

GCE Examinations  
Advanced Subsidiary

# Core Mathematics C1

Paper B

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. 
$$f(x) = (\sqrt{x} + 3)^2 + (1 - 3\sqrt{x})^2.$$

Show that  $f(x)$  can be written in the form  $ax + b$  where  $a$  and  $b$  are integers to be found. (3)

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2. The curve  $C$  has the equation

$$y = x^2 + ax + b,$$

where  $a$  and  $b$  are constants.

Given that the minimum point of  $C$  has coordinates  $(-2, 5)$ , find the values of  $a$  and  $b$ . (4)

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3. The sequence  $u_1, u_2, u_3, \dots$  is defined by

$$u_n = 2^n + kn,$$

where  $k$  is a constant.

Given that  $u_1 = u_3$ ,

(a) find the value of  $k$ , (3)

(b) find the value of  $u_5$ . (2)

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4. Given that

$$\frac{dy}{dx} = 2x^3 + 1,$$

and that  $y = 3$  when  $x = 0$ , find the value of  $y$  when  $x = 2$ . (6)

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5. 
$$f(x) = 4x - 3x^2 - x^3.$$

(a) Fully factorise  $4x - 3x^2 - x^3$ . (3)

(b) Sketch the curve  $y = f(x)$ , showing the coordinates of any points of intersection with the coordinate axes. (3)

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6. The straight line  $l$  has the equation  $x - 2y = 12$  and meets the coordinate axes at the points  $A$  and  $B$ .

Find the distance of the mid-point of  $AB$  from the origin, giving your answer in the form  $k\sqrt{5}$ .

(6)

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7. (a) Given that  $y = 2^x$ , find expressions in terms of  $y$  for

(i)  $2^{x+2}$ ,

(ii)  $2^{3-x}$ .

(4)

- (b) Show that using the substitution  $y = 2^x$ , the equation

$$2^{x+2} + 2^{3-x} = 33$$

can be rewritten as

$$4y^2 - 33y + 8 = 0.$$

(2)

- (c) Hence solve the equation

$$2^{x+2} + 2^{3-x} = 33.$$

(4)

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8. Given that

$$y = 2x^{\frac{3}{2}} - 1,$$

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

(3)

- (b) show that

$$4x^2 \frac{d^2y}{dx^2} - 3y = k,$$

where  $k$  is an integer to be found,

(2)

- (c) find

$$\int y^2 dx.$$

(6)

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*Turn over*

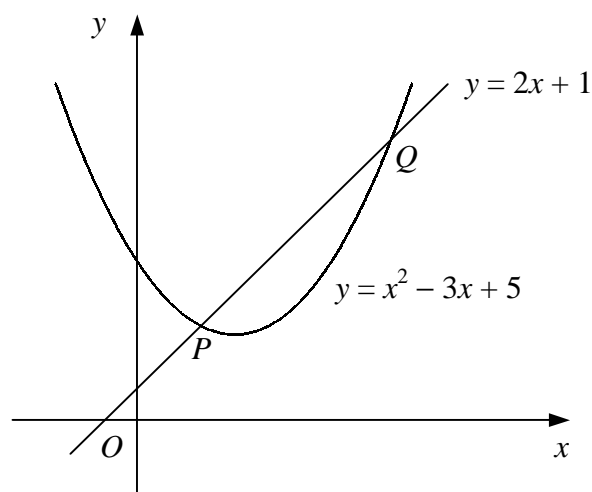
9. The second and fifth terms of an arithmetic series are 26 and 41 respectively.
- (a) Show that the common difference of the series is 5. (4)
- (b) Find the 12th term of the series. (3)

Another arithmetic series has first term  $-12$  and common difference 7.

Given that the sums of the first  $n$  terms of these two series are equal,

- (c) find the value of  $n$ . (4)

10.



**Figure 1**

Figure 1 shows the curve  $y = x^2 - 3x + 5$  and the straight line  $y = 2x + 1$ . The curve and line intersect at the points  $P$  and  $Q$ .

- (a) Using algebra, show that  $P$  has coordinates  $(1, 3)$  and find the coordinates of  $Q$ . (4)
- (b) Find an equation for the tangent to the curve at  $P$ . (4)
- (c) Show that the tangent to the curve at  $Q$  has the equation  $y = 5x - 11$ . (2)
- (d) Find the coordinates of the point where the tangent to the curve at  $P$  intersects the tangent to the curve at  $Q$ . (3)

**END**