

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS  
AS GCE**

**4751**

**MATHEMATICS (MEI)**

**Introduction to Advanced Mathematics (C1)**

**QUESTION PAPER**

**WEDNESDAY 16 MAY 2012: Morning**

**DURATION: 1 hour 30 minutes  
plus your additional time allowance**

**MODIFIED ENLARGED**

**Candidates answer on the Printed Answer Book or any suitable paper provided by the centre. The Printed Answer Book may be enlarged by the centre.**

**OCR SUPPLIED MATERIALS:**

**Printed Answer Book 4751**

**MEI Examination Formulae and Tables (MF2)**

**Insert for question 12(i)**

**OTHER MATERIALS REQUIRED:**

**None**

**READ INSTRUCTIONS OVERLEAF**

## **INSTRUCTIONS TO CANDIDATES**

**These instructions are the same on the Printed Answer Book and the Question Paper.**

- **The Question Paper will be found in the centre of the Printed Answer Book.**
- **Write your name, centre number and candidate number in the spaces provided on the Printed Answer Book. Please write clearly and in capital letters.**
- **WRITE YOUR ANSWER TO EACH QUESTION IN THE SPACE PROVIDED IN THE PRINTED ANSWER BOOK.** Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- **Use black ink. HB pencil may be used for graphs and diagrams only.**
- **Read each question carefully. Make sure you know what you have to do before starting your answer.**
- **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**

**This information is the same on the Printed Answer Book and the Question Paper.**

- **The number of marks is given in brackets [ ] at the end of each question or part question on the Question Paper.**
- **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.**

## **INSTRUCTION TO EXAMS OFFICER/INVIGILATOR**

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## SECTION A (36 marks)

- 1 Find the equation of the line with gradient  $-2$  which passes through the point  $(3, 1)$ . Give your answer in the form  $y = ax + b$ .

Find also the points of intersection of this line with the axes. [3]

- 2 Make  $b$  the subject of the following formula.

$$a = \frac{2}{3} b^2 c \quad [3]$$

- 3 (i) Evaluate  $\left(\frac{1}{5}\right)^{-2}$ . [2]

(ii) Evaluate  $\left(\frac{8}{27}\right)^{\frac{2}{3}}$ . [2]

- 4 Factorise and hence simplify the following expression.

$$\frac{x^2 - 9}{x^2 + 5x + 6} \quad [3]$$

- 5 (i) Simplify  $\frac{10(\sqrt{6})^3}{\sqrt{24}}$ . [3]

(ii) Simplify  $\frac{1}{4 - \sqrt{5}} + \frac{1}{4 + \sqrt{5}}$ . [2]

**6 (i) Evaluate  ${}^5C_3$ . [1]**

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

**7 Find the set of values of  $k$  for which the graph of  $y = x^2 + 2kx + 5$  does not intersect the  $x$ -axis. [4]**

**8 The function  $f(x) = x^4 + bx + c$  is such that  $f(2) = 0$ . Also, when  $f(x)$  is divided by  $x + 3$ , the remainder is 85.**

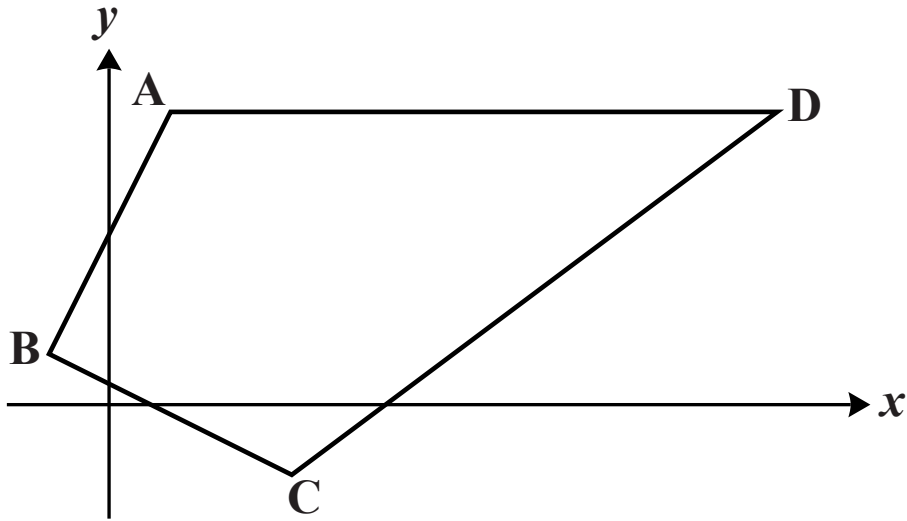
**Find the values of  $b$  and  $c$ . [5]**

**9 Simplify  $(n + 3)^2 - n^2$ . Hence explain why, when  $n$  is an integer,  $(n + 3)^2 - n^2$  is never an even number.**

**Given also that  $(n + 3)^2 - n^2$  is divisible by 9, what can you say about  $n$ ? [4]**

**SECTION B (36 marks)**

**10** The following diagram is Fig. 10.



**Fig. 10 is a sketch of quadrilateral ABCD with vertices A (1, 5), B (−1, 1), C (3, −1) and D (11, 5).**

- (i) Show that  $AB = BC$ . [3]**
- (ii) Show that the diagonals AC and BD are perpendicular. [3]**
- (iii) Find the midpoint of AC. Show that BD bisects AC but AC does not bisect BD. [5]**

**11** A cubic curve has equation  $y = f(x)$ . The curve crosses the  $x$ -axis where  $x = -\frac{1}{2}$ ,  $-2$  and  $5$ .

(i) Write down three linear factors of  $f(x)$ . Hence find the equation of the curve in the form  $y = 2x^3 + ax^2 + bx + c$ . [4]

(ii) Sketch the graph of  $y = f(x)$ . [3]

(iii) The curve  $y = f(x)$  is translated by  $\begin{pmatrix} 0 \\ -8 \end{pmatrix}$ . State the coordinates of the point where the translated curve intersects the  $y$ -axis. [1]

(iv) The curve  $y = f(x)$  is translated by  $\begin{pmatrix} 3 \\ 0 \end{pmatrix}$  to give the curve  $y = g(x)$ .

Find an expression in factorised form for  $g(x)$  and state the coordinates of the point where the curve  $y = g(x)$  intersects the  $y$ -axis. [4]

**[QUESTION 12 IS PRINTED OVERLEAF.]**

12 The following diagram is Fig. 12.

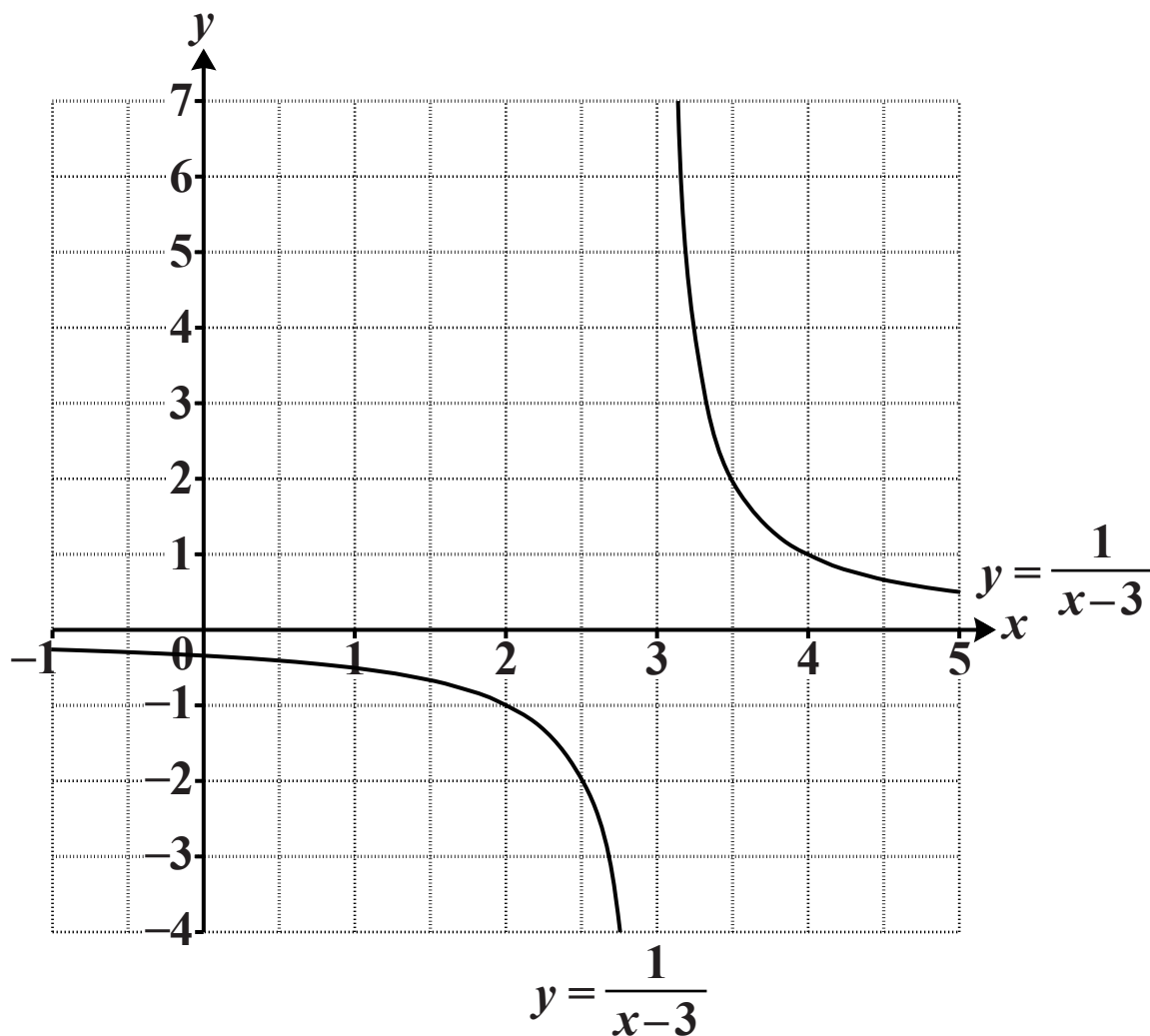


Fig. 12 shows the graph of  $y = \frac{1}{x-3}$ .

- (i) Draw accurately, on the copy of Fig. 12 in the Printed Answer Book or on the Insert, the graph of  $y = x^2 - 4x + 1$  for  $-1 \leq x \leq 5$ . Use your graph to estimate the coordinates of the intersections of  $y = \frac{1}{x-3}$  and  $y = x^2 - 4x + 1$ . [5]
- (ii) Show algebraically that, where the curves intersect,  $x^3 - 7x^2 + 13x - 4 = 0$ . [3]



- (iii) Use the fact that  $x = 4$  is a root of  $x^3 - 7x^2 + 13x - 4 = 0$  to find a quadratic factor of  $x^3 - 7x^2 + 13x - 4$ . Hence find the exact values of the other two roots of this equation. [5]**

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