

GCE Examinations  
Advanced Subsidiary

## **Core Mathematics C1**

Paper K

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 ten 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. Find the value of  $y$  such that

$$4^{y+3} = 8. \quad (3)$$

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2. Find

$$\int \left( 3x^2 + \frac{1}{2x^2} \right) dx. \quad (4)$$

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- 3.



**Figure 1**

Figure 1 shows the rectangles  $ABCD$  and  $EFGH$  which are similar.

Given that  $AB = (3 - \sqrt{5})$  cm,  $AD = \sqrt{5}$  cm and  $EF = (1 + \sqrt{5})$  cm, find the length  $EH$  in cm, giving your answer in the form  $a + b\sqrt{5}$  where  $a$  and  $b$  are integers. (6)

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4. (a) Sketch on the same diagram the curves  $y = x^2 - 4x$  and  $y = -\frac{1}{x}$ . (4)

(b) State, with a reason, the number of real solutions to the equation

$$x^2 - 4x + \frac{1}{x} = 0. \quad (2)$$

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5. (a) By completing the square, find in terms of the constant  $k$  the roots of the equation

$$x^2 + 2kx + 4 = 0. \quad (4)$$

(b) Hence find the exact roots of the equation

$$x^2 + 6x + 4 = 0. \quad (2)$$

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6. (a) Evaluate

$$\sum_{r=1}^{50} (80 - 3r). \quad (3)$$

- (b) Show that

$$\sum_{r=1}^n \frac{r+3}{2} = kn(n+7),$$

where  $k$  is a rational constant to be found. (4)

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7. Solve the simultaneous equations

$$x - 3y + 7 = 0$$

$$x^2 + 2xy - y^2 = 7 \quad (7)$$

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8. Given that

$$\frac{dy}{dx} = \frac{x^3 - 4}{x^3}, \quad x \neq 0,$$

- (a) find  $\frac{d^2y}{dx^2}$ . (3)

Given also that  $y = 0$  when  $x = -1$ ,

- (b) find the value of  $y$  when  $x = 2$ . (6)
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*Turn over*

9. A curve has the equation  $y = (\sqrt{x} - 3)^2$ ,  $x \geq 0$ .

(a) Show that  $\frac{dy}{dx} = 1 - \frac{3}{\sqrt{x}}$ . (4)

The point  $P$  on the curve has  $x$ -coordinate 4.

(b) Find an equation for the normal to the curve at  $P$  in the form  $y = mx + c$ . (5)

(c) Show that the normal to the curve at  $P$  does not intersect the curve again. (4)

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10. The straight line  $l$  has gradient 3 and passes through the point  $A (-6, 4)$ .

(a) Find an equation for  $l$  in the form  $y = mx + c$ . (2)

The straight line  $m$  has the equation  $x - 7y + 14 = 0$ .

Given that  $m$  crosses the  $y$ -axis at the point  $B$  and intersects  $l$  at the point  $C$ ,

(b) find the coordinates of  $B$  and  $C$ , (4)

(c) show that  $\angle BAC = 90^\circ$ , (4)

(d) find the area of triangle  $ABC$ . (4)

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**END**