



GCE AS/A level

0973/01

MATHEMATICS C1

Pure Mathematics

A.M. FRIDAY, 13 January 2012

1½ 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

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

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

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

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

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

6. Given that the quadratic equation

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

has no real roots, show that

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

Find the range of values of k satisfying this inequality.

[7]

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 $a = 4$.

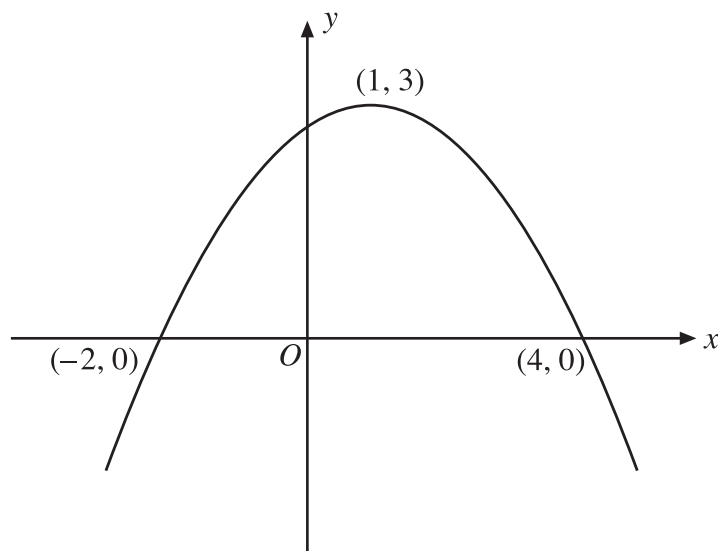
[2]

- (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

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

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]