

GCE Examinations  
Advanced Subsidiary

# Core Mathematics C1

Paper E

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  $\frac{18}{\sqrt{3}}$  in the form  $k\sqrt{3}$ . (2)

(b) Express  $(1 - \sqrt{3})(4 - 2\sqrt{3})$  in the form  $a + b\sqrt{3}$  where  $a$  and  $b$  are integers. (2)

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2. Solve the equation

$$3x - \frac{5}{x} = 2. \quad (4)$$

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3. The straight line  $l$  has the equation  $x - 5y = 7$ .

The straight line  $m$  is perpendicular to  $l$  and passes through the point  $(-4, 1)$ .

Find an equation for  $m$  in the form  $y = mx + c$ . (5)

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4. A sequence of terms is defined by

$$u_n = 3^n - 2, \quad n \geq 1.$$

(a) Write down the first four terms of the sequence. (2)

The same sequence can also be defined by the recurrence relation

$$u_{n+1} = au_n + b, \quad n \geq 1, \quad u_1 = 1,$$

where  $a$  and  $b$  are constants.

(b) Find the values of  $a$  and  $b$ . (4)

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5.

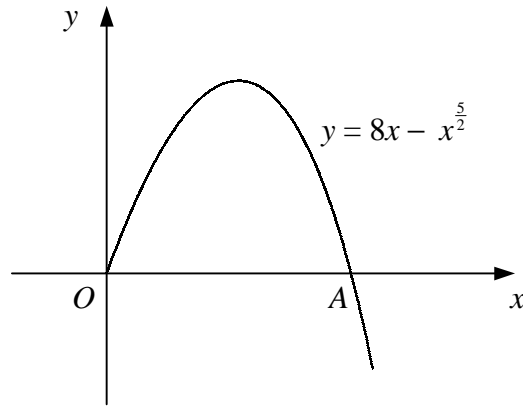
**Figure 1**

Figure 1 shows the curve with equation  $y = 8x - x^{\frac{5}{2}}$ ,  $x \geq 0$ .

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

(a) Find the  $x$ -coordinate of  $A$ . (3)

(b) Find the gradient of the tangent to the curve at  $A$ . (4)

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6.

$$f(x) = 2x^2 - 4x + 1.$$

(a) Find the values of the constants  $a$ ,  $b$  and  $c$  such that

$$f(x) = a(x + b)^2 + c. \quad (4)$$

(b) State the equation of the line of symmetry of the curve  $y = f(x)$ . (1)

(c) Solve the equation  $f(x) = 3$ , giving your answers in exact form. (3)

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7.

$$f(x) \equiv \frac{(x-4)^2}{2x^{\frac{1}{2}}}, \quad x > 0.$$

(a) Find the values of the constants  $A$ ,  $B$  and  $C$  such that

$$f(x) = Ax^{\frac{3}{2}} + Bx^{\frac{1}{2}} + Cx^{-\frac{1}{2}}. \quad (3)$$

(b) Show that

$$f'(x) = \frac{(3x+4)(x-4)}{4x^{\frac{3}{2}}}. \quad (6)$$


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**Turn over**

8. (a) Describe fully the single transformation that maps the graph of  $y = f(x)$  onto the graph of  $y = f(x - 1)$ . (2)
- (b) Showing the coordinates of any points of intersection with the coordinate axes and the equations of any asymptotes, sketch the graph of  $y = \frac{1}{x-1}$ . (3)
- (c) Find the  $x$ -coordinates of any points where the graph of  $y = \frac{1}{x-1}$  intersects the graph of  $y = 2 + \frac{1}{x}$ . Give your answers in the form  $a + b\sqrt{3}$ , where  $a$  and  $b$  are rational. (5)
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9. A store begins to stock a new range of DVD players and achieves sales of £1500 of these products during the first month.

In a model it is assumed that sales will decrease by  $\pounds x$  in each subsequent month, so that sales of  $\pounds(1500 - x)$  and  $\pounds(1500 - 2x)$  will be achieved in the second and third months respectively.

Given that sales total £8100 during the first six months, use the model to

- (a) find the value of  $x$ , (4)
- (b) find the expected value of sales in the eighth month, (2)
- (c) show that the expected total of sales in pounds during the first  $n$  months is given by  $kn(51 - n)$ , where  $k$  is an integer to be found. (3)
- (d) Explain why this model cannot be valid over a long period of time. (1)
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10. The curve  $C$  with equation  $y = f(x)$  is such that

$$\frac{dy}{dx} = 3x^2 + 4x + k,$$

where  $k$  is a constant.

Given that  $C$  passes through the points  $(0, -2)$  and  $(2, 18)$ ,

- (a) show that  $k = 2$  and find an equation for  $C$ , (7)
- (b) show that the line with equation  $y = x - 2$  is a tangent to  $C$  and find the coordinates of the point of contact. (5)
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**END**