

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS**

**Advanced Subsidiary General Certificate of Education  
Advanced General Certificate of Education**

**MEI STRUCTURED MATHEMATICS**

**4751**

Introduction to Advanced Mathematics (C1)

Wednesday **12 JANUARY 2005** Afternoon 1 hour 30 minutes

Additional materials:  
Answer booklet  
Graph paper  
MEI Examination Formulae and Tables (MF2)

**TIME** 1 hour 30 minutes

**INSTRUCTIONS TO CANDIDATES**

- Write your name, centre number and candidate number in the spaces provided on the answer booklet.
- Answer **all** the questions.
- 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.
- You are advised that an answer may receive **no marks** unless you show sufficient detail of the working to indicate that a correct method is being used.
- Final answers should be given to a degree of accuracy appropriate to the context.
- The total number of marks for this paper is 72.



**WARNING**

**You are not allowed to use  
a calculator in this paper**

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**This question paper consists of 4 printed pages.**

## Section A (36 marks)

1 Solve the inequality  $2(x - 3) < 6x + 15$ . [3]

2 Make  $r$  the subject of  $V = \frac{4}{3}\pi r^3$ . [3]

3 In each case, choose one of the statements

$$P \Rightarrow Q$$

$$P \Leftarrow Q$$

$$P \Leftrightarrow Q$$

to describe the complete relationship between P and Q.

(i) For  $n$  an integer:

P:  $n$  is an even number

Q:  $n$  is a multiple of 4

[1]

(ii) For triangle ABC:

P: B is a right-angle

Q:  $AB^2 + BC^2 = AC^2$

[1]

4 Find the coefficient of  $x^3$  in the expansion of  $(2 + 3x)^5$ . [4]

5 Find the value of the following.

(i)  $\left(\frac{1}{3}\right)^{-2}$  [2]

(ii)  $16^{\frac{3}{4}}$  [2]

6 The line  $L$  is parallel to  $y = -2x + 1$  and passes through the point  $(5, 2)$ .

Find the coordinates of the points of intersection of  $L$  with the axes. [5]

7 Express  $x^2 - 6x$  in the form  $(x - a)^2 - b$ .

Sketch the graph of  $y = x^2 - 6x$ , giving the coordinates of its minimum point and the intersections with the axes. [5]

8 Find, in the form  $y = mx + c$ , the equation of the line passing through A  $(3, 7)$  and B  $(5, -1)$ .

Show that the midpoint of AB lies on the line  $x + 2y = 10$ . [5]

9 Simplify  $(3 + \sqrt{2})(3 - \sqrt{2})$ .

Express  $\frac{1 + \sqrt{2}}{3 - \sqrt{2}}$  in the form  $a + b\sqrt{2}$ , where  $a$  and  $b$  are rational. [5]

## Section B (36 marks)

10

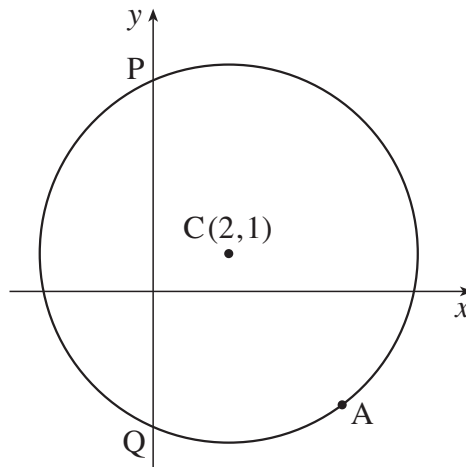


Fig. 10

Fig. 10 shows a circle with centre  $C(2, 1)$  and radius 5.

- (i) Show that the equation of the circle may be written as

$$x^2 + y^2 - 4x - 2y - 20 = 0. \quad [3]$$

- (ii) Find the coordinates of the points P and Q where the circle cuts the y-axis. Leave your answers in the form  $a \pm \sqrt{b}$ . [3]

- (iii) Verify that the point  $A(5, -3)$  lies on the circle.

Show that the tangent to the circle at A has equation  $4y = 3x - 27$ . [6]

11 A cubic polynomial is given by  $f(x) = x^3 + x^2 - 10x + 8$ .

- (i) Show that  $(x - 1)$  is a factor of  $f(x)$ .

Factorise  $f(x)$  fully.

Sketch the graph of  $y = f(x)$ . [7]

- (ii) The graph of  $y = f(x)$  is translated by  $\begin{pmatrix} -3 \\ 0 \end{pmatrix}$ .

Write down an equation for the resulting graph. You need not simplify your answer.

Find also the intercept on the y-axis of the resulting graph. [5]

**12 (i)** Show that the graph of  $y = x^2 - 3x + 11$  is above the  $x$ -axis for all values of  $x$ . [3]

**(ii)** Find the set of values of  $x$  for which the graph of  $y = 2x^2 + x - 10$  is above the  $x$ -axis. [4]

**(iii)** Find algebraically the coordinates of the points of intersection of the graphs of

$$y = x^2 - 3x + 11 \quad \text{and} \quad y = 2x^2 + x - 10. \quad [5]$$

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