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

DC (NF/SW) 12MEP06288 63599/1

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

- **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.

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

10 The following diagram is Fig. 10.

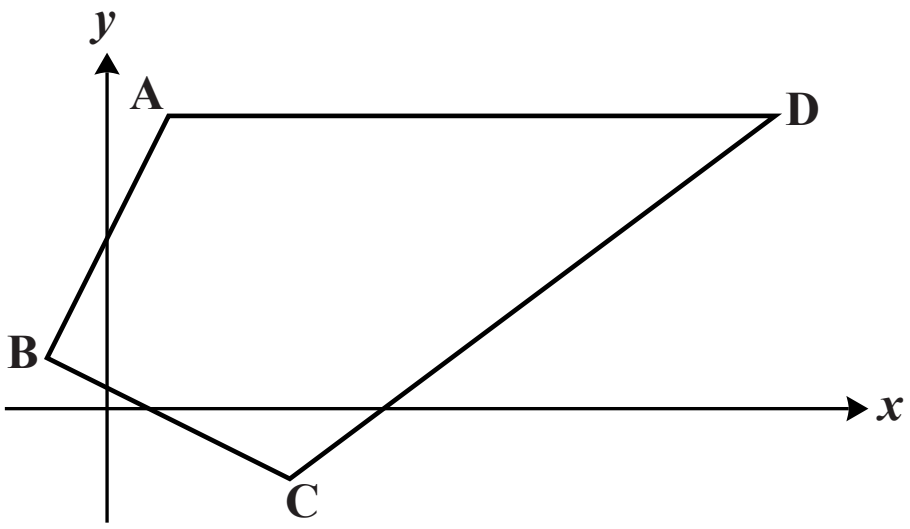

Fig. 10 is a sketch of quadrilateral ABCD with vertices A (1, 5), B (−1, 1), C (3, −1) and D (11, 5).

(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.

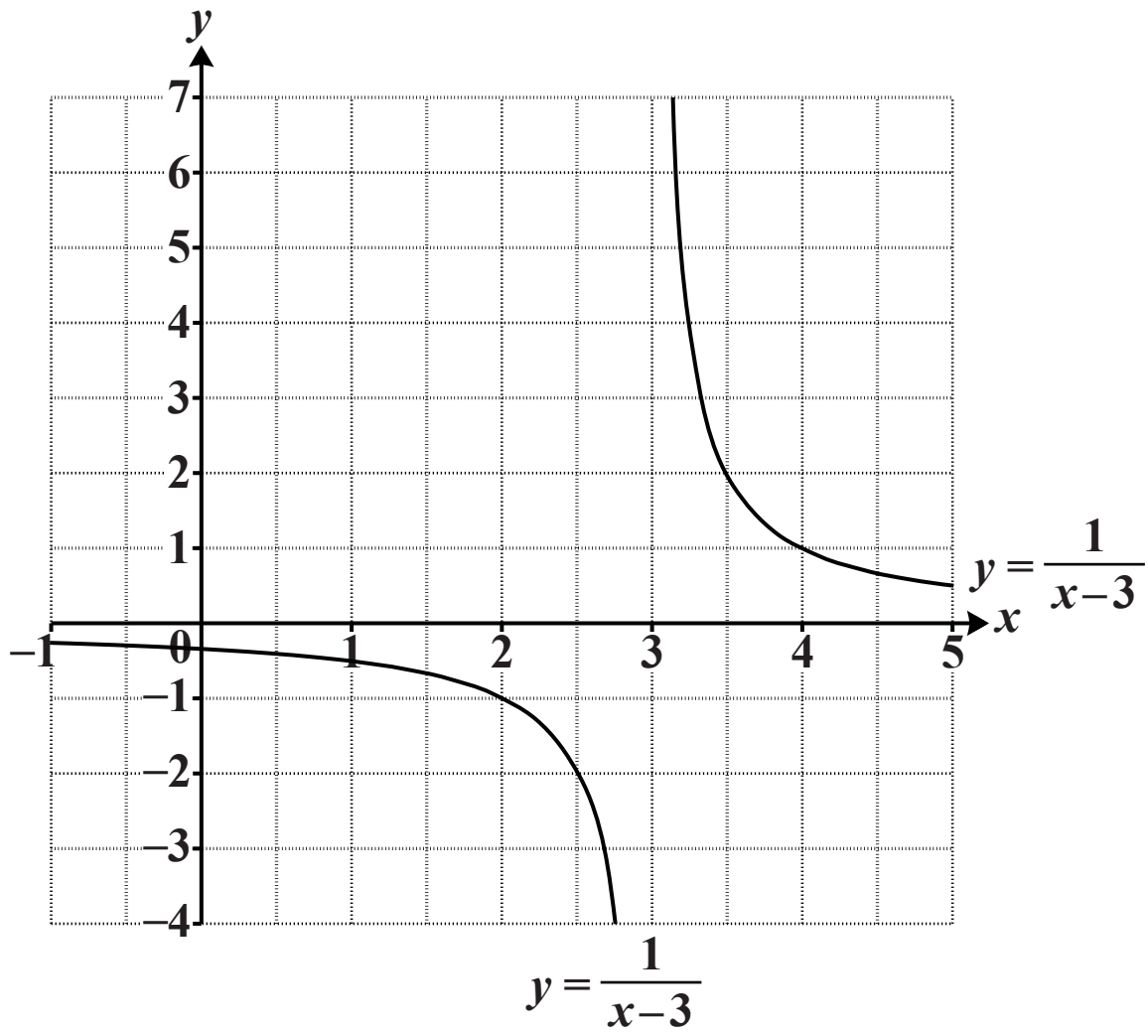

Fig. 12 shows the graph of $y = \frac{1}{x-3}$.

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

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