OCR
RECOGNISING ACHIEVEMENT

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.

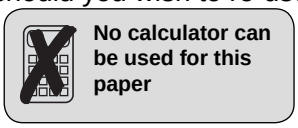
INFORMATION FOR CANDIDATES

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

- Do not send this Question Paper for marking; it should be retained in the centre or recycled. Please contact OCR Copyright should you wish to re-use this document.



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.

$$a = \tfrac{2}{3} b^2 c$$ **[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.

$$\frac{x^2 - 9}{x^2 + 5x + 6}$$ **[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)

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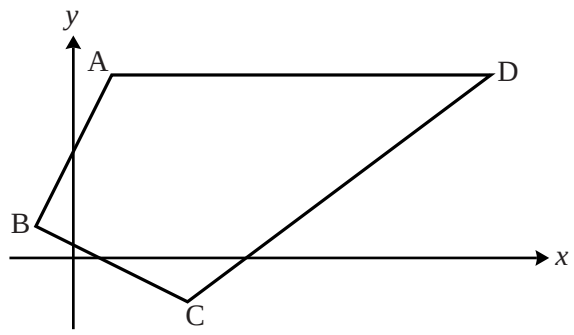

Fig. 10

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

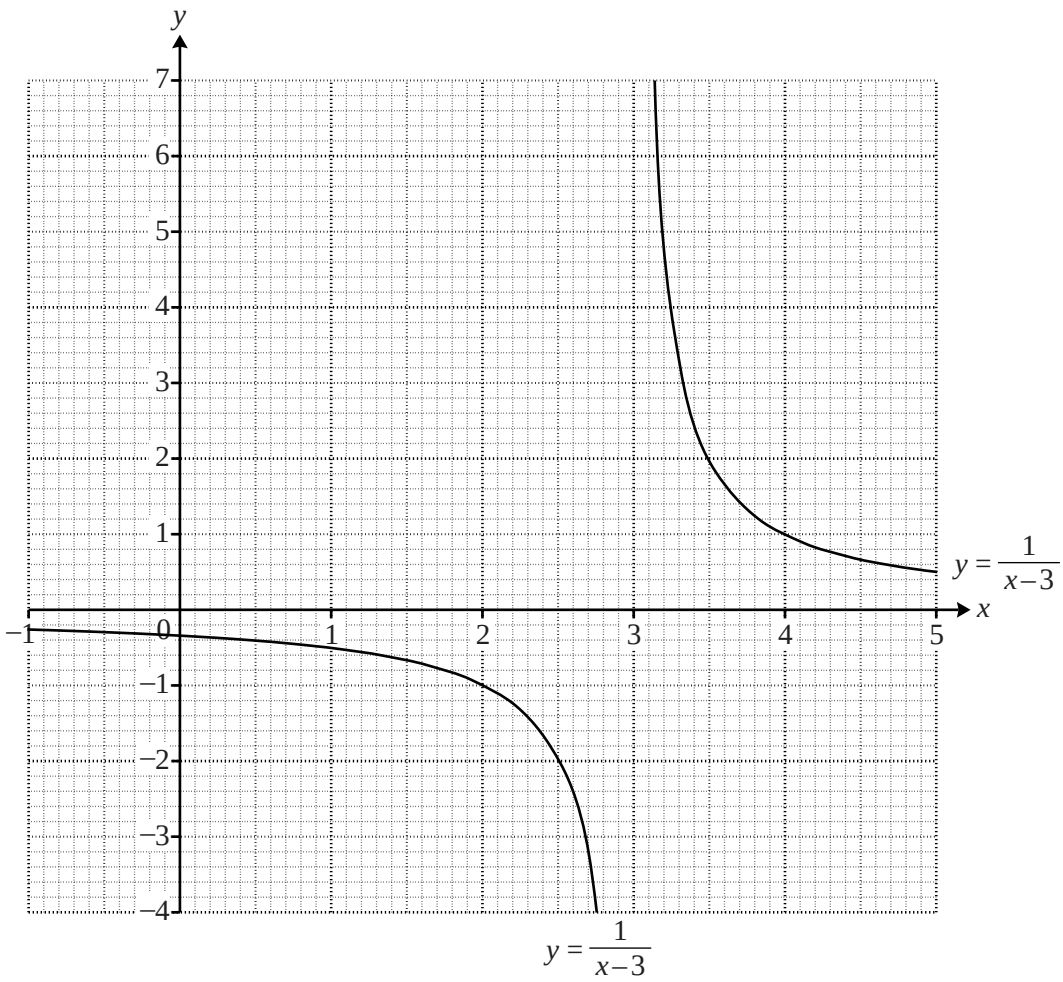

Fig. 12

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 $-1 \leqslant x \leqslant 5$. 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]**