

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS
AS GCE**

4755/01

MATHEMATICS (MEI)

**Further Concepts for Advanced
Mathematics (FP1)**

FRIDAY 16 MAY 2014: Afternoon

**DURATION: 1 hour 30 minutes
plus your additional time allowance**

MODIFIED ENLARGED

**Candidates answer on the Printed Answer Booklet, or any
suitable paper provided by the centre. The Printed Answer Book
may be enlarged by the centre.**

OCR SUPPLIED MATERIALS:

Printed Answer Book 4755/01

MEI Examination Formulae and Tables (MF2)

OTHER MATERIALS REQUIRED:

Scientific or graphical calculator

READ INSTRUCTIONS OVERLEAF

INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the spaces provided on the Printed Answer Book or on the paper provided by the centre. Please write clearly and in capital letters.

If you use the Printed Answer Book, write your answer to each question in the space provided. 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 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

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 Use standard series formulae to find $\sum_{r=1}^n r(r-2)$, factorising your answer as far as possible. [5]
- 2 Fig. 2 below shows the unit square, OABC, and its image, OA'B'C', after undergoing a transformation. [5]

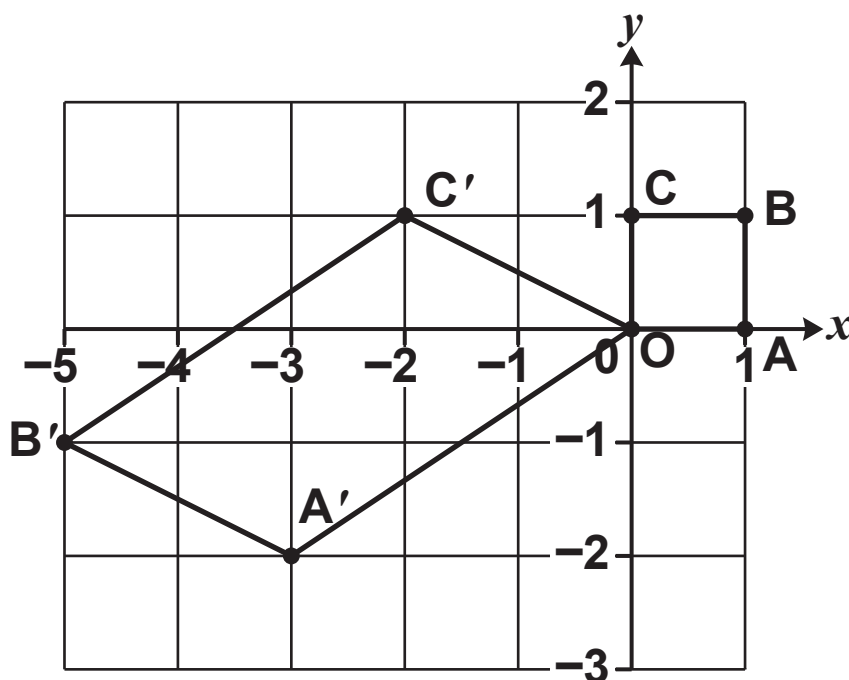


Fig. 2

- (i) Write down the matrix T representing this transformation. [2]

The quadrilateral OA'B'C' is reflected in the x -axis to give a new quadrilateral, OA''B''C''.

- (ii) Write down the matrix representing reflection in the x -axis. [1]

(iii) Find the single matrix that will transform OABC onto OA''B''C''. [2]

3 You are given that $z = 2 + 3j$ is a root of the quartic equation $z^4 - 5z^3 + 15z^2 - 5z - 26 = 0$. Find the other roots. [7]

4 Use the identity $\frac{1}{2r+3} - \frac{1}{2r+5} \equiv \frac{2}{(2r+3)(2r+5)}$ and the method of differences to find $\sum_{r=1}^n \frac{1}{(2r+3)(2r+5)}$, expressing your answer as a single fraction. [5]

5 The roots of the cubic equation $3x^3 - 9x^2 + x - 1 = 0$ are α , β and γ . Find the cubic equation whose roots are $3\alpha - 1$, $3\beta - 1$ and $3\gamma - 1$, expressing your answer in a form with integer coefficients. [7]

6 Prove by induction that

$$\frac{1}{1 \times 3} + \frac{1}{3 \times 5} + \frac{1}{5 \times 7} + \dots + \frac{1}{(2n-1)(2n+1)} = \frac{n}{2n+1}. \quad [7]$$

SECTION B (36 marks)

7 A curve has equation $y = \frac{x^2 - 5}{(x + 3)(x - 2)(ax - 1)}$, where a is a constant.

(i) Find the coordinates of the points where the curve crosses the x -axis and the y -axis. [2]

(ii) You are given that the curve has a vertical asymptote at $x = \frac{1}{2}$. Write down the value of a and the equations of the other asymptotes. [3]

(iii) Sketch the curve. [4]

(iv) Find the set of values of x for which $y > 0$. [3]

8 You are given the complex number $w = 2 + 2\sqrt{3}j$.

(i) Express w in modulus-argument form. [3]

(ii) Indicate on an Argand diagram the set of points, z , which satisfy both of the following inequalities.

$$-\frac{\pi}{2} \leq \arg z \leq \frac{\pi}{3} \text{ and } |z| \leq 4$$

Mark w on your Argand diagram and find the greatest value of $|z - w|$. [9]

9 You are given that $A = \begin{pmatrix} 1 & 3 & -1 \\ -1 & \alpha & -1 \\ -2 & -1 & 3 \end{pmatrix},$

$$B = \begin{pmatrix} 3\alpha - 1 & -8 & \alpha - 3 \\ 5 & 1 & 2 \\ 2\alpha + 1 & -5 & \alpha + 3 \end{pmatrix} \text{ and } AB = \begin{pmatrix} \gamma & 0 & 0 \\ \beta & \gamma & 0 \\ 0 & 0 & \gamma \end{pmatrix}.$$

(i) Show that $\beta = 0$. [2]

(ii) Find γ in terms of α . [2]

(iii) Write down A^{-1} for the case when $\alpha = 2$. State the value of α for which A^{-1} does not exist. [3]

(iv) Use your answer to part (iii) to solve the following simultaneous equations.

$$\begin{aligned} x + 3y - z &= 25 \\ -x + 2y - z &= 11 \\ -2x - y + 3z &= -23 \end{aligned} \quad [5]$$

END OF QUESTION PAPER

THERE ARE NO QUESTIONS PRINTED ON THIS PAGE.



Copyright Information

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download from our public website (www.ocr.org.uk) after the live examination series.

If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact the Copyright Team, First Floor, 9 Hills Road, Cambridge CB2 1GE.

OCR is part of the Cambridge Assessment Group; Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.



* 3 9 6 2 3 7 4 4 2 5 *