FOR OCR

GCE Examinations

Advanced / Advanced Subsidiary

Core Mathematics C1

Paper K

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.**

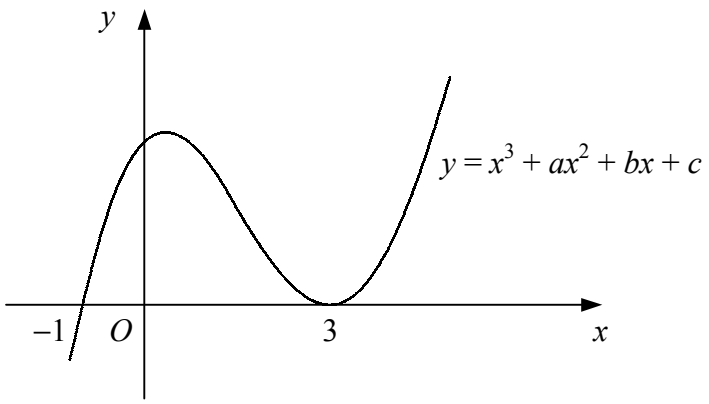
Written by Shaun Armstrong

1. Express $\sqrt{50} + 3\sqrt{8}$ in the form $k\sqrt{2}$. [3]

2. Find the coordinates of the stationary point of the curve with equation

$$y = x + \frac{4}{x^2}.$$ [5]

3.



The diagram 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]

4. The curve C has the equation $y = (x - a)^2$ where a is a constant.

Given that

$$\frac{dy}{dx} = 2x - 6,$$

(i) find the value of a, [4]

(ii) describe fully a single transformation that would map C onto the graph of $y = x^2$. [2]

5. The straight line l_1 has the equation $3x - y = 0$.
The straight line l_2 has the equation $x + 2y - 4 = 0$.

(i) Sketch l_1 and l_2 on the same diagram, showing the coordinates of any points where each line meets the coordinate axes. [4]

(ii) Find, as exact fractions, the coordinates of the point where l_1 and l_2 intersect. [3]

6. *(a)* Given that $y = 2^x$, find expressions in terms of y for

(i) 2^{x+2}, [2]

(ii) 2^{3-x}. [2]

(b) Show that using the substitution $y = 2^x$, the equation

$$2^{x+2} + 2^{3-x} = 33$$

can be rewritten as

$$4y^2 - 33y + 8 = 0.$$ [2]

(c) Hence solve the equation

$$2^{x+2} + 2^{3-x} = 33.$$ [4]

7. The point A has coordinates (4, 6).

Given that OA, where O is the origin, is a diameter of circle C,

(i) find an equation for C. [4]

Circle C crosses the x-axis at O and at the point B.

(ii) Find the coordinates of B. [2]

(iii) Find an equation for the tangent to C at B, giving your answer in the form $ax + by = c$, where a, b and c are integers. [5]

8. *(i)* Express $3x^2 - 12x + 11$ in the form $a(x + b)^2 + c$. [4]

(ii) Sketch the curve with equation $y = 3x^2 - 12x + 11$, showing the coordinates of the minimum point of the curve. [3]

Given that the curve $y = 3x^2 - 12x + 11$ crosses the x-axis at the points A and B,

(iii) find the length AB in the form $k\sqrt{3}$. [5]

Turn over

9. A curve has the equation $y = x^3 - 5x^2 + 7x$.

(i) Show that the curve only crosses the x-axis at one point. [4]

The point P on the curve has coordinates (3, 3).

(ii) Find an equation for the normal to the curve at P, giving your answer in the form $ax + by = c$, where a, b and c are integers. [6]

The normal to the curve at P meets the coordinate axes at Q and R.

(iii) Show that triangle OQR, where O is the origin, has area $28\frac{1}{8}$. [3]