FOR OCR

GCE Examinations
Advanced / Advanced Subsidiary

Core Mathematics C1

Paper G

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. Find the value of y such that

$$4^{y+1} = 8^{2y-1}.$$ [4]

2. Express $\sqrt{22.5}$ in the form $k\sqrt{10}$. [4]

3. A circle has the equation

$$x^2 + y^2 + 8x - 4y + k = 0,$$

where k is a constant.

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

Given that the x-axis is a tangent to the circle,

(ii) find the value of k. [3]

4. $$\mathrm{f}(x) = 4x - 3x^2 - x^3.$$

(i) Fully factorise $4x - 3x^2 - x^3$. [3]

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

5. *(i)* Find in exact form the coordinates of the points where the curve $y = x^2 - 4x + 2$ crosses the x-axis. [4]

(ii) Find the value of the constant k for which the straight line $y = 2x + k$ is a tangent to the curve $y = x^2 - 4x + 2$. [4]

6. Some ink is poured onto a piece of cloth forming a stain that then spreads.

The area of the stain, A cm^2, after t seconds is given by

$$A = (p + qt)^2,$$

where p and q are positive constants.

Given that when $t = 0$, $A = 4$ and that when $t = 5$, $A = 9$,

(i) find the value of p and show that $q = \frac{1}{5}$, [5]

(ii) find $\frac{dA}{dt}$ in terms of t, [3]

(iii) find the rate at which the area of the stain is increasing when $t = 15$. [2]

7. The curve C has the equation $y = x^2 + 2x + 4$.

(i) Express $x^2 + 2x + 4$ in the form $(x + p)^2 + q$ and hence state the coordinates of the minimum point of C. [4]

The straight line l has the equation $x + y = 8$.

(ii) Sketch l and C on the same set of axes. [3]

(iii) Find the coordinates of the points where l and C intersect. [4]

8.
$$f(x) \equiv \frac{(x-4)^2}{2x^{\frac{1}{2}}}, \quad x > 0.$$

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

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

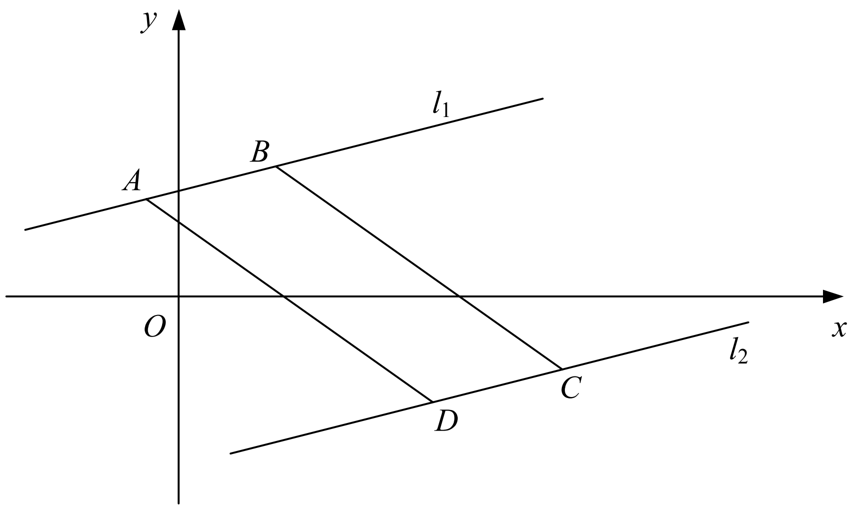
(ii) Show that

$$f'(x) = \frac{3x^2 - 8x - 16}{4x^{\frac{3}{2}}}.$$ [5]

(iii) Find the coordinates of the stationary point of the curve $y = f(x)$. [3]

Turn over

9.



The diagram shows the parallelogram *ABCD*.

The points *A* and *B* have coordinates $(-1, 3)$ and $(3, 4)$ respectively and lie on the straight line l_1.

(i) Find an equation for l_1, giving your answer in the form $ax + by + c = 0$, where a, b and c are integers. [4]

The points *C* and *D* lie on the straight line l_2 which has the equation $x - 4y - 21 = 0$.

(ii) Show that the distance between l_1 and l_2 is $k\sqrt{17}$, where k is an integer to be found. [7]

(iii) Find the area of parallelogram *ABCD*. [2]