

GCE Examinations  
Advanced Subsidiary

# Core Mathematics C1

Paper G

Time: 1 hour 30 minutes

## *Instructions and Information*

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Candidates may NOT use a calculator in this paper

Full marks may be obtained for answers to ALL questions.

Mathematical formulae and statistical tables are available.

This paper has nine questions.

## *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. Solve the equation

$$9^x = 3^{x+2}. \quad (3)$$


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2. Solve the inequality

$$x(2x + 1) \leq 6. \quad (4)$$


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3. The curve  $C$  has the equation  $y = (x - a)^2$  where  $a$  is a constant.

Given that

$$\frac{dy}{dx} = 2x - 6,$$

- (a) find the value of  $a$ , (4)  
 (b) describe fully a single transformation that would map  $C$  onto the graph of  $y = x^2$ . (2)
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4. (a) Find in exact form the coordinates of the points where the curve  $y = x^2 - 4x + 2$  crosses the  $x$ -axis. (4)  
 (b) Find the value of the constant  $k$  for which the straight line  $y = 2x + k$  is a tangent to the curve  $y = x^2 - 4x + 2$ . (3)
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5. The curve  $C$  with equation  $y = (2 - x)(3 - x)^2$  crosses the  $x$ -axis at the point  $A$  and touches the  $x$ -axis at the point  $B$ .

- (a) Sketch the curve  $C$ , showing the coordinates of  $A$  and  $B$ . (3)  
 (b) Show that the tangent to  $C$  at  $A$  has the equation

$$x + y = 2. \quad (7)$$


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6.  $f(x) = 9 + 6x - x^2$ .

- (a) Find the values of  $A$  and  $B$  such that

$$f(x) = A - (x + B)^2. \quad (4)$$

- (b) State the maximum value of  $f(x)$ . (1)

- (c) Solve the equation  $f(x) = 0$ , giving your answers in the form  $a + b\sqrt{2}$  where  $a$  and  $b$  are integers. (3)

- (d) Sketch the curve  $y = f(x)$ . (2)
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7. (a) An arithmetic series has a common difference of 7.

Given that the sum of the first 20 terms of the series is 530, find

- (i) the first term of the series,  
(ii) the smallest positive term of the series. (5)

- (b) The terms of a sequence are given by

$$u_n = (n + k)^2, \quad n \geq 1,$$

where  $k$  is a positive constant.

Given that  $u_2 = 2u_1$ ,

- (i) find the value of  $k$ ,  
(ii) show that  $u_3 = 11 + 6\sqrt{2}$ . (6)
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*Turn over*

8. The straight line  $l_1$  passes through the point  $A(-2, 5)$  and the point  $B(4, 1)$ .
- (a) Find an equation for  $l_1$  in the form  $ax + by = c$ , where  $a$ ,  $b$  and  $c$  are integers. (4)

The straight line  $l_2$  passes through  $B$  and is perpendicular to  $l_1$ .

- (b) Find an equation for  $l_2$ . (3)

Given that  $l_2$  meets the  $y$ -axis at the point  $C$ ,

- (c) show that triangle  $ABC$  is isosceles. (4)
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9. The curve  $C$  has the equation  $y = f(x)$  where

$$f'(x) = 1 + \frac{2}{\sqrt{x}}, \quad x > 0.$$

The straight line  $l$  has the equation  $y = 2x - 1$  and is a tangent to  $C$  at the point  $P$ .

- (a) State the gradient of  $C$  at  $P$ . (1)
- (b) Find the  $x$ -coordinate of  $P$ . (3)
- (c) Find an equation for  $C$ . (6)
- (d) Show that  $C$  crosses the  $x$ -axis at the point  $(1, 0)$  and at no other point. (3)
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**END**