

Core Mathematics C4 Advanced Level

For Edexcel

Paper G

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. The parametric equations of a curve are

$$x = \cos t, y = 2 \sin t, \text{ for } 0 \leq t \leq 2\pi.$$

(a) Find the gradient of the curve at the point where $t = \frac{\pi}{2}$. (2)

(b) Find the cartesian equation of the curve. (3)

2. (a) Express

$$\frac{7x^2 + 2x - 12}{(x - 2)(2x + 1)(x + 2)}$$

in partial fractions (4)

(b) Hence show that $\int_3^4 \frac{7x^2 + 2x - 12}{(x - 2)(2x + 1)(x + 2)} dx = \ln\left(\frac{12}{5}\right) + \frac{3}{2} \ln\left(\frac{9}{7}\right)$ (5)

3. (a) Expand $(1 + ax)^6$ in ascending powers of x up to and including the term in x^2 . (3)

(b) The coefficients of x and x^2 in the expansion of

$$(1 + bx)(1 + ax)^6$$

are -9 and 24 respectively.

Find the values of a and b , given that a is an integer. (7)

4. (a) Work out $\int x \sec^2 x \, dx$. (4)

(b) Given that

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

and that $y = 4$ when $x = 0$, show that when $x = \frac{\pi}{4}$ the value of y is

$$\left(\frac{\pi}{8} + 2 - \frac{1}{4} \ln 2\right)^2. \quad (6)$$

5. (a) Use the trapezium rule, with the number of trapeziums given below, to find approximate values for

$$\int_1^3 \frac{12}{x} dx,$$

(i) using two trapeziums, (2)

(ii) using four trapeziums. (2)

- (b) Work out the exact value for this integral. For each case in part (a) work out the error when using the trapezium rule as a percentage of the exact value, giving your answers correct to one decimal place. (5)
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6. Relative to an origin O , the position vectors of the points A and B are $\mathbf{i} - 2\mathbf{j} + 8\mathbf{k}$ and $3\mathbf{i} + 3\mathbf{j} + m\mathbf{k}$ respectively, where m is a constant.

The point C is such that $OABC$ is a rectangle.

(a) Find the value of m . (4)

(b) Write down the position vector of C . (1)

(c) Find a vector equation of the line AC . (2)

(d) Calculate the acute angle between the diagonals of $OABC$, giving your answer to the nearest degree. (3)

7. A curve has the equation

$$y = 12x - e^{\frac{1}{2}x}.$$

(a) Show that the x -coordinate of the stationary point on the curve is $2 \ln 24$. (3)

(b) Find the corresponding y -coordinate in the form $a \ln 24 + b$, where a and b are integers to be determined. (1)

(c) Find an expression for $\frac{d^2y}{dx^2}$ and hence determine the nature of the stationary point. (1)

(d) Show that the area of the region enclosed by the curve, the x -axis and lines $x = 2$ and $x = 4$ is $72 + 2e(1 - e)$. (5)

8. The equation of a curve is $2x^2 - xy + y^2 = 56$.

(a) Find $\frac{dy}{dx}$ in terms of x and y . (4)

(b) Find the equation of the normal to the curve at the point $(2, -6)$. (3)

(c) Find the coordinates of the two points on the curve at which the tangents to the curve are parallel to the x -axis. (5)

END

TOTAL 75 MARKS