OCR
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.

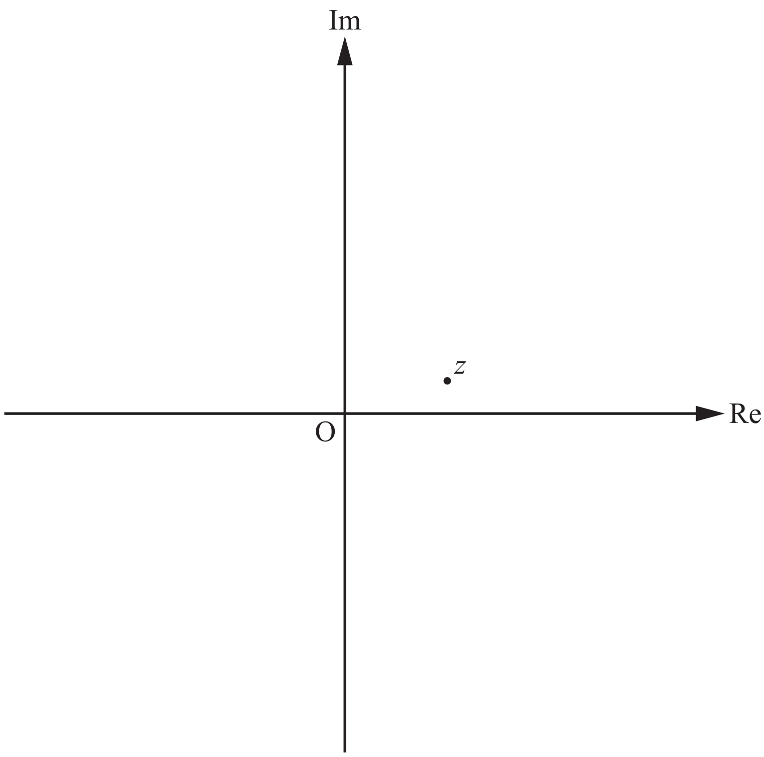

Fig. 3

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 $z = k + 3\text{i}$, where k is a negative real number.

Given that $z + \dfrac{12}{z}$ 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.

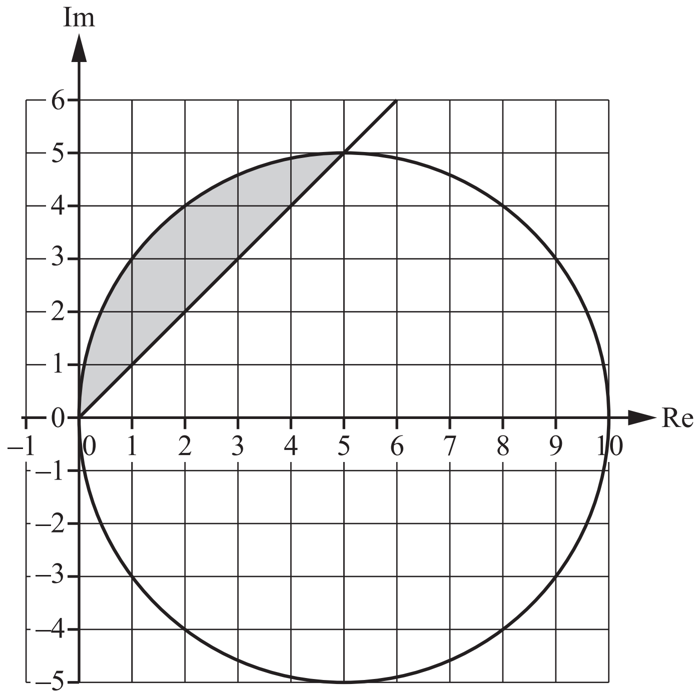

Fig. 7

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 $1 + 2\mathrm{i}$ 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

$$\begin{aligned} \Pi_1&: \ 2x + y - 3z = 9, \\ \Pi_2&: \ x - 4y + 4z = -3, \\ \Pi_3&: \ 3x + 2y + z = c, \end{aligned}$$

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