OXFORD AQA

INTERNATIONAL QUALIFICATIONS

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

INTERNATIONAL AS
FURTHER MATHEMATICS

(9665/FM01) Unit FP1 Pure Mathematics

Thursday 15 May 2025 07:00 GMT Time allowed: 1 hour 30 minutes

Materials
- For this paper you must have the OxfordAQA Booklet of Formulae and Statistical Tables (enclosed).
- You may use a graphical calculator.

Instructions
- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.

Advice
- Unless stated otherwise, you may quote formulae, without proof, from the booklet.
- Show all necessary working; otherwise marks may be lost.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
TOTAL	

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Answer **all** questions in the spaces provided.

1 It is given that

$$\frac{5 + a\mathrm{i}}{7 + b\mathrm{i}} = \frac{1 + \mathrm{i}}{a}$$

where a and b are real numbers such that $a < b$

Find the value of a and the value of b

[5 marks]

$a =$ _____ $b =$ _____

5

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2 [The volume of a sphere is given by the formula $V = \frac{4}{3}\pi r^3$ where r is the radius.]

The volume of a sphere is increasing at a constant rate of $12\ \text{cm}^3\ \text{s}^{-1}$

Find the rate of increase of the radius of the sphere when its volume is $300\ \text{cm}^3$

Give your answer in $\text{cm}\,\text{s}^{-1}$ to three significant figures.

[5 marks]

Answer _____

5

Turn over ►

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3 (a) Find the general solution of the equation

$$\sin\left(2x+\frac{\pi}{3}\right)=\frac{1}{\sqrt{2}}$$

[4 marks]

Answer _____

Do not write outside the box

3 (b) Find the sum of the four smallest positive solutions of the equation

$$\sin\left(2x+\frac{\pi}{3}\right)=\frac{1}{\sqrt{2}}$$

[2 marks]

Answer _____

6

Turn over for the next question

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4 The numbers α and β are roots of the quadratic equation

$$x^2 + 4x + c = 0$$

where c is a constant.

4 (a) Express $\alpha^3 + \beta^3$ in terms of c

[4 marks]

Answer _____

4 (b) The numbers $\alpha^2 - \beta$ and $\beta^2 - \alpha$ are roots of the quadratic equation

$$x^2 + px + q = 0$$

where p and q are constants.

4 (b) (i) Express p in terms of c

[3 marks]

Do not write outside the box

Answer _____

4 (b) (ii) Express q in terms of c

[3 marks]

Answer _____

10

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5 (a) Use the formulae for $\sum_{r=1}^{n} r$ and $\sum_{r=1}^{n} r^2$ to show that

$$\sum_{r=1}^{n} \left(3r^2 - 3r + 1\right)$$

is a cube number for all values of n

[5 marks]

Do not write outside the box

5 (b) It is given that p is a prime number where $p > 10$

Express

$$\sum_{r=p+1}^{4p} \left(3r^2 - 3r + 1\right)$$

as a product of prime factors.

[3 marks]

Answer _____

8

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6 The curve C has equation

$$y = \frac{6x + 10}{2x - 5}$$

The line L has equation

$$y = 2x - 2$$

6 (a) Write down the equations of the two asymptotes of C

[2 marks]

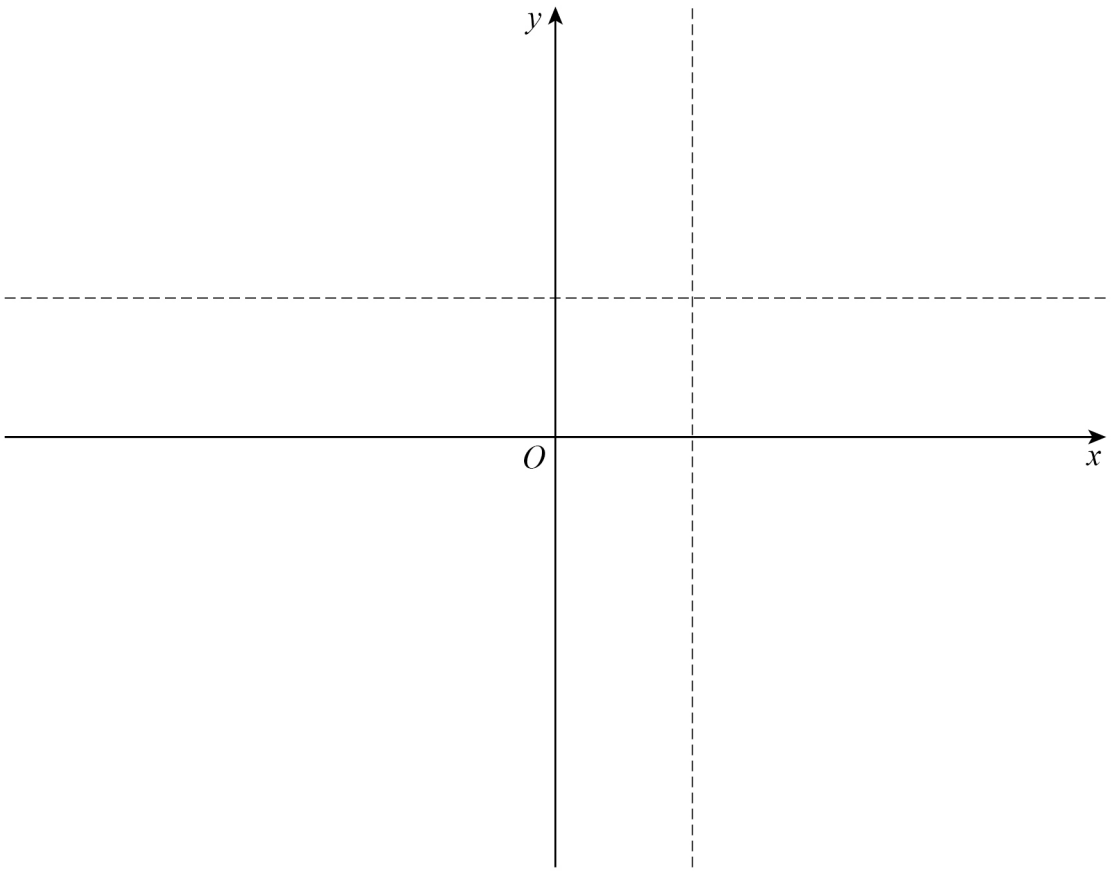
Asymptote 1 _____ Asymptote 2 _____

6 (b) The asymptotes of C are shown on the axes below.

Sketch C and L on the same axes.

Show the coordinates of any axis intercepts.

[4 marks]



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6 (c) Hence, or otherwise, solve the inequality

$$\frac{6x+10}{2x-5} \leq 2x-2$$

[5 marks]

Answer _____

11

Turn over ►

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7 The integral I is defined as

$$I = \int_{-1}^{2} \left(\frac{2}{\sqrt[3]{x}} \right) \mathrm{d}x$$

7 (a) Explain why I is an improper integral.

[1 mark]

7 (b) The integral I is equal to the sum of two improper integrals such that

$$I = \int_{-1}^{0} \left(\frac{2}{\sqrt[3]{x}} \right) \mathrm{d}x + \int_{a}^{b} \left(\frac{2}{\sqrt[3]{x}} \right) \mathrm{d}x$$

where a and b are integers and $0 \leq a < b$

7 (b) (i) Write down the value of a and the value of b

[1 mark]

$a =$ _____ $b =$ _____

Do not write outside the box

7 (b) (ii) Hence express I in the form

$$m\left(\sqrt[3]{n} - 1\right)$$

where m and n are integers.

Show the limiting processes used.

[4 marks]

6

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8 The curve C_1 has equation

$$4x^2 + y^2 = 8$$

The curve C_2 has equation

$$4x^2 + y^2 - 24x - 4y + p = 0$$

where p is a constant.

The curve C_1 is mapped onto the curve C_2 by the translation $\begin{bmatrix} a \\ b \end{bmatrix}$

8 (a) Find the value of a, the value of b and the value of p

[5 marks]

$a =$ _____ $b =$ _____ $p =$ _____

Question 8 continues on the next page

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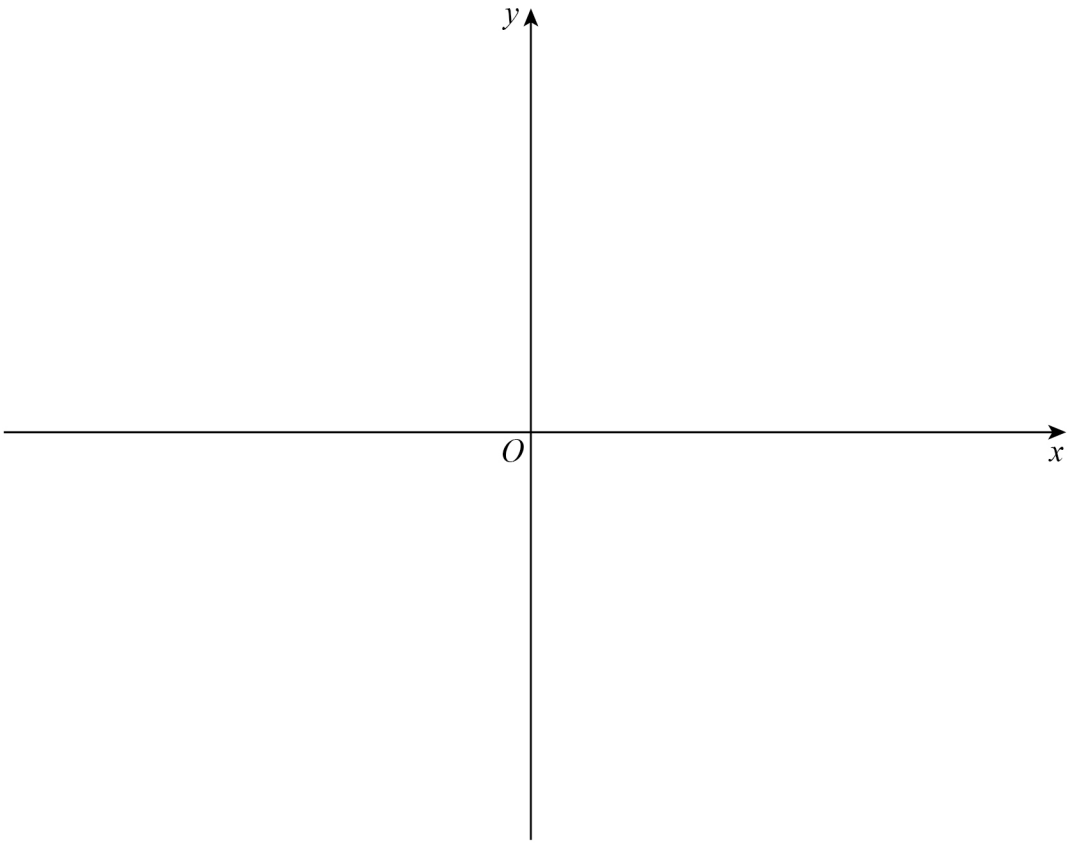
8 (b) Sketch C_1 and C_2 on the axes below.

Show the coordinates of any points where the curves intersect the axes.

[6 marks]



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8 (c) A rectangle R with sides parallel to the axes contains both C_1 and C_2

Find the minimum possible area of R

Give your answer in the form $m+n\sqrt{2}$ where m and n are integers.

[3 marks]

Answer _____

14

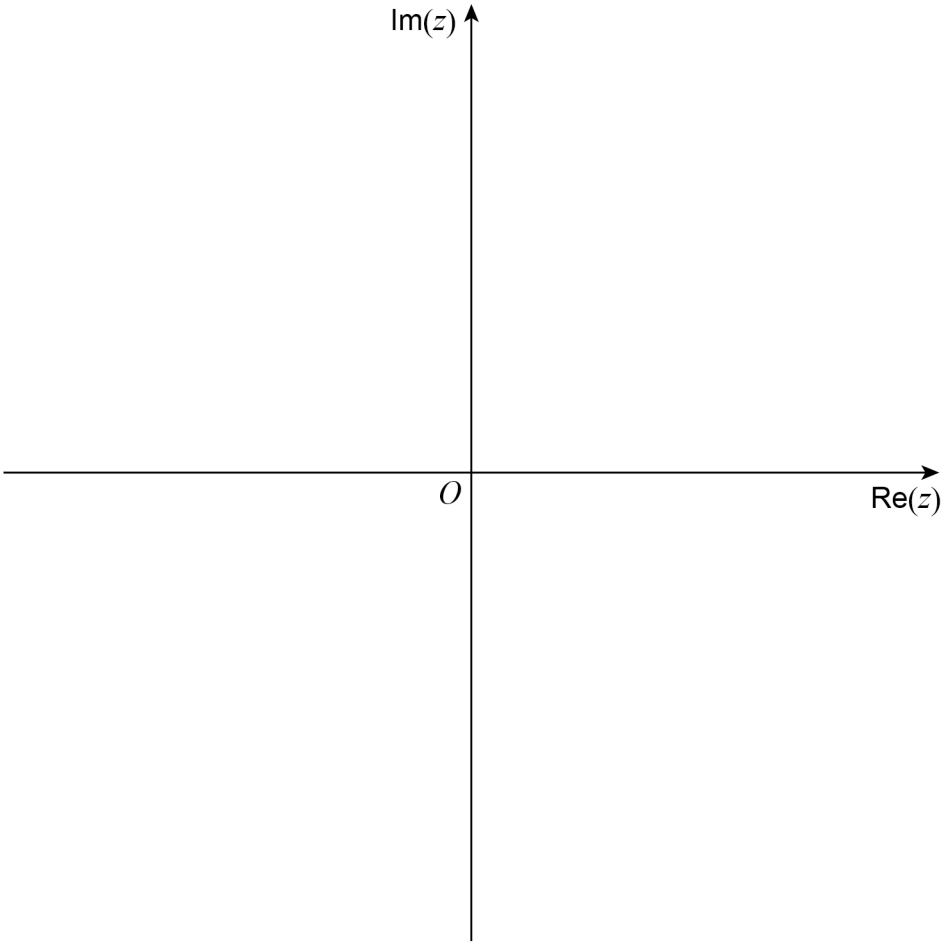
Turn over for the next question

Do not write outside the box

9 (a) On the Argand diagram below, sketch the locus of points which satisfies the equation

$$\left|z-\left(8+6\mathrm{i}\right)\right| = 6$$

[3 marks]



9 (b) Write down the least value of $\arg\left(z\right)$

[1 mark]

Answer _____

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9 (c) Find the greatest value of $\arg(z)$

Give your answer to two decimal places.

[3 marks]

Answer _____

Question 9 continues on the next page

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9 (d) It is given that the complex numbers z_1 and z_2 satisfy the equation

$$\left|z-\left(8+6\mathrm{i}\right)\right| = 6$$

where

$$\arg\left(z_1\right) = \arg\left(z_2\right)$$

$$\left|z_2\right| = 12$$

$$\left|z_1\right| < 12$$

9 (d) (i) Calculate the possible values of $\arg\left(z_2\right)$

Give your answer to two decimal places.

[4 marks]

Answer _____

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9 (d) (ii) Calculate the exact value of $|z_1|$

[4 marks]

Answer _____

15

END OF QUESTIONS

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