

GCE Examinations  
Advanced Subsidiary

# Core Mathematics C1

Paper H

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.



*Written by Shaun Armstrong*

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1. Evaluate

$$\sum_{r=1}^{30} (3r + 4). \quad (3)$$

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2. (a) Express  $x^2 + 6x + 7$  in the form  $(x + a)^2 + b$ . (3)

(b) State the coordinates of the minimum point of the curve  $y = x^2 + 6x + 7$ . (1)

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3. The straight line  $l_1$  has the equation  $3x - y = 0$ .  
The straight line  $l_2$  has the equation  $x + 2y - 4 = 0$ .

(a) Sketch  $l_1$  and  $l_2$  on the same diagram, showing the coordinates of any points where each line meets the coordinate axes. (3)

(b) Find, as exact fractions, the coordinates of the point where  $l_1$  and  $l_2$  intersect. (3)

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4. Find the pairs of values  $(x, y)$  which satisfy the simultaneous equations

$$\begin{aligned} 3x^2 + y^2 &= 21 \\ 5x + y &= 7 \end{aligned} \quad (7)$$

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5. (a) Sketch on the same diagram the graphs of  $y = (x - 1)^2(x - 5)$  and  $y = 8 - 2x$ .

Label on your diagram the coordinates of any points where each graph meets the coordinate axes. (5)

(b) Explain how your diagram shows that there is only one solution,  $\alpha$ , to the equation

$$(x - 1)^2(x - 5) = 8 - 2x. \quad (1)$$

(c) State the integer,  $n$ , such that

$$n < \alpha < n + 1. \quad (1)$$

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6. The curve with equation  $y = x^2 + 2x$  passes through the origin,  $O$ .

(a) Find an equation for the normal to the curve at  $O$ . (5)

(b) Find the coordinates of the point where the normal to the curve at  $O$  intersects the curve again. (3)

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7. Given that

$$y = \sqrt{x} - \frac{4}{\sqrt{x}},$$

(a) find  $\frac{dy}{dx}$ , (3)

(b) find  $\frac{d^2y}{dx^2}$ , (2)

(c) show that

$$4x^2 \frac{d^2y}{dx^2} + 4x \frac{dy}{dx} - y = 0. \quad (3)$$

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8. (a) Prove that the sum of the first  $n$  positive integers is given by

$$\frac{1}{2}n(n+1). \quad (4)$$

(b) Hence, find the sum of

(i) the integers from 100 to 200 inclusive,

(ii) the integers between 300 to 600 inclusive which are divisible by 3. (5)

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**Turn over**

9. (a) Express each of the following in the form  $p + q\sqrt{2}$  where  $p$  and  $q$  are rational.

(i)  $(4 - 3\sqrt{2})^2$

(ii)  $\frac{1}{2 + \sqrt{2}}$  (5)

(b) (i) Solve the equation

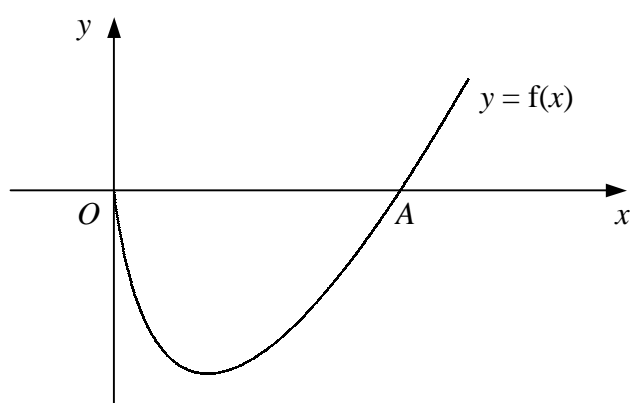
$$y^2 + 8 = 9y.$$

(ii) Hence solve the equation

$$x^3 + 8 = 9x^{\frac{3}{2}}. \quad (5)$$

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10.



**Figure 1**

Figure 1 shows the curve with equation  $y = f(x)$ .

The curve meets the  $x$ -axis at the origin and at the point  $A$ .

Given that

$$f'(x) = 3x^{\frac{1}{2}} - 4x^{-\frac{1}{2}},$$

(a) find  $f(x)$ , (5)

(b) find the coordinates of  $A$ . (2)

The point  $B$  on the curve has  $x$ -coordinate 2.

(c) Find an equation for the tangent to the curve at  $B$  in the form  $y = mx + c$ . (6)

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**END**

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Paper I

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1. The  $n$ th term of a sequence is defined by

$$u_n = n^2 - 6n + 11, \quad n \geq 1.$$

Given that the  $k$ th term of the sequence is 38, find the value of  $k$ . (3)

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2. Find

$$\int (4x^2 - \sqrt{x}) \, dx. \quad (3)$$

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3. Find the integer  $n$  such that

$$4\sqrt{12} - \sqrt{75} = \sqrt{n}. \quad (4)$$

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4. (a) Evaluate

$$(36^{\frac{1}{2}} + 16^{\frac{1}{4}})^{\frac{1}{3}}. \quad (3)$$

- (b) Solve the equation

$$3x^{-\frac{1}{2}} - 4 = 0. \quad (3)$$

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5. The curve  $y = f(x)$  passes through the point  $P(-1, 3)$  and is such that

$$\frac{dy}{dx} = -\frac{1}{x^2}, \quad x \neq 0.$$

- (a) Using integration, find  $f(x)$ . (4)

- (b) Sketch the curve  $y = f(x)$  and write down the equations of its asymptotes. (3)
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