

GCE Examinations  
Advanced Subsidiary

# Core Mathematics C1

Paper A

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. (a) Express  $\frac{21}{\sqrt{7}}$  in the form  $k\sqrt{7}$ . (2)

(b) Express  $8^{-\frac{1}{3}}$  as an exact fraction in its simplest form. (2)

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2. Evaluate

$$\sum_{r=10}^{30} (7 + 2r). \quad (4)$$


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3. Differentiate with respect to  $x$

$$\frac{6x^2 - 1}{2\sqrt{x}}. \quad (5)$$


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4. (a) Solve the inequality

$$x^2 + 3x > 10. \quad (3)$$

(b) Find the set of values of  $x$  which satisfy both of the following inequalities:

$$3x - 2 < x + 3$$

$$x^2 + 3x > 10 \quad (3)$$


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5. The sequence  $u_1, u_2, u_3, \dots$  is defined by the recurrence relation

$$u_{n+1} = (u_n)^2 - 1, \quad n \geq 1.$$

Given that  $u_1 = k$ , where  $k$  is a constant,

(a) find expressions for  $u_2$  and  $u_3$  in terms of  $k$ . (3)

Given also that  $u_2 + u_3 = 11$ ,

(b) find the possible values of  $k$ . (4)

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

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

- (b) Hence find the set of values of  $k$  for which the equation has no real roots. (4)
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7. (a) Describe fully a single transformation that maps the graph of  $y = \frac{1}{x}$  onto the graph of  $y = \frac{3}{x}$ . (2)

- (b) Sketch the graph of  $y = \frac{3}{x}$  and write down the equations of any asymptotes. (3)

- (c) Find the values of the constant  $c$  for which the straight line  $y = c - 3x$  is a tangent to the curve  $y = \frac{3}{x}$ . (4)
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8. The points  $P$  and  $Q$  have coordinates  $(7, 4)$  and  $(9, 7)$  respectively.

- (a) Find an equation for the straight line  $l$  which passes through  $P$  and  $Q$ . Give your answer in the form  $ax + by + c = 0$ , where  $a$ ,  $b$  and  $c$  are integers. (4)

The straight line  $m$  has gradient 8 and passes through the origin,  $O$ .

- (b) Write down an equation for  $m$ . (1)

The lines  $l$  and  $m$  intersect at the point  $R$ .

- (c) Show that  $OP = OR$ . (5)
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*Turn over*

9.

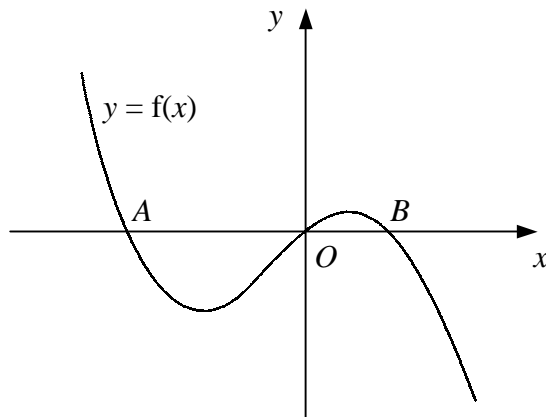
**Figure 1**

Figure 1 shows the curve with equation  $y = f(x)$  which crosses the  $x$ -axis at the origin and at the points  $A$  and  $B$ .

Given that

$$f'(x) = 6 - 4x - 3x^2,$$

(a) find an expression for  $y$  in terms of  $x$ , (5)

(b) show that  $AB = k\sqrt{7}$ , where  $k$  is an integer to be found. (6)

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10. A curve has the equation  $y = x + \frac{3}{x}$ ,  $x \neq 0$ .

The point  $P$  on the curve has  $x$ -coordinate 1.

(a) Show that the gradient of the curve at  $P$  is  $-2$ . (3)

(b) Find an equation for the normal to the curve at  $P$ , giving your answer in the form  $y = mx + c$ . (4)

(c) Find the coordinates of the point where the normal to the curve at  $P$  intersects the curve again. (4)

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**END**