answer. (6)

(b) Find the gradient of the curve at the point  $(2, 4)$  and hence find the equation of a tangent to the curve at that point. (3)

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5. In the series expansion of  $(1 + kx)^n$ , the coefficients of  $x$  and  $x^2$  are  $-6$  and  $27$  respectively. Find

(a) the value of  $k$  and the value of  $n$ , (4)

(b) the coefficient of  $x^3$  in the expansion, (3)

(c) the set of values of  $x$  for which the expansion is valid. (1)

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6. (a) Solve the differential equation

$$x^2 \frac{dy}{dx} = y^2(4x^5 - 1),$$

given that  $y = \frac{1}{2}$  when  $x = 1$ . (6)

(b) Use the substitution  $t = 1 + x^2$  to show that

$$\int_0^2 \frac{x^3}{(1 + x^2)^{\frac{1}{2}}} dx = \frac{2}{3}(1 + \sqrt{5}). \quad (7)$$

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7.

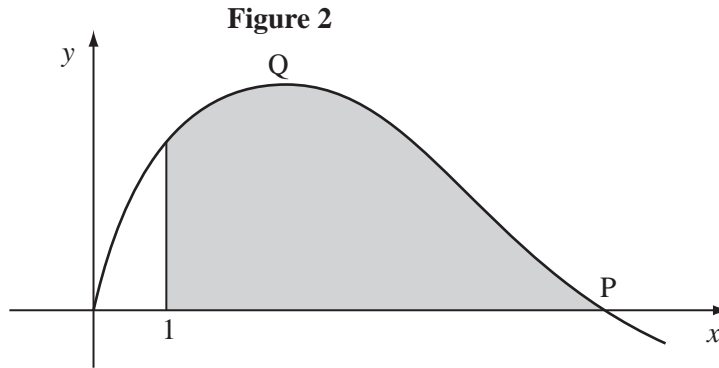


Figure 2 shows the graph of  $y = 2x - x \ln x$ . The graph crosses the  $x$ -axis at the point  $P$  and has a turning point at  $Q$ .

(a) Find the coordinates of  $Q$ .

Verify that  $\frac{d^2y}{dx^2} < 0$  at this point. (4)

(b) Show that the coordinates of  $P$  are  $(e^2, 0)$ . (2)

(c) (i) Show that  $\int_1^{e^2} x \ln x \, dx = \frac{3e^4 + 1}{4}$ . (6)

(ii) Find the area of the shaded region bounded by the curve, the  $x$ -axis and the line  $x = 1$ . (3)

8. The position vectors of  $A$ ,  $B$ ,  $C$  and  $D$  with respect to the origin are:

$$\begin{pmatrix} A \\ 6 \\ 2 \\ 0 \end{pmatrix} \quad \begin{pmatrix} B \\ 2 \\ 4 \\ 1 \end{pmatrix} \quad \begin{pmatrix} C \\ 9 \\ 3 \\ 0 \end{pmatrix} \quad \begin{pmatrix} D \\ 4 \\ 8 \\ 2 \end{pmatrix}$$

(a) The line through  $B$  and  $C$  is denoted by  $l_1$  and the line through  $A$  and  $D$  is denoted by  $l_2$ . Show that  $l_1$  has equation

$$\mathbf{r} = \begin{pmatrix} 2 \\ 4 \\ 1 \end{pmatrix} + \lambda \begin{pmatrix} 7 \\ -1 \\ -1 \end{pmatrix} \quad (2)$$

(b) Find an equation for  $l_2$ . (2)

(c) Find the position vector of the point where  $l_1$  and  $l_2$  intersect. (4)

(d) Calculate the acute angle between  $l_1$  and  $l_2$ , correct to one decimal place. (3)

END

TOTAL 75 MARKS