

**Wednesday 16 May 2012 – Morning**

**AS GCE MATHEMATICS (MEI)**

**4751** Introduction to Advanced Mathematics (C1)

**QUESTION PAPER**

Candidates answer on the Printed Answer Book.

**OCR supplied materials:**

- Printed Answer Book 4751
- MEI Examination Formulae and Tables (MF2)

**Other materials required:**

None

**Duration:** 1 hour 30 minutes



**MODIFIED LANGUAGE**

**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.
- Do **not** write in the bar codes.
- 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.

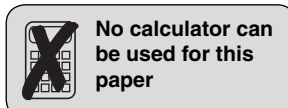
**INFORMATION FOR CANDIDATES**

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**.
- The Printed Answer Book consists of **12** pages. The Question Paper consists of **4** pages. Any blank pages are indicated.

**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

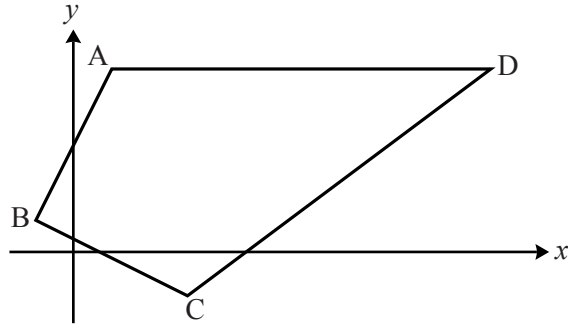


Fig. 10

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  $g(x)$ . State the coordinates of the point where the curve  $y = g(x)$  intersects the  $y$ -axis. [4]

[Question 12 is printed overleaf.]

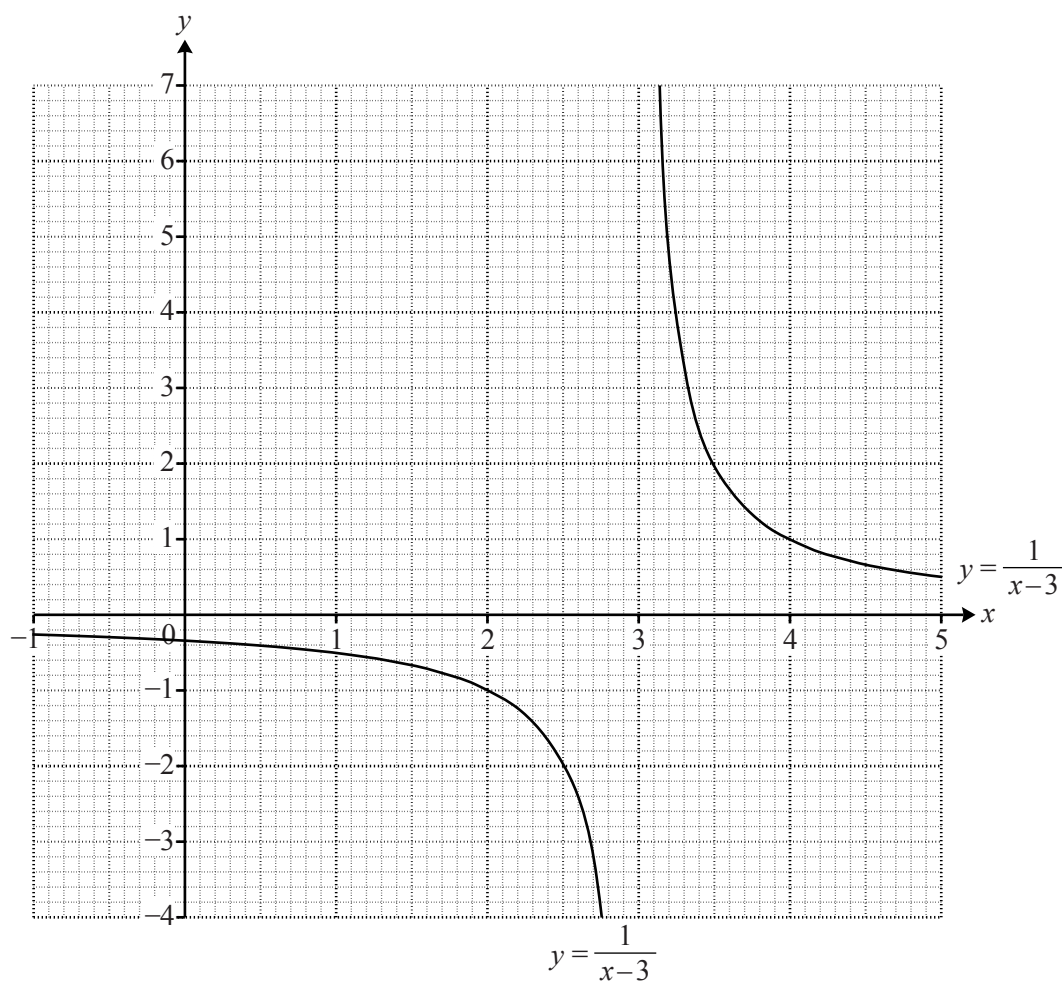


Fig. 12

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

- (i) On the copy of Fig. 12, draw accurately 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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