FOR OCR

GCE Examinations

Advanced / Advanced Subsidiary

Core Mathematics C1

Paper C

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. Solve the equation

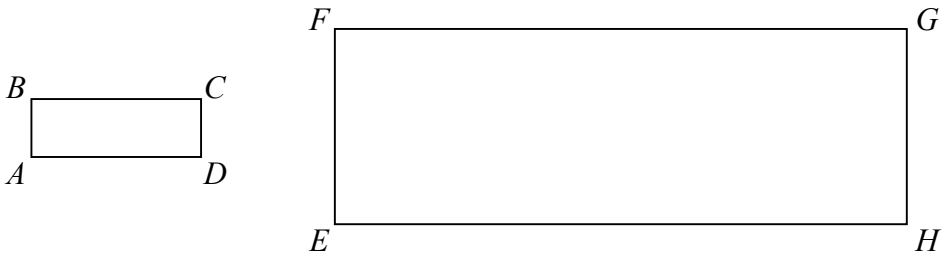
$$9^x = 3^{x+2}.$$ [3]

2. 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 $y = mx + c$. [4]

3.



The diagram shows the rectangles $ABCD$ and $EFGH$ which are similar.

Given that $AB = (3 - \sqrt{5})$ cm, $AD = \sqrt{5}$ cm and $EF = (1 + \sqrt{5})$ cm, find the length EH in cm, giving your answer in the form $a + b\sqrt{5}$ where a and b are integers. [5]

4. *(i)* Sketch on the same diagram the curves $y = x^2 - 4x$ and $y = -\frac{1}{x}$. [4]

(ii) State, with a reason, the number of real solutions to the equation

$$x^2 - 4x + \frac{1}{x} = 0.$$ [2]

5. *(i)* Solve the inequality

$$x^2 + 3x > 10.$$ [3]

(ii) Find the set of values of x which satisfy both of the following inequalities:

$$3x - 2 < x + 3$$

$$x^2 + 3x > 10$$ [3]

6. $f(x) = 4x^2 + 12x + 9.$

(i) Determine the number of real roots that exist for the equation $f(x) = 0$. [2]

(ii) Solve the equation $f(x) = 8$, giving your answers in the form $a + b\sqrt{2}$ where a and b are rational. [4]

7. The circle C has centre $(-1, 6)$ and radius $2\sqrt{5}$.

(i) Find an equation for C. [2]

The line $y = 3x - 1$ intersects C at the points A and B.

(ii) Find the x-coordinates of A and B. [4]

(iii) Show that $AB = 2\sqrt{10}$. [3]

8. $f(x) = 2 - x + 3x^{\frac{2}{3}}, \quad x > 0.$

(i) Find $f'(x)$ and $f''(x)$. [3]

(ii) Find the coordinates of the turning point of the curve $y = f(x)$. [4]

(iii) Determine whether the turning point is a maximum or minimum point. [2]

9. *(i)* Find an equation for the tangent to the curve $y = x^2 + 2$ at the point $(1, 3)$ in the form $y = mx + c$. [4]

(ii) Express $x^2 - 6x + 11$ in the form $(x + a)^2 + b$ where a and b are integers. [2]

(iii) Describe fully the transformation that maps the graph of $y = x^2 + 2$ onto the graph of $y = x^2 - 6x + 11$. [2]

(iv) Use your answers to parts *(i)* and *(iii)* to deduce an equation for the tangent to the curve $y = x^2 - 6x + 11$ at the point with x-coordinate 4. [2]

Turn over

10. The curve C has the equation $y = \mathrm{f}(x)$ where

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

(i) Sketch the curve C, showing the coordinates of any points of intersection with the coordinate axes. [3]

(ii) Find $\mathrm{f}'(x)$. [4]

The straight line l is the tangent to C at the point $P(-1, 1)$.

(iii) Find an equation for l. [3]

The straight line m is parallel to l and is also a tangent to C.

(iv) Show that m has the equation $y = 3x + 8$. [4]