



Oxford Cambridge and RSA

AS Level Further Mathematics B (MEI)

Y410/01 Core Pure

Practice Paper – Set 1

Time allowed: 1 hour 15 minutes

You must have:

- Printed Answer Booklet
- Formulae Further Mathematics B (MEI)

You may use:

- a scientific or graphical calculator

INSTRUCTIONS

- Use black ink. HB pencil may be used for graphs and diagrams only.
- Complete the boxes provided on the Printed Answer Booklet with your name, centre number and candidate number.
- Answer **all** the questions.
- **Write your answer to each question in the space provided in the Printed Answer Booklet.** Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the barcodes.
- 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

- The total number of marks for this paper is **60**.
- The marks for each question are shown in brackets [].
- 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 used. You should communicate your method with correct reasoning.
- The Printed Answer Booklet consists of **12** pages. The Question Paper consists of **4** pages.

Answer **all** the questions.

1 Using standard summation formulae, find $\sum_{r=1}^n r(r-2)$, giving your answer in a fully factorised form. [5]

2 **In this question you must show detailed reasoning.**

Find, in exact form, the roots of the equation $x^3 - x^2 - 2x - 12 = 0$. [6]

3 (i) Given that z is a complex number with modulus r and argument θ , where $-\frac{1}{2}\pi < \theta < \frac{1}{2}\pi$, state

- the modulus of z^2 ,
- the argument of z^2 .

[2]

(ii) Fig. 3 shows a complex number z , where the modulus of z is 3, represented on an Argand diagram.

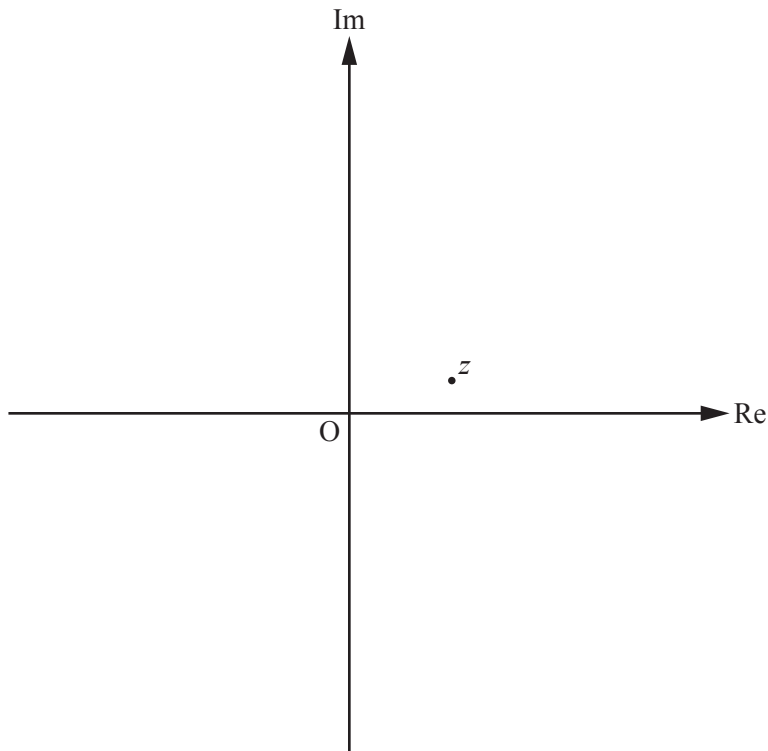


Fig. 3

Indicate the positions of the points representing iz , z^* and z^2 on the copy of Fig. 3 in the Printed Answer Booklet, labelling them clearly. [3]

4 A sequence u_n is defined by $u_{n+1} = 2u_n + 3$ and $u_1 = 1$.

Prove by induction that $u_n = 4 \times 2^{n-1} - 3$ for all positive integers n . [5]

- 5 (i) Write down the 3×3 matrix \mathbf{M}_1 that represents a reflection in the plane $y = 0$. [1]
- (ii) Write down the single transformation represented by the matrix $\mathbf{M}_2 = \begin{pmatrix} 1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & -1 \end{pmatrix}$. [1]
- (iii) (A) Find the determinants of \mathbf{M}_1 and \mathbf{M}_2 . [2]
- (B) Explain how the signs and magnitudes of these determinants relate to the transformations represented by the matrices \mathbf{M}_1 and \mathbf{M}_2 . [2]
- (iv) (A) Find the matrix \mathbf{M}_3 where $\mathbf{M}_3 = \mathbf{M}_1\mathbf{M}_2$. [1]
- (B) Describe the single transformation represented by the matrix \mathbf{M}_3 . [2]
- 6 The complex number z is given by $z = k + 3i$, where k is a negative real number.
Given that $z + \frac{12}{z}$ is real, express z in exact modulus-argument form. [7]

- 7 Fig. 7 shows a circle and a straight line drawn in an Argand diagram.

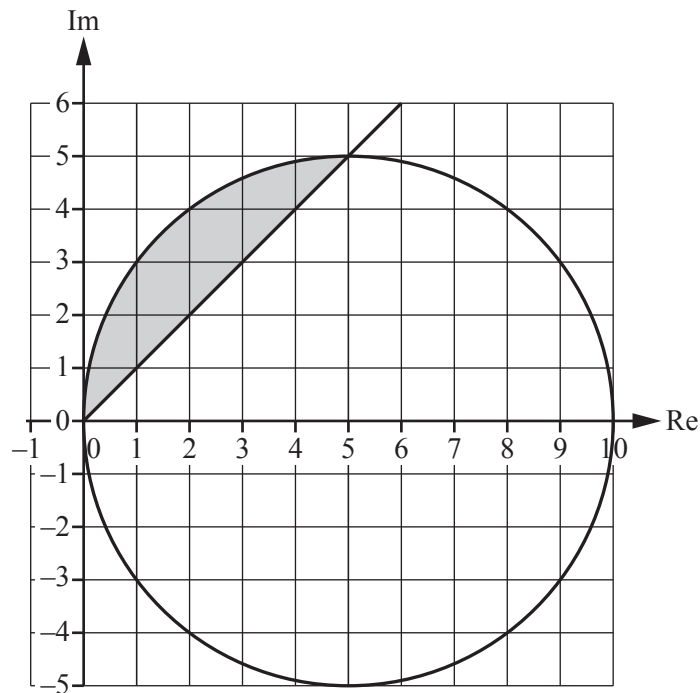


Fig. 7

The point representing the complex number z lies in the shaded region, excluding its boundaries.

Write down two inequalities satisfied by z . [4]

8 You are given that $1 + 2i$ is a root of the equation $z^3 + az + b = 0$, where $a \in \mathbb{R}$ and $b \in \mathbb{R}$.

(i) Find the other roots of the equation. [3]

(ii) Find the values of a and b . [4]

9 Three planes Π_1 , Π_2 and Π_3 have cartesian equations

$$\Pi_1: 2x + y - 3z = 9,$$

$$\Pi_2: x - 4y + 4z = -3,$$

$$\Pi_3: 3x + 2y + z = c,$$

where c is a constant.

(i) Find the acute angle between the planes Π_1 and Π_2 . [4]

(ii) (A) Show that the three planes always meet at a point. [4]

(B) In the case where $c = -4$, find the exact distance of the point of intersection from the origin. [4]

END OF QUESTION PAPER

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