

Core Mathematics C1 Advanced Subsidiary

For Edexcel

Paper J

Time: 1 hour 30 minutes

Instructions and Information

Candidates may NOT use a calculator in this paper.

Full marks may be obtained for answers to ALL questions.

The booklet 'Mathematical Formulae and Statistical Tables', available from Edexcel, may be used.

Advice to Candidates

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 $(\sqrt{3} + 2)^2$ in the form $a + b\sqrt{3}$, where a and b are integers. (2)

(b) Hence express $\frac{(\sqrt{3} + 2)^2}{(\sqrt{3} + 1)}$ in the form $p + q\sqrt{3}$, where p and q are rational numbers. (4)

2. The point A has coordinates $(3, 10)$ and the point B has coordinates $(7, -2)$.

The mid-point of AB is P .

Find the equation of the straight line which passes through P and which is perpendicular to the line $4y + 2x = 11$.

Give your answer in the form $y = mx + c$. (5)

3. Solve the simultaneous equations

$$\begin{aligned} x + y - 3 &= 0 \\ x^2 + 3xy + y^2 &= 11. \end{aligned} \quad (7)$$

4. $f(x) = \frac{(3x^2 - 1)^2}{x^3}, \quad x \neq 0$

(a) Show that $f(x) = 9x - 6x^{-1} + x^{-3}$. (2)

(b) Hence, or otherwise, differentiate $f(x)$ with respect to x . (3)

5. Given that

$$f(x) = x^2 + x + 2$$

(a) express $f(x)$ in the form $(x + a)^2 + b$, where a and b are rational numbers. (3)

The curve C with equation $y = f(x)$ meets the y -axis at P and has a minimum point at Q .

(b) Sketch the graph of C , showing the coordinates of P and Q . (4)

6.

Figure 1

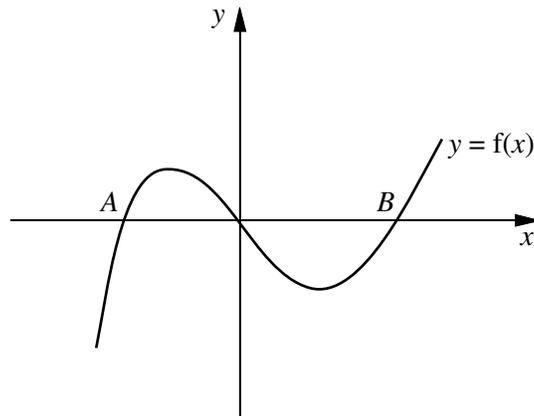


Figure 1 shows the curve with equation $y = f(x)$ which crosses the x -axis at the origin and at the points A and B .

Given that

$$f'(x) = 3x^2 - 2x - 2$$

- (a) find an expression for y in terms of x , (5)
- (b) find the coordinates of the points A and B . (5)
-

7. The width of a rectangular field is x metres, $x > 0$. The length of the field is 40 m more than its width. Given that the perimeter of the pitch must be less than 200 m,

- (a) form a linear inequality in x . (2)

Given that the area of the field must be greater than 500 m^2 ,

- (b) form a quadratic inequality in x . (2)

- (c) by solving your inequalities, find the set of possible values of x . (4)
-

8. $f(x) = (x - 2)(x + 4)$.
- (a) Solve the equation $f(x) = 0$. (1)
- (b) Sketch the curve with equation $y = f(x)$, showing the coordinates of any points of intersection with the coordinate axes. (3)
- (c) Sketch the curve with equation $y = f(2x)$, showing the coordinates of any points of intersection with the coordinate axes. (3)

When the graph of $y = f(x)$ is stretched by a scale factor of 3 parallel to the y-axis it maps onto the graph with equation $y = ax^2 + bx + c$, where a , b , and c are constants.

- (d) Find the values of a , b and c . (3)
-

9. (a) By completing the square, find in terms of m , the roots of the equation

$$x^2 + 2mx - 1 = 0 \quad (4)$$

- (b) Prove that, for all values of m , the roots of $x^2 + 2mx - 1 = 0$ are real and different. (2)
- (c) Given that $m = \sqrt{3}$, find the exact roots of the equation. (2)
-

10. The curve C has equation $y = x^3 + 2 + \frac{4}{x}$, $x \neq 0$. The point P on C has x -coordinate 2.

- (a) Show that the value of $\frac{dy}{dx}$ at P is 11. (5)

- (b) Find an equation of the tangent to C at P . (3)

This tangent meets the y -axis at the point $(0, k)$

- (c) Find the value of k . (2)
-

END

TOTAL 75 MARKS