

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

Wednesday 7 January 2026

07:00 UK Time

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	
10	
TOTAL	



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

1 The complex number z is given by

$$z = -\sqrt{3} - i$$

1 (a) (i) Express z in the form $r(\cos\theta + i\sin\theta)$ where $r \geq 0$ and $-\pi < \theta \leq \pi$

[3 marks]

Answer _____

1 (a) (ii) Hence write down z^* in the form $r(\cos\theta + i\sin\theta)$ where $r \geq 0$ and $-\pi < \theta \leq \pi$

[1 mark]

Answer _____



- 1 (b) On an Argand diagram, the point P represents z and the point Q represents z^* .
Find the acute angle POQ where O is the origin.

[2 marks]

Answer _____

6

Turn over for the next question

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2 (b) Use your answer to **part (a)** to find the gradient of C at the point where $x = 7$

Show the limiting process used.

[2 marks]

Answer _____

5

Turn over for the next question

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3 (a) Show that

$$\frac{1}{3r-1} - \frac{1}{3r+2} = \frac{3}{9r^2+3r-2}$$

[1 mark]

3 (b) Hence use the method of differences to show that

$$\sum_{r=1}^n \frac{3}{9r^2+3r-2}$$

can be written in the form $\frac{3n}{cn+d}$ where c and d are integers.

[4 marks]



3 (c) Find the value of p such that

$$\sum_{r=p}^{\infty} \frac{3}{9r^2 + 3r - 2} = \frac{1}{1001}$$

[3 marks]

$p =$ _____

8

Turn over ►



4 The integral I_k is defined by

$$I_k = \int_k^5 \left(\frac{1}{x^2} \right) dx$$

where $k < 5$

4 (a) Write down the range of values of k for which I_k is an improper integral.

[1 mark]

Answer

4 (b) Explain why I_{-3} does not have a finite value.

[1 mark]



7 The equation

$$\cos\left(3x + \frac{\pi}{4}\right) = \frac{1}{2}$$

has the general solution

$$x = \frac{\pi}{36} (24n \pm a + b)$$

where a and b are **positive** integers.

7 (a) A student claims that n can be any real number. This student's claim is incorrect.

Write down a correct statement about the values n can take.

[1 mark]

7 (b) In the case when $a = 4$ find the least possible value of b

[3 marks]

$$b = \underline{\hspace{10em}}$$

7 (c) In the case when $b = 9$ find the least possible value of a

[3 marks]

$$a = \underline{\hspace{10em}}$$



- 7 (d) Find the number of solutions of the equation

$$\cos\left(3x + \frac{\pi}{4}\right) = \frac{1}{2}$$

which lie in the interval $-\pi < x \leq \pi$

[2 marks]

Answer _____

- 7 (e) Hence, or otherwise, find the number of solutions of the equation

$$\cos\left(3x + \frac{\pi}{4}\right) = \frac{1}{2}$$

which lie in the interval $\theta < x \leq \theta + 80\pi$ where θ is a constant.

[2 marks]

Answer _____



Answer _____

8 (b) The asymptotes of H are perpendicular to each other.

8 (b) (i) Find the value of k

[3 marks]

$k =$ _____

Question 8 continues on the next page

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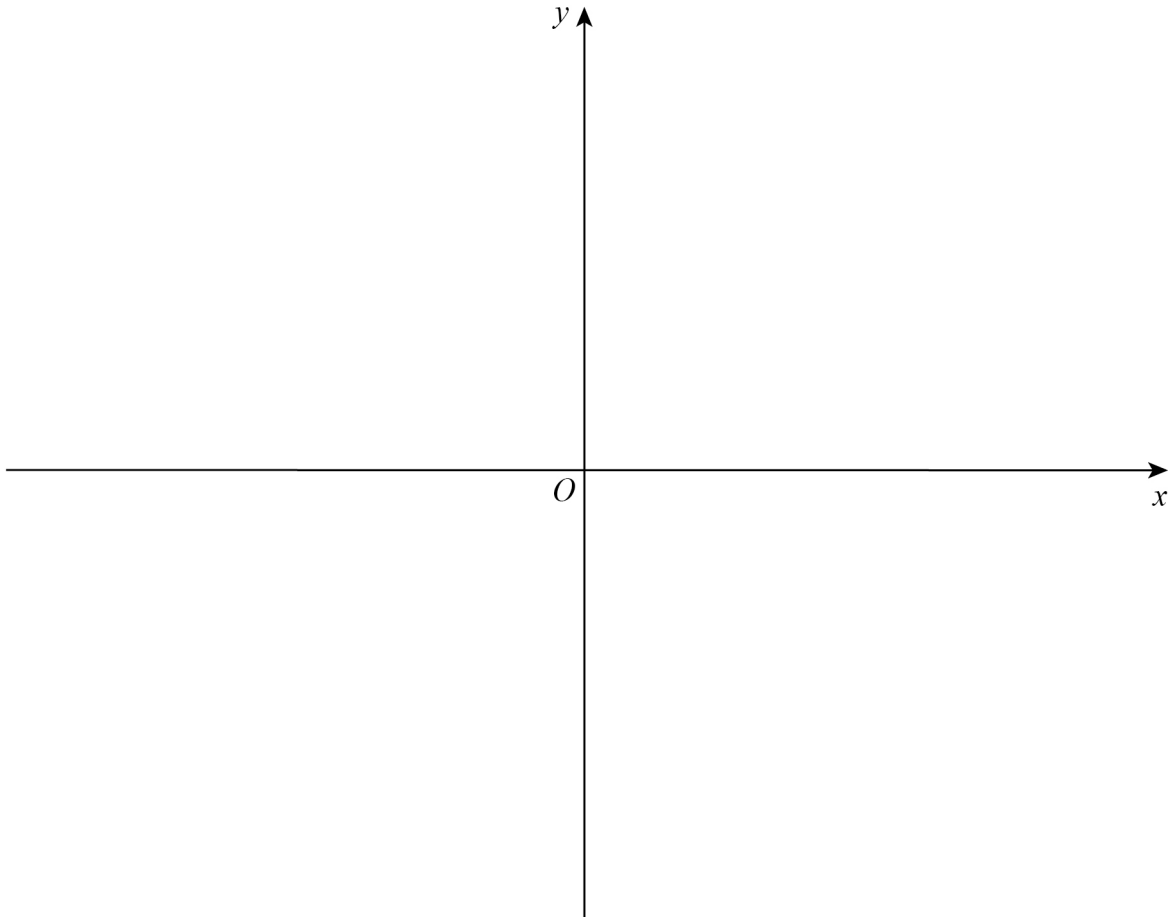
8 (b) (ii) Sketch the graph of H on **Figure 1**

Include the coordinates of any axis intercepts.

Include the asymptotes and their equations.

[3 marks]

Figure 1



10



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9 The function f is defined by $f(x) = \frac{x^2 + 2}{x^2 + 3x}$

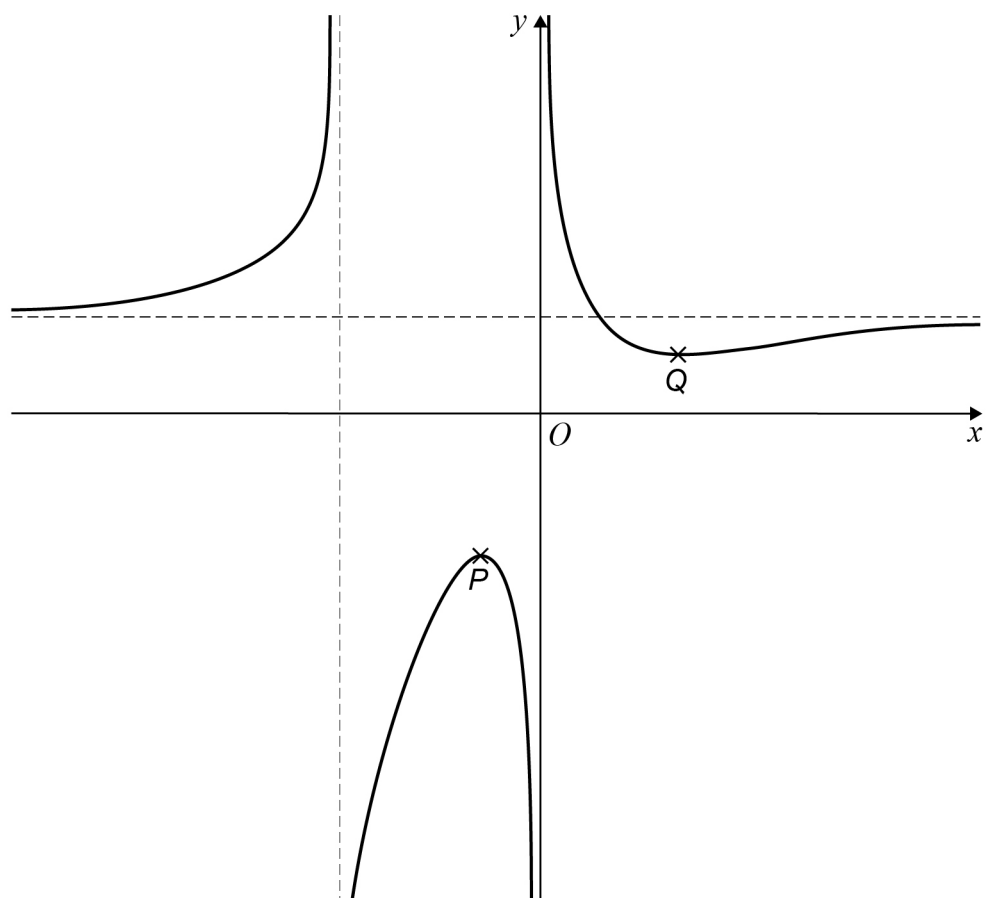
The curve C_1 has equation $y = f(x)$

The point P is the local maximum of C_1

The point Q is the local minimum of C_1

The graph of C_1 is shown in **Figure 2**

Figure 2



- 9 (b)** Use your answer to **part (a)** to find the y -coordinate of P and the y -coordinate of Q
Give your answers in an exact form.

[2 marks]

y -coordinate of P = _____

y -coordinate of Q = _____

- 9 (c)** The curve C_2 has equation $y = \frac{1}{f(x)}$

- 9 (c) (i)** Write down the number of asymptotes of C_2

[1 mark]

Answer _____

- 9 (c) (ii)** Write down the y -coordinate of the point of intersection of C_1 and C_2

[1 mark]

Answer _____

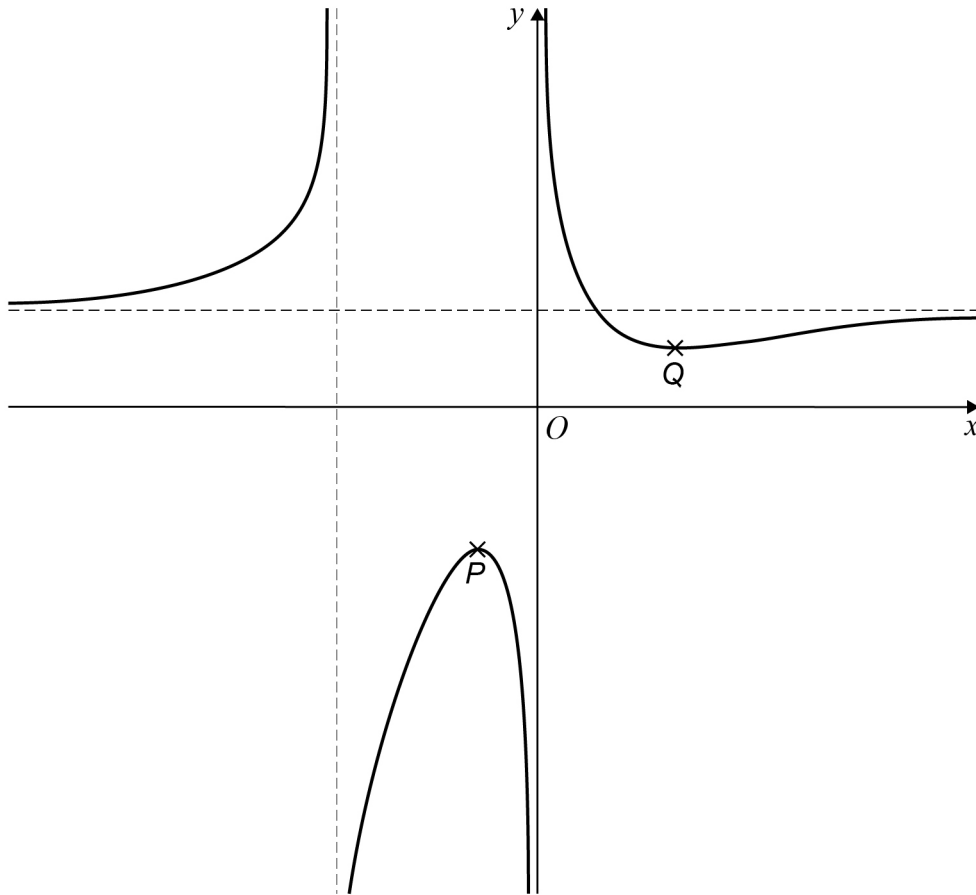


9 (c) (iii) The graph of C_1 is shown again in **Figure 3**

Sketch the graph of C_2 on **Figure 3**

[4 marks]

Figure 3



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10 (c) The four roots of the equation

$$(z^2 + mz + n)(z^2 + 6z + 153) = 0$$

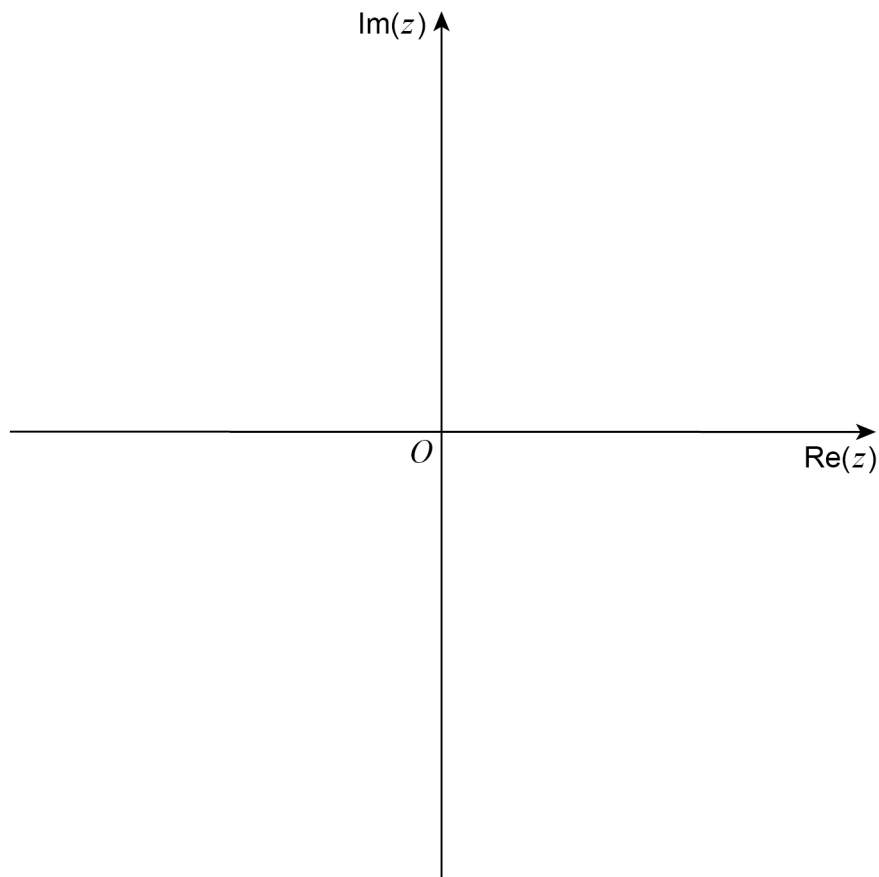
are represented by the points P , Q , R and S on an Argand diagram.

10 (c) (i) Sketch the quadrilateral $PQRS$ on the Argand diagram in **Figure 4**

You are not required to label the vertices or include the axis intercepts.

[2 marks]

Figure 4



10 (c) (ii) Calculate the area of quadrilateral $PQRS$

[2 marks]

Answer _____

Question 10 continues on the next page

Turn over ►



10 (d) The four roots of the equation

$$(z^2 + mz + n)(z^2 + 6z + 153) = 0$$

also satisfy the equation

$$|z - \alpha| = \beta$$

where α and β are constants.

10 (d) (i) Find the value of α

[3 marks]

$\alpha =$ _____



10 (d) (ii) Find the value of β

[2 marks]

$\beta =$ _____

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END OF QUESTIONS



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