

GCE Examinations  
Advanced / Advanced Subsidiary

# Core Mathematics C1

Paper A

Time: 1 hour 30 minutes

## INSTRUCTIONS TO CANDIDATES

- Answer **all** the questions.
- Give non-exact numerical answers correct to 3 significant figures, unless a different degree of accuracy is specified in the question or is clearly appropriate.
- **You are not permitted to use a calculator in this paper.**

## INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is 72.
- **You are reminded of the need for clear presentation in your answers.**



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1. Find the value of  $y$  such that

$$4^{y+3} = 8. \quad [3]$$

2. Express

$$\frac{2}{3\sqrt{5}+7}$$

in the form  $a + b\sqrt{5}$  where  $a$  and  $b$  are rational. [3]

3. A circle has the equation

$$x^2 + y^2 - 6y - 7 = 0.$$

(i) Find the coordinates of the centre of the circle. [2]

(ii) Find the radius of the circle. [2]

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

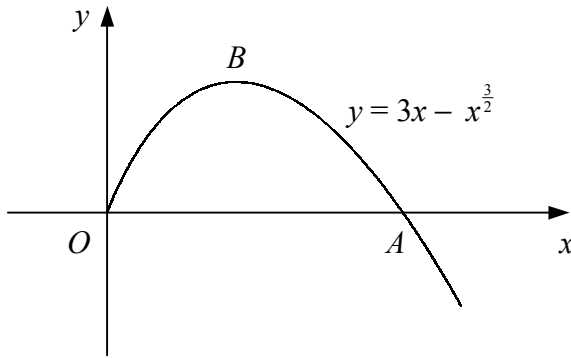
(ii) State the coordinates of the vertex of the curve  $y = x^2 + 6x + 7$ . [2]

5. Solve the simultaneous equations

$$x + y = 2$$

$$3x^2 - 2x + y^2 = 2 \quad [7]$$

6.



The diagram shows the curve with equation  $y = 3x - x^2$ ,  $x \geq 0$ .

The curve meets the  $x$ -axis at the origin and at the point  $A$  and has a maximum at the point  $B$ .

(i) Find the  $x$ -coordinate of  $A$ . [3]

(ii) Find the coordinates of  $B$ . [5]

7. (i) Calculate the discriminant of  $x^2 - 6x + 12$ . [2]

(ii) State the number of real roots of the equation  $x^2 - 6x + 12 = 0$  and hence, explain why  $x^2 - 6x + 12$  is always positive. [3]

(iii) Show that the line  $y = 8 - 2x$  is a tangent to the curve  $y = x^2 - 6x + 12$ . [4]

8.  $f(x) = x^3 - 6x^2 + 5x + 12$ .

(a) Show that

$$(x + 1)(x - 3)(x - 4) \equiv x^3 - 6x^2 + 5x + 12. \quad [2]$$

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

(c) Showing the coordinates of any points of intersection with the coordinate axes, sketch on separate diagrams the curves

(i)  $y = f(x + 3)$ , [2]

(ii)  $y = f(-x)$ . [2]

**Turn over**

9. A curve has the equation  $y = \frac{x}{2} + 3 - \frac{1}{x}$ ,  $x \neq 0$ .

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

- (i) Find the gradient of the curve at  $A$ . [4]

- (ii) Show that the tangent to the curve at  $A$  has equation

$$3x - 4y + 8 = 0. \quad [3]$$

The tangent to the curve at the point  $B$  is parallel to the tangent at  $A$ .

- (iii) Find the coordinates of  $B$ . [3]

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

- (i) 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  $C$ ,

- (ii) find the coordinates of  $B$  and  $C$ , [4]

- (iii) show that  $\angle BAC = 90^\circ$ , [4]

- (iv) find the area of triangle  $ABC$ . [4]