

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)

Monday **16 JANUARY 2006** Morning 1 hour 30 minutes

Additional materials:
8 page 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.
- Final answers should be given to a degree of accuracy appropriate to the context.

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.
- The total number of marks for this paper is 72.



WARNING

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

This question paper consists of 4 printed pages.

Section A (36 marks)

1 n is a positive integer. Show that $n^2 + n$ is always even. [2]

2

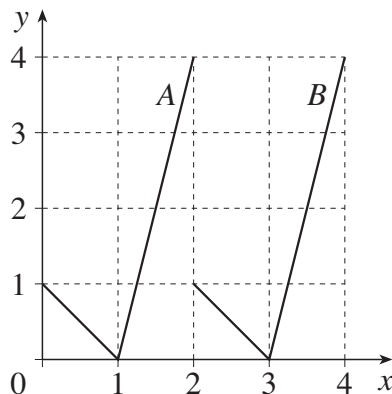


Fig. 2

Fig. 2 shows graphs A and B .

(i) State the transformation which maps graph A onto graph B . [2]

(ii) The equation of graph A is $y = f(x)$.

Which one of the following is the equation of graph B ?

$$y = f(x) + 2$$

$$y = f(x) - 2$$

$$y = f(x + 2)$$

$$y = f(x - 2)$$

$$y = 2f(x)$$

$$y = f(x + 3)$$

$$y = f(x - 3)$$

$$y = 3f(x)$$

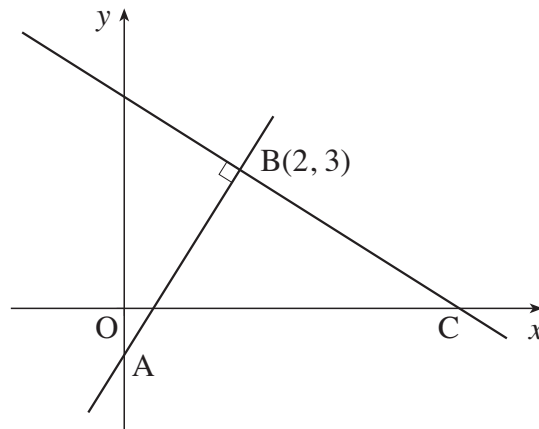
[2]

3 Find the binomial expansion of $(2 + x)^4$, writing each term as simply as possible. [4]

4 Solve the inequality $\frac{3(2x + 1)}{4} > -6$. [4]

5 Make C the subject of the formula $P = \frac{C}{C + 4}$. [4]

6 When $x^3 + 3x + k$ is divided by $x - 1$, the remainder is 6. Find the value of k . [3]



Not to scale

Fig. 7

The line AB has equation $y = 4x - 5$ and passes through the point $B(2, 3)$, as shown in Fig. 7. The line BC is perpendicular to AB and cuts the x -axis at C. Find the equation of the line BC and the x -coordinate of C. [5]

- 8 (i) Simplify $5\sqrt{8} + 4\sqrt{50}$. Express your answer in the form $a\sqrt{b}$, where a and b are integers and b is as small as possible. [2]
- (ii) Express $\frac{\sqrt{3}}{6 - \sqrt{3}}$ in the form $p + q\sqrt{3}$, where p and q are rational. [3]
- 9 (i) Find the range of values of k for which the equation $x^2 + 5x + k = 0$ has one or more real roots. [3]
- (ii) Solve the equation $4x^2 + 20x + 25 = 0$. [2]

Section B (36 marks)

- 10 A circle has equation $x^2 + y^2 = 45$.
- (i) State the centre and radius of this circle. [2]
- (ii) The circle intersects the line with equation $x + y = 3$ at two points, A and B. Find algebraically the coordinates of A and B.
- Show that the distance AB is $\sqrt{162}$. [8]

- 11** (i) Write $x^2 - 7x + 6$ in the form $(x - a)^2 + b$. [3]
- (ii) State the coordinates of the minimum point on the graph of $y = x^2 - 7x + 6$. [2]
- (iii) Find the coordinates of the points where the graph of $y = x^2 - 7x + 6$ crosses the axes and sketch the graph. [5]
- (iv) Show that the graphs of $y = x^2 - 7x + 6$ and $y = x^2 - 3x + 4$ intersect only once. Find the x -coordinate of the point of intersection. [3]
- 12** (i) Sketch the graph of $y = x(x - 3)^2$. [3]
- (ii) Show that the equation $x(x - 3)^2 = 2$ can be expressed as $x^3 - 6x^2 + 9x - 2 = 0$. [2]
- (iii) Show that $x = 2$ is one root of this equation and find the other two roots, expressing your answers in surd form.
- Show the location of these roots on your sketch graph in part (i). [8]