



Oxford Cambridge and RSA

Thursday 14 May 2015 – Morning

AS GCE MATHEMATICS (MEI)

4755/01 Further Concepts for Advanced Mathematics (FP1)

QUESTION PAPER



Candidates answer on the Printed Answer Book.

OCR supplied materials:

- Printed Answer Book 4755/01
- MEI Examination Formulae and Tables (MF2)

Other materials required:

- Scientific or graphical calculator

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 inside 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 permitted to use a scientific or graphical 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 **16** 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.

This paper has been pre modified for carrier language

Section A (36 marks)

1 Given that $\mathbf{M} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 1 \\ 3 \end{pmatrix}$, where $\mathbf{M} = \begin{pmatrix} 4 & -3 \\ 8 & 21 \end{pmatrix}$, find x and y . [6]

2 Find the roots of the quadratic equation $z^2 - 4z + 13 = 0$.
Find the modulus and argument of each root. [5]

3 The equation $2x^3 + px^2 + qx + r = 0$ has a root at $x = 4$. The sum of the roots is 6 and the product of the roots is -10 . Find p , q and r . [6]

4 Indicate, on a single Argand diagram
 (i) the set of points for which $\arg(z - (-1 - j)) = \frac{\pi}{4}$, [2]
 (ii) the set of points for which $|z - (1 + 2j)| = 2$, [2]
 (iii) the set of points for which $|z - (1 + 2j)| \geq 2$ and $0 \leq \arg(z - (-1 - j)) \leq \frac{\pi}{4}$. [2]

5 (i) Show that $\sum_{r=1}^n (2r - 1) = n^2$. [3]
 (ii) Show that $\frac{\sum_{r=1}^n (2r - 1)}{\sum_{r=n+1}^{2n} (2r - 1)} = k$, where k is a constant to be determined. [4]

6 A sequence is defined by $u_1 = 3$ and $u_{n+1} = 3u_n - 5$. Prove by induction that $u_n = \frac{3^{n-1} + 5}{2}$. [6]

Section B (36 marks)

7 A curve has equation $y = \frac{(3x+2)(x-3)}{(x-2)(x+1)}$.

(i) Write down the equations of the three asymptotes and the coordinates of the points where the curve crosses the axes. [4]

(ii) Sketch the curve, justifying how it approaches the horizontal asymptote. [5]

(iii) Find the set of values of x for which $y \geq 3$. [3]

8 The complex number $5 + 4j$ is denoted by α .

(i) Find α^2 and α^3 , showing your working. [3]

(ii) The real numbers q and r are such that $\alpha^3 + q\alpha^2 + 11\alpha + r = 0$. Find q and r . [4]

Let $f(z) = z^3 + qz^2 + 11z + r$, where q and r are as in part (ii).

(iii) Solve the equation $f(z) = 0$. [3]

(iv) Solve the equation $z^4 + qz^3 + 11z^2 + rz = z^3 + qz^2 + 11z + r$. [2]

9 The triangle ABC has vertices at A(0,0), B(0,2) and C(4,1). The matrix $\begin{pmatrix} 1 & -2 \\ 3 & 0 \end{pmatrix}$ represents a transformation T.

(i) The transformation T maps triangle ABC onto triangle A'B'C'. Find the coordinates of A', B' and C'. [3]

Triangle A'B'C' is now mapped onto triangle A''B''C'' using the matrix $\mathbf{M} = \begin{pmatrix} 4 & 0 \\ 0 & 2 \end{pmatrix}$.

(ii) Describe fully the transformation represented by \mathbf{M} . [3]

(iii) Triangle A''B''C'' is now mapped back onto ABC by a single transformation. Find the matrix representing this transformation. [3]

(iv) Calculate the area of A''B''C''. [3]

END OF QUESTION PAPER



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