

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



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.

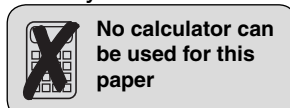
INFORMATION FOR CANDIDATES

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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**No calculator can
be used for this
paper**

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

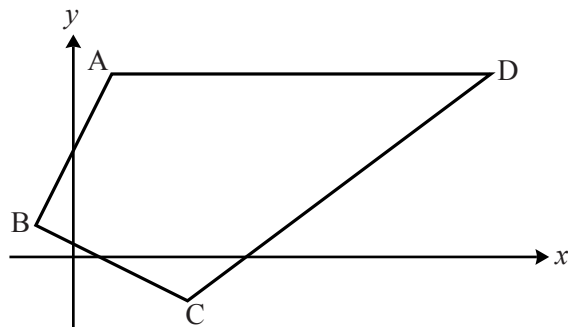


Fig. 10

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

[Question 12 is printed overleaf.]

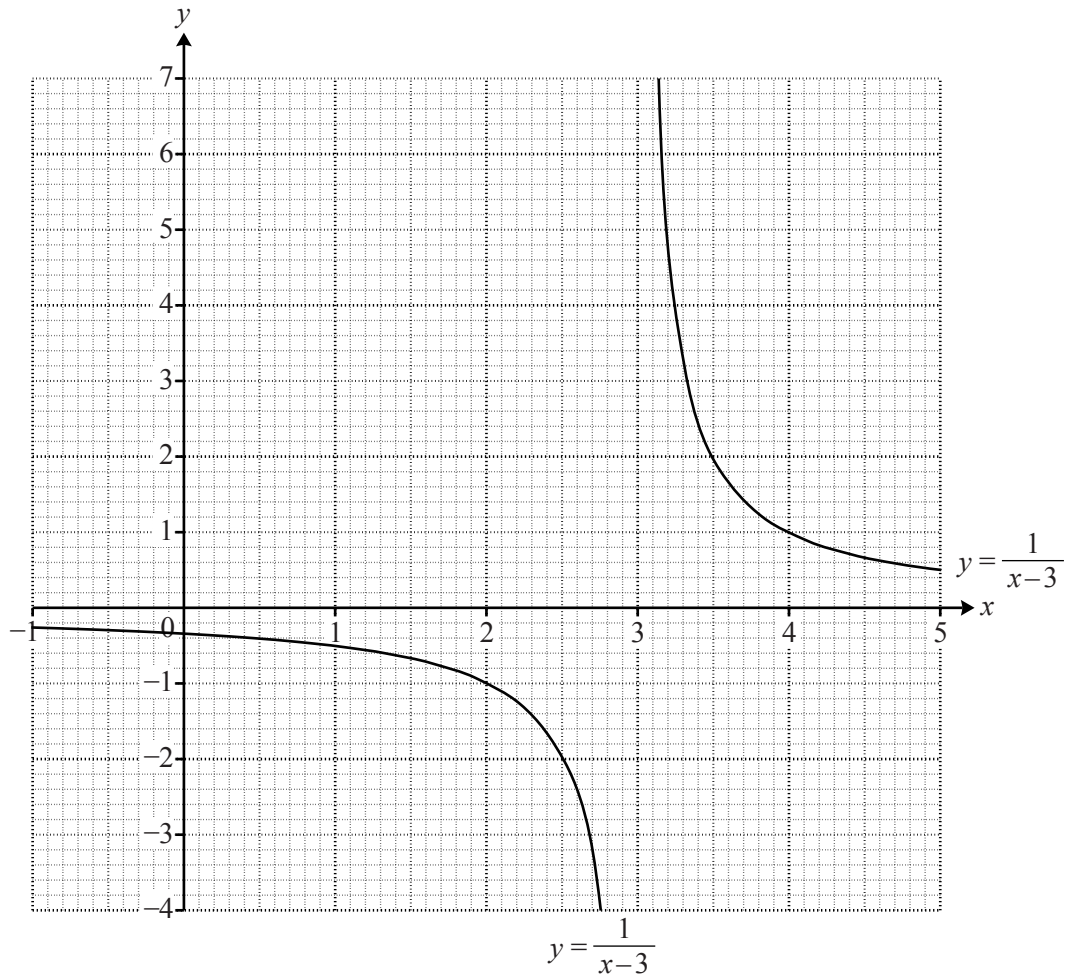


Fig. 12

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

- (i) Draw accurately, on the copy of Fig. 12, 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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