

973/01

MATHEMATICS C1

Pure Mathematics

A.M. MONDAY, 21 May 2007

(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.

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 $(-1, 3), (1, 7), (2, -1), (5, k)$, respectively. The line AB is parallel to the line CD .
- (a) Find the gradient of AB . [2]
- (b) Show that $k = 5$. [3]
- (c) The line L is perpendicular to CD and passes through the point A . Show that the equation of L is $x + 2y - 5 = 0$. [3]
- (d) The line L intersects the line CD at the point E . Find the coordinates of E . [4]
2. Simplify
- (a) $2\sqrt{8} + \sqrt{18} - \frac{12}{\sqrt{2}}$, [4]
- (b) $\frac{5 + \sqrt{15}}{5 - \sqrt{15}}$. [4]
3. (a) Given that $x - 3$ is a factor of $x^3 - 5x^2 - 2x + p$, show that $p = 24$. [2]
- (b) Solve the equation
- $$x^3 - 5x^2 - 2x + 24 = 0. \quad [4]$$
- (c) Find the remainder when $x^3 - 5x^2 - 2x + 24$ is divided by $x - 2$. [2]
4. (a) Find the equation of the tangent to the curve $y = \frac{16}{x} + 3x + 2$ at the point $(4, 18)$. [5]
- (b) Find the solution of the simultaneous equations $y = x^2 + 2x + 4$ and $y = 4x + 7$. Interpret your results geometrically. [5]
5. (a) Expand $(a + b)^5$. Hence find the coefficient of x in the expansion of $\left(x + \frac{1}{2x}\right)^5$. [4]
- (b) The coefficient of x^2 in the expansion of $(1 + x)^n$ is 36. Given that n is a positive integer, find the value of n . [3]
6. Given $y = x^2 - 12x + 10$, find $\frac{dy}{dx}$ from first principles. [5]

7. (a) Express $2x^2 + 4x + 5$ in the form $a(x + b)^2 + c$, where a , b and c are to be determined. [3]

(b) Use the result derived in (a) to find the greatest value of $\frac{1}{2x^2 + 4x + 9}$. [2]

8. (a) Show that the equation

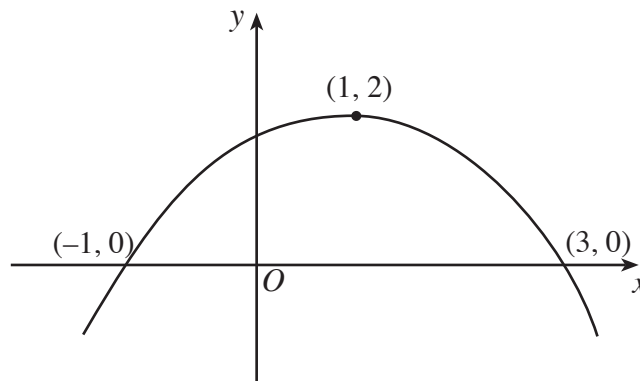
$$x^2 + (2k + 1)x + (k^2 + k + 1) = 0$$

has no real roots whatever the value of k . [4]

(b) Find the range of values of x satisfying the inequality

$$2x^2 + 7x + 3 < 0. \quad [3]$$

9.



The diagram shows the graph of $y = f(x)$. The graph passes through the points $(-1, 0)$ and $(3, 0)$ and has a maximum point at $(1, 2)$.

Sketch, on separate diagrams, the graphs of

(a) $y = f(x - 3)$, [3]

(b) $y = f\left(\frac{x}{2}\right)$, [3]

showing the stationary points and the points of intersection of the graphs with the x -axis.

10. The curve C has equation

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

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