

**Elmwood Press**  
**Core Mathematics C3**  
**Paper E**  
**(Question Paper)**

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# Core Mathematics C3 Advanced Level

# For Edexcel

## Paper E

**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 in the form  $Ax + B$ , where  $A$  and  $B$  are to be found,

$$\frac{2x^2 - x - 3}{x + 1} + \frac{x^2 - 4}{x + 2}. \quad (4)$$

- (b) Hence solve the equation

$$\frac{2x^2 - x - 3}{x + 1} + \frac{x^2 - 4}{x + 2} = x^2 - 9 \quad (2)$$

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2. Given that  $x = \sin^{-1}\left(-\frac{3}{5}\right)$ , find the value of

(a)  $\cos x$  (4)

(b)  $\cos 2x$  (2)

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3. (a) Sketch the graph of  $y = e^{ax+b}$ , given  $a$  and  $b > 0$ .

Mark the coordinates of the point where the graph meets either the  $x$ -axis or the  $y$ -axis. (2)

(b) Given that when  $x = 0$ ,  $y = 4$ , find the exact value of  $b$ . (1)

(c) Given further that the gradient at the point whose  $x$  coordinate is 2 is equal to  $10e^5$ , find the value of  $a$ . (5)

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4. Differentiate the following functions with respect to  $x$ .

(a)  $\cos^2 x$  (3)

(b)  $\frac{\ln x}{x}$  (3)

(c)  $x^2 e^x$  (4)

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5. (a) Prove that

$$\sin x + \cot x \cos x = \operatorname{cosec} x. \quad (3)$$

- (b) Hence or otherwise find the values of  $x$ ,  $0 < x < 180^\circ$ , which satisfy the equation

$$\cot x \cos x = 3,$$

giving your answers to 1 decimal place. (4)

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6. Sketch the graphs of  $y = \sin x$  and  $y = x^3 - 1$ , for  $0 < x < 2\pi$ , indicating clearly the coordinates of the points where the curves meet the axes. (4)

(a) Using your graph, explain why there is only one solution to the equation

$$\sin x - x^3 + 1 = 0. \quad (1)$$

(b) If  $\alpha$  is such that

$$\sin \alpha - \alpha^3 + 1 = 0,$$

prove that  $0 < \alpha < \frac{\pi}{2}$ . (2)

(c) Use the iteration

$$x_{n+1} = \sqrt[3]{\sin x_n + 1} \quad \text{and} \quad x_0 = 1$$

to obtain the values of  $x_1, x_2, x_3, x_4$  and hence find the value of  $\alpha$  to 4 decimal places. (3)

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7. Given  $a > 0$ , sketch the graphs of

$$y = ax \quad \text{and} \quad y = |6a^2 - x^2|$$

on the same pair of axes. Indicate clearly the points of intersection of the graphs with the coordinate axes. (4)

(a) Show that the point  $(2a, 2a^2)$  lies on both the line and the curve. (1)

(b) Write down an equation that will give the  $x$  coordinate of the second point of intersection of the line and the curve. (2)

(c) Solve the equation to find the coordinates of the second point of intersection. (4)

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8. (a) Express  $f(x) = \sqrt{3} \sin x + \cos x$  in the form  $R \cos(x - \alpha)$ , where  $R > 0$  and  $0 < \alpha < \frac{\pi}{2}$ . The values of  $R$  and  $\alpha$  are to be given exactly. (4)

(b) Hence solve the equation

$$\sqrt{3} \sin x + \cos x = \sqrt{2}, \quad \text{where} \quad 0 < x < \pi. \quad (6)$$

(c) Sketch the graph of  $y = f(x)$  for  $0 \leq x \leq 2\pi$ . (4)

(d) You are given that  $y = 2f(x) + 1$ . State the maximum and minimum values of  $y$ . (3)

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END

TOTAL 75 MARKS