

GCE Examinations  
Advanced Subsidiary

# Core Mathematics C1

Paper F

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 in exact form the real solutions of the equation

$$x^4 = 5x^2 + 14. \quad (3)$$


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2. Express

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

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

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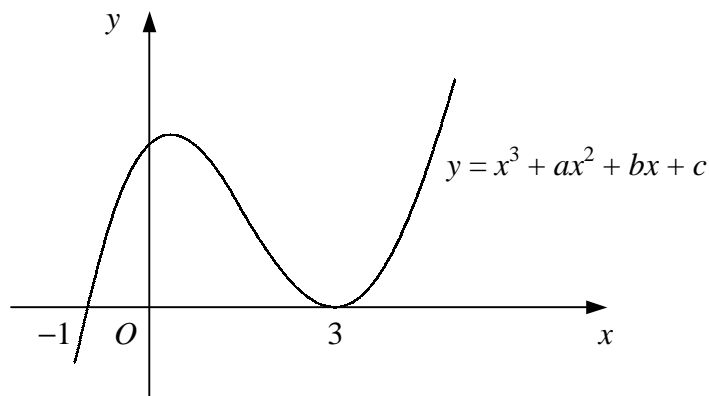
3. (a) Solve the equation

$$x^{\frac{3}{2}} = 27. \quad (2)$$

(b) Express  $(2\frac{1}{4})^{-\frac{1}{2}}$  as an exact fraction in its simplest form. (2)

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- 4.



**Figure 1**

Figure 1 shows the curve with equation  $y = x^3 + ax^2 + bx + c$ , where  $a$ ,  $b$  and  $c$  are constants. The curve crosses the  $x$ -axis at the point  $(-1, 0)$  and touches the  $x$ -axis at the point  $(3, 0)$ .

Show that  $a = -5$  and find the values of  $b$  and  $c$ . (5)

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5. Given that

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

(a) find  $\frac{dy}{dx}$ , (4)

(b) show that  $\frac{d^2y}{dx^2} = \frac{x^4 - 9}{x^4}$ . (2)

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6. (a) Sketch on the same diagram the curve with equation  $y = (x - 2)^2$  and the straight line with equation  $y = 2x - 1$ .

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

(b) Find the set of values of  $x$  for which

$$(x - 2)^2 > 2x - 1. \quad (3)$$


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7. 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.

(a) Find the gradient of the curve at  $A$ . (4)

(b) 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  $A$ .

(c) Find the coordinates of  $B$ . (3)

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*Turn over*

8. The straight line  $l_1$  has gradient  $\frac{3}{2}$  and passes through the point  $A(5, 3)$ .

(a) Find an equation for  $l_1$  in the form  $y = mx + c$ . (2)

The straight line  $l_2$  has the equation  $3x - 4y + 3 = 0$  and intersects  $l_1$  at the point  $B$ .

(b) Find the coordinates of  $B$ . (3)

(c) Find the coordinates of the mid-point of  $AB$ . (2)

(d) Show that the straight line parallel to  $l_2$  which passes through the mid-point of  $AB$  also passes through the origin. (4)

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9. The third term of an arithmetic series is  $5\frac{1}{2}$ .

The sum of the first four terms of the series is  $22\frac{3}{4}$ .

(a) Show that the first term of the series is  $6\frac{1}{4}$  and find the common difference. (7)

(b) Find the number of positive terms in the series. (3)

(c) Hence, find the greatest value of the sum of the first  $n$  terms of the series. (2)

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10. The curve  $C$  has the equation  $y = f(x)$ .

Given that

$$\frac{dy}{dx} = 8x - \frac{2}{x^3}, \quad x \neq 0,$$

and that the point  $P(1, 1)$  lies on  $C$ ,

(a) find an equation for the tangent to  $C$  at  $P$  in the form  $y = mx + c$ , (3)

(b) find an equation for  $C$ , (5)

(c) find the  $x$ -coordinates of the points where  $C$  meets the  $x$ -axis, giving your answers in the form  $k\sqrt{2}$ . (5)

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END