

# Core Mathematics C3 Advanced Level

# For Edexcel

## 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

$$\frac{1}{x+4} - \frac{2(x-1)}{3x^2+14x+8}$$

as a single fraction in its simplest form. (4)

(b) Find the value of  $x$  for which

$$\frac{1}{x+4} - \frac{2(x-1)}{3x^2+14x+8} = \frac{1}{x-5} \quad (3)$$

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2. Solve each equation giving your answers in exact form.

(a)  $\ln(4x+1) = 2$  (3)

(b)  $3e^x + 2e^{-x} = 7$ . (5)

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3. The functions  $f$  and  $g$  are defined

$$f: x \mapsto (x+4)^2, \quad x \in \mathbb{R}$$

$$g: x \mapsto (8-x), \quad x > 0$$

(a) Find the range of each function. (4)

(b) Prove algebraically that there are no values of  $x$  which satisfy

$$f(x) = g(x). \quad (4)$$

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4.  $f(x) = \frac{1}{2}x^2 - \ln(x-3)^4, \quad x \in \mathbb{R}, \quad x > 3.$

(a) Find an expression for  $f'(x)$ . (3)

(b) Find the range of values for  $x$  for which the function  $f(x)$  is a decreasing function. (5)

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5. (a) Using the formulae for  $\sin(A \pm B)$  and  $\cos(A \pm B)$ ,

show that 
$$\frac{\cos(A-B) - \cos(A+B)}{\sin(A+B) - \sin(A-B)} = \tan A \quad (6)$$

(b) Using the result of (a) and the exact values of  $\sin 60^\circ$  and  $\cos 60^\circ$ ,

find an exact value for  $\tan 75^\circ$  in its simplest form. (4)

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6. (a) On the same axes sketch the graphs of  $y = \frac{1}{x-3}$  and  $y = e^x$ . (4)

(b) Explain how your graphs show that there is only one solution to the equation

$$e^x(x-3) = 1. \quad (2)$$

(c) Using the iteration  $x_{n+1} = e^{-x_n} + 3$ , with  $x_0 = 3$ , find the value of  $x$  to 3 d.p. (2)

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7. Differentiate with respect to  $x$ ,

(a)  $x^2e^{-3x}$  (3)

(b)  $\sec^2 x$  (3)

(c)  $\frac{5x}{\sin x}$  (3)

(d) Given that

$$x = (\ln y) \cos y,$$

find  $\frac{dy}{dx}$  in terms of  $y$ . (4)

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8. (a) Show that  $y = 6 \sin 2x + 4 \cos 2x$  satisfies the equation

$$\frac{d^2y}{dx^2} + 4y = 0. \quad (4)$$

(b) The expression

$$6 \sin 2x + 4 \cos 2x$$

can be written as  $R \sin(2x + \alpha)$ , where  $R$  and  $\alpha$  are positive constants,  $0 < \alpha < \pi/2$ . Find the values of  $R$  and  $\alpha$ , correct to 3 decimal places. (4)

(c) What is the smallest positive value of  $x$  where  $y$  has a point of inflection? (5)

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END

TOTAL 75 MARKS