OCR
RECOGNISING ACHIEVEMENT

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.

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Section A (36 marks)

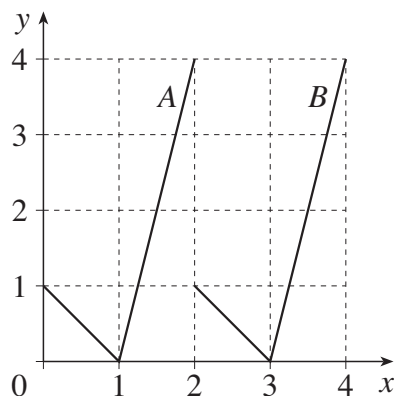**1** n is a positive integer. Show that $n^2 + n$ is always even. [2]

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 $y = \mathrm{f}(x)$.

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

$$y = \mathrm{f}(x) + 2 \qquad y = \mathrm{f}(x) - 2 \qquad y = \mathrm{f}(x + 2) \qquad y = \mathrm{f}(x - 2)$$

$$y = 2\mathrm{f}(x) \qquad y = \mathrm{f}(x + 3) \qquad y = \mathrm{f}(x - 3) \qquad y = 3\mathrm{f}(x) \qquad [2]$$

3   Find the binomial expansion of $(2 + x)^4$, writing each term as simply as possible. [4]
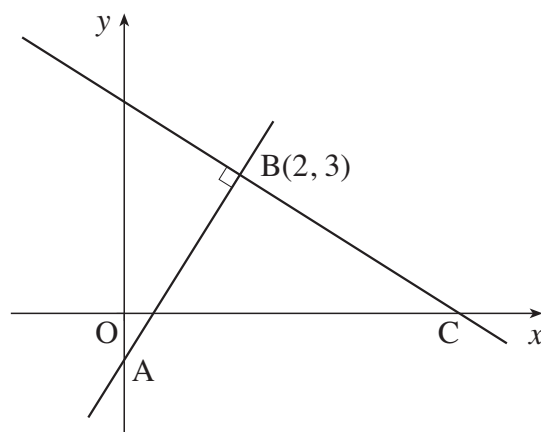
4   Solve the inequality $\dfrac{3(2x + 1)}{4} > -6$. [4]

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

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

7

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 $\dfrac{\sqrt{3}}{6 - \sqrt{3}}$ 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]

[Turn over

4

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]