



GCE AS/A level

973/01

MATHEMATICS C1

Pure Mathematics

A.M. THURSDAY, 15 May 2008

1½ hours

ADDITIONAL MATERIALS

In addition to this examination paper, you will need:

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

INSTRUCTIONS TO CANDIDATES

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.

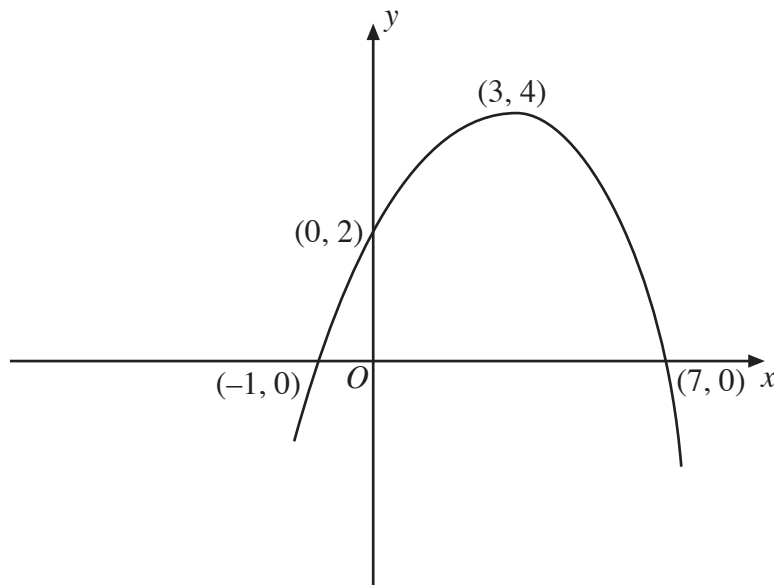
1. The points A, B, C, D have coordinates $(-7, 4), (3, -1), (6, 1), (k, -15)$ respectively.
- (a) Find the gradient of AB . [2]
- (b) Find the equation of AB and simplify your answer. [3]
- (c) Find the length of AB . [2]
- (d) The point E is the mid-point of AB . Find the coordinates of E . [2]
- (e) Given that CD is perpendicular to AB , find the value of the constant k . [4]
2. Simplify
- (a) $\sqrt{75} - \frac{9}{\sqrt{3}} + (\sqrt{6} \times \sqrt{2})$, [4]
- (b) $\frac{5\sqrt{5} - 2}{4 + \sqrt{5}}$. [4]
3. The point P lies on the curve C with equation $y = 3x^2 - 8x + 7$. Given that the x -coordinate of P is 2, find the equation of the normal to C at P . [6]
4. (a) Given that $y = 5x^2 + 3x - 4$, find $\frac{dy}{dx}$ from first principles. [5]
- (b) Given that $y = \frac{8}{x} + 3\sqrt{x}$, find the value of $\frac{dy}{dx}$ when $x = 4$. [4]
5. (a) Express $x^2 + 6x - 4$ in the form $(x + a)^2 + b$ where the values of a, b are to be determined. [2]
- (b) Use your results to part (a) to find the least value of $2x^2 + 12x - 8$ and the corresponding value of x . [2]
6. Use the binomial theorem to expand $(5 + 2x)^3$, simplifying each term of your expansion. [3]

7. The polynomial $4x^3 + px^2 - 11x + q$ has $x - 2$ as a factor. When the polynomial is divided by $x + 1$, the remainder is 9.

(a) Show that $p = -4$ and $q = 6$. [6]

(b) Factorise $4x^3 - 4x^2 - 11x + 6$. [3]

8. The diagram shows a sketch of the graph of $y = f(x)$. The graph has a maximum point at $(3, 4)$ and intersects the x -axis at the points $(-1, 0)$ and $(7, 0)$ and the y -axis at the point $(0, 2)$.



(a) Sketch the graph of $y = f(x + 2)$, indicating the coordinates of the stationary point and the coordinates of the points of intersection of the graph with the x -axis. [3]

(b) Sketch the graph of $y = f(x) + 3$, indicating the coordinates of the stationary point and the coordinates of the point of intersection of the graph with the y -axis. [3]

9. The curve C has equation

$$y = -2x^3 + 3x^2 + 12x - 5.$$

Find the coordinates and nature of each of the stationary points of C . [7]

10. (a) Solve the inequality $2x^2 - 3x - 9 \geq 0$. [3]

(b) (i) Find the range of values of m for which the quadratic equation

$$3x^2 - 6x + m = 0$$

has no real roots.

(ii) The curve C has equation $y = 3x^2 - 4x + 7$. The line L has equation $y = 2x + k$, where k is a constant. Given that L and C do not intersect, find the range of possible values of k . [7]