

OCR

Oxford Cambridge and RSA

Friday 19 May 2017 – Morning

AS GCE MATHEMATICS (MEI)

4755/01 Further Concepts for Advanced Mathematics (FP1)

QUESTION PAPER

Candidates answer on the Printed Answer Book.

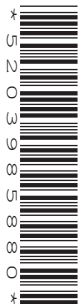
OCR supplied materials:

- 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.

Section A (36 marks)

- 1 The matrices **A** and **B** are given by $\mathbf{A} = \begin{pmatrix} 4 & -3 \\ 2 & 1 \end{pmatrix}$, $\mathbf{B} = \begin{pmatrix} a & 4 \\ 7 & a+3 \end{pmatrix}$ and **I** is the 2×2 identity matrix. Find
- (i) $2\mathbf{A} - \mathbf{B} + 3\mathbf{I}$, giving your answer in terms of a , [3]
 - (ii) the value of a for which $\mathbf{AB} = \begin{pmatrix} 3 & -11 \\ 19 & 17 \end{pmatrix}$, [2]
 - (iii) the values of a for which **B** is singular. [3]
- 2 The complex number $2 - 3j$ is denoted by z .
- (i) Find $|z|$ and $\arg z$. [2]
 - (ii) You are given that $2az + 3z^* = 5 - bj$, where a and b are real. Find the values of a and b . [4]
- 3 (i) Using the standard summation formulae, find an expression for $\sum_{r=1}^n (1 - 2r)^2$ in terms of n . Give your answer in a fully factorised form. [6]
- (ii) Hence evaluate $\sum_{r=25}^{75} (1 - 2r)^2$. [2]

- 4 The Argand diagram in Fig. 4 shows a half-line l and a circle C . The circle has centre $3 + 4j$.

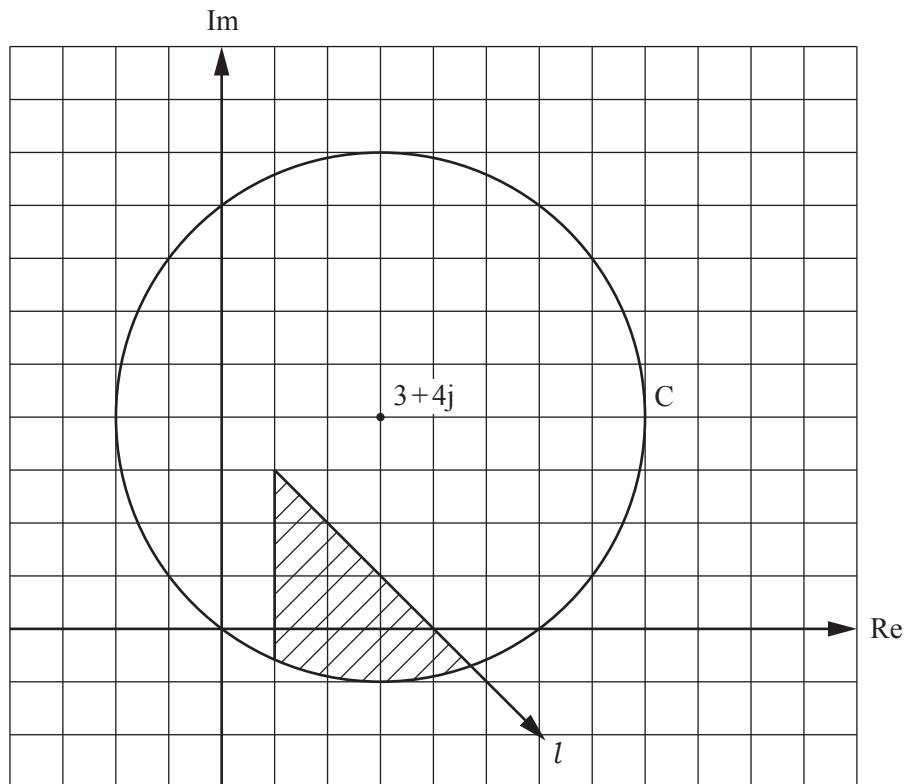


Fig. 4

- (i) Write down, in complex number form, the equations of l and C . [4]
- (ii) Write down inequalities that define the shaded region indicated in Fig. 4, together with its boundaries. [3]
- 5 Prove by induction that $\sum_{r=1}^n \frac{r}{2^r} = 2 - \left(\frac{1}{2}\right)^n (2+n)$. [7]

Section B (36 marks)

- 6 A curve has equation $y = \frac{ax^2 - 12}{4x^2 + bx - 6}$, where a and b are constants.
- (i) Find the coordinates of the point where the curve crosses the y -axis. [1]
 - (ii) You are given that the curve has a vertical asymptote at $x = 2$. Find the value of b and the equation of the other vertical asymptote. [3]
 - (iii) You are given that the curve crosses the x -axis when $x = \pm\sqrt{6}$. Find the value of a and the equation of the horizontal asymptote. [2]
 - (iv) Sketch the curve. [3]
 - (v) Find the set of values for which $y \geq 0$. [3]
- 7 (a) The roots of the cubic equation $2x^3 - x^2 + 4x + 2 = 0$ are α , β and γ . Find the cubic equation whose roots are 3α , 3β and 3γ , expressing your answer in a form with integer coefficients. [5]
- (b) A second cubic equation $x^3 + px^2 + qx + r = 0$, where p , q and r are real, has roots that may be written as $a - \lambda$, a and $a + \lambda$.
- (i) By considering the sum of the roots show that $2p^3 - 9pq + 27r = 0$. [4]
 - (ii) Given that $p = -6$ and $q = 37$ find the roots of this second cubic equation. [4]
- 8 (i) The matrix \mathbf{P} is given by $\mathbf{P} = \begin{pmatrix} \frac{1}{2} & \frac{\sqrt{3}}{2} \\ -\frac{\sqrt{3}}{2} & \frac{1}{2} \end{pmatrix}$. Describe fully the geometrical transformation represented by \mathbf{P} . [2]
- The matrix \mathbf{R} is given by $\mathbf{R} = \begin{pmatrix} 2 - 3\sqrt{3} & 3 + 2\sqrt{3} \\ 1 + \sqrt{3} & -1 + \sqrt{3} \end{pmatrix}$.
- (ii) Show that the multiplication of \mathbf{P} and \mathbf{R} is not commutative. [2]
 - (iii) The transformation represented by \mathbf{R} is equivalent to the transformation represented by \mathbf{P} followed by another transformation represented by the matrix \mathbf{Q} . Find \mathbf{Q} . [5]
 - (iv) The transformation represented by \mathbf{Q} is applied to a figure of area 4 square units. Find the area of the transformed figure. [2]

END OF QUESTION PAPER

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.