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.**



Registered Charity 106696
**[Turn over**

**Section A** (36 marks)

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

**2**

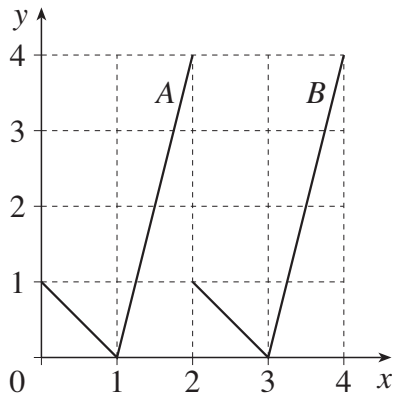



**Fig. 2**

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 $B$?

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

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

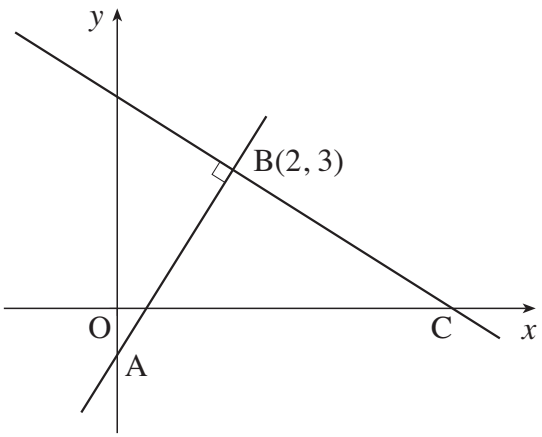
**3** Find the binomial expansion of $(2 + x)^4$, writing each term as simply as possible. [4]

**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**




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

**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]