

GCE AS/A level

MATHEMATICS C1 Pure Mathematics

A.M. FRIDAY, 13 January 2012 $1\frac{1}{2}$ hours

ADDITIONAL MATERIALS

In addition to this examination paper, you will need:

- a 12 page answer book;
- a Formula Booklet.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Answer all questions.

Sufficient working must be shown to demonstrate the mathematical method employed.

Calculators are **not** allowed for this paper.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question. You are reminded of the necessity for good English and orderly presentation in your answers.

- 1. The points A, B, C, D have coordinates (-5, 14), (1, 2), (5, 4), (3, 8) respectively.
 - (a) (i) Show that AB and CD are parallel.
 - (ii) Find the equation of *AB*.
 - (iii) The line L passes through the point D and is perpendicular to AB. Show that L has equation

$$x - 2y + 13 = 0.$$
 [8]

- (b) The lines L and AB intersect at the point E.
 - (i) Find the coordinates of *E*.
 - (ii) Calculate the length of *EF*, where *F* denotes the mid-point of *AB*. [6]
- 2. Simplify

(a)
$$\frac{9+4\sqrt{2}}{5+3\sqrt{2}}$$
, [4]

(b)
$$\left(\sqrt{8} \times \sqrt{10}\right) + \frac{\sqrt{90}}{\sqrt{2}} - \frac{30}{\sqrt{5}}.$$
 [4]

- 3. The curve C has equation $y = 2x^2 8x + 13$. The point P, whose x-coordinate is 3, lies on the curve C. Find the equation of the **normal** to C at P. [6]
- 4. (a) Use the binomial theorem to expand $\left(x + \frac{3}{x}\right)^4$, simplifying each term of the expansion. [4]
 - (b) The coefficient of x^2 in the expansion of $(1+2x)^n$ is 760. Given that *n* is a positive integer, find the value of *n*. [3]
- 5. (a) Express $3x^2 6x + 5$ in the form $a(x+b)^2 + c$, where a, b and c are constants whose values are to be found. [3]
 - (b) Use your answer to part (a) to find the greatest value of

$$\frac{1}{3x^2 - 6x + 11}$$
 [2]

6. Given that the quadratic equation

 $(k+6)x^2 + 4x + (k+3) = 0$

has no real roots, show that

$$k^2 + 9k + 14 > 0.$$

[7]

Find the range of values of k satisfying this inequality.

7. (a) Given that
$$y = 8x^2 - 5x - 6$$
, find $\frac{dy}{dx}$ from first principles. [5]

(b) Given that
$$y = \frac{a}{x} + 10\sqrt{x}$$
 and that $\frac{dy}{dx} = 3$ when $x = 4$,
find the value of the constant a . [4]

8. (a) When $ax^3 - 21x - 10$ is divided by x - 3, the remainder is 35. Write down an equation satisfied by a and hence show that a = 4. [2]

(b) Factorise
$$4x^3 - 21x - 10$$
. [5]

TURN OVER

9. The diagram shows a sketch of the graph of y = f(x). The graph has a maximum point at (1, 3) and intersects the x-axis at the points (-2, 0) and (4, 0).



- (a) Sketch the graph of y = f(2x), indicating the coordinates of the stationary point and the coordinates of the points of intersection of the graph with the x-axis. [3]
- (b) (i) Sketch the graph of y = f(x) 5, indicating the coordinates of the stationary point.
 - (ii) Given that f is a quadratic function, use the graph you have drawn in part (i) to write down the number of real roots of the equation

$$f(x) - 5 = 0.$$
 [3]

10. The curve *C* has equation

$$y = x^3 - 6x^2 + 12x - 9.$$

- (a) Show that C has only one stationary point. Find the coordinates of this point. [4]
- (b) Verify that this stationary point is a point of inflection. [2]