

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

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Forename(s)

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Candidate signature

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I declare this is my own work.

INTERNATIONAL AS FURTHER MATHEMATICS

(9665/FM01) Unit FP1 Pure Mathematics

Tuesday 4 January 2022 07:00 GMT Time allowed: 1 hour 30 minutes

Materials

- For this paper you must have the Oxford International AQA 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	



1 Show that

$$\sum_{r=n+1}^{2n} r^3 = \frac{1}{4}n^2(an+b)(bn+1)$$

[5 marks]

[illegible]

Find, in terms of k , the real part of z and the imaginary part of z

[illegible]

2 (b) Use your answer to **part (a)** to show that $\arg\left(\frac{7-3i}{2-5i}\right) = \frac{\pi}{4}$

[illegible]

[6 marks]

[illegible]

Answer

6



- 4 (a)** Find the general solution of the equation

$$\cos\left(2x - \frac{\pi}{2}\right) = -\frac{1}{2}$$

giving your answer in terms of π

[4 marks]

Answer _____

- 4 (b)** Hence find the number of solutions of the equation

$$\cos\left(2x - \frac{\pi}{2}\right) = -\frac{1}{2}$$

which are between 0 and $(4k-1)\frac{\pi}{2}$ where k is an integer and $k \geq 1$

Give your answer in terms of k

[3 marks]

Answer _____



5

$$x^2 + 5x + 9 = 0$$

has roots α and β

5

[2 marks]

$$\alpha + \beta = \underline{\hspace{2cm}} \qquad \alpha\beta = \underline{\hspace{2cm}}$$

5

[2 marks]

Answer

5

[2 marks]



[6 marks]

$$\alpha + \frac{\beta}{\alpha} \quad \text{and} \quad \beta + \frac{\alpha}{\beta}$$

[illegible]

Answer _____



6 The function f is defined by

$$f(x) = \frac{2x+1}{x^2}$$

6 (a) Write down the equations of the asymptotes of the graph of $y = f(x)$

[2 marks]

Answer _____

6 (b) It is given that the line $y = k$, where k is a constant, intersects the graph of $y = f(x)$

Prove that $k \geq -1$

[3 marks]

6 (c) The graph of $y = f(x)$ has one stationary point.

Use the result given in **part (b)** to find the coordinates of this stationary point.

[2 marks]

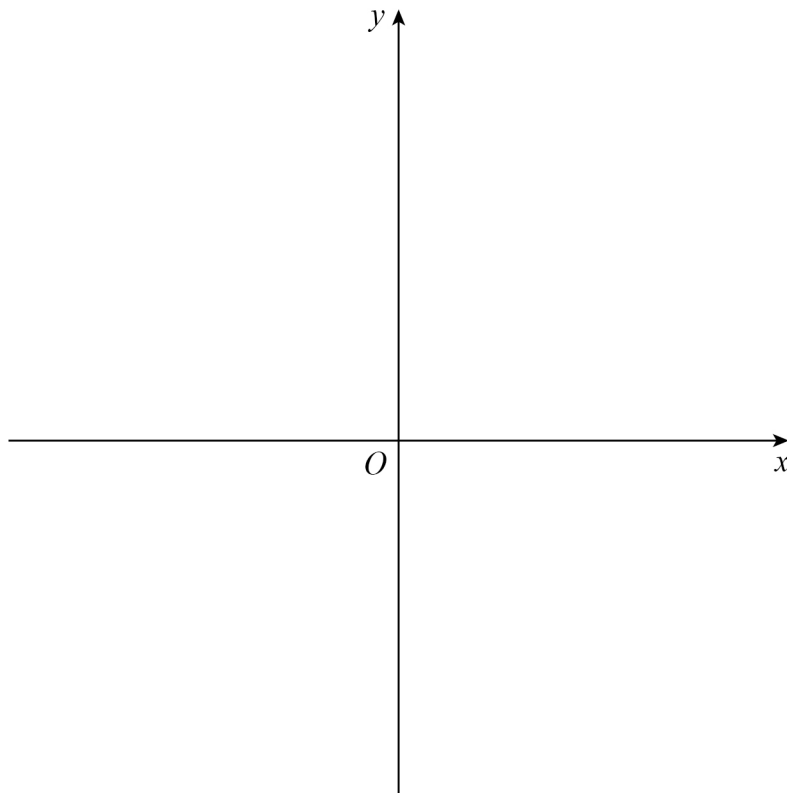
Answer _____



- 6 (d)** Sketch the graph of $y = f(x)$ on the axes below.

Show the coordinates of the stationary point and of any intersection with the axes.

[3 marks]



- 6 (e)** Solve the inequality

$$\frac{2x+1}{x^2} > 3$$

[4 marks]



- 7** The integrals I_1 and I_2 are defined below.

$$I_1 = \int_1^{\infty} \frac{1}{x^2} dx \quad \text{and} \quad I_2 = \int_0^{64} \frac{1}{(\sqrt[3]{x})^2} dx$$

- 7 (a)** Explain why I_1 is an improper integral.

[1 mark]

- 7 (b)** Explain why I_2 is an improper integral.

[1 mark]



[3 marks]

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Answer _____

5

Turn over ►



- 8** The circle C is the locus of points on an Argand diagram such that

$$|z - 4 - 6i| = 4$$

The half-line L is the locus of points on an Argand diagram such that

$$\arg(z - 4) = \frac{\pi}{2}$$

P is the point on C with the smallest argument.

The line OP meets the half-line L at the point T

- 8 (a)** Write down the complex number that represents the centre of C

[1 mark]

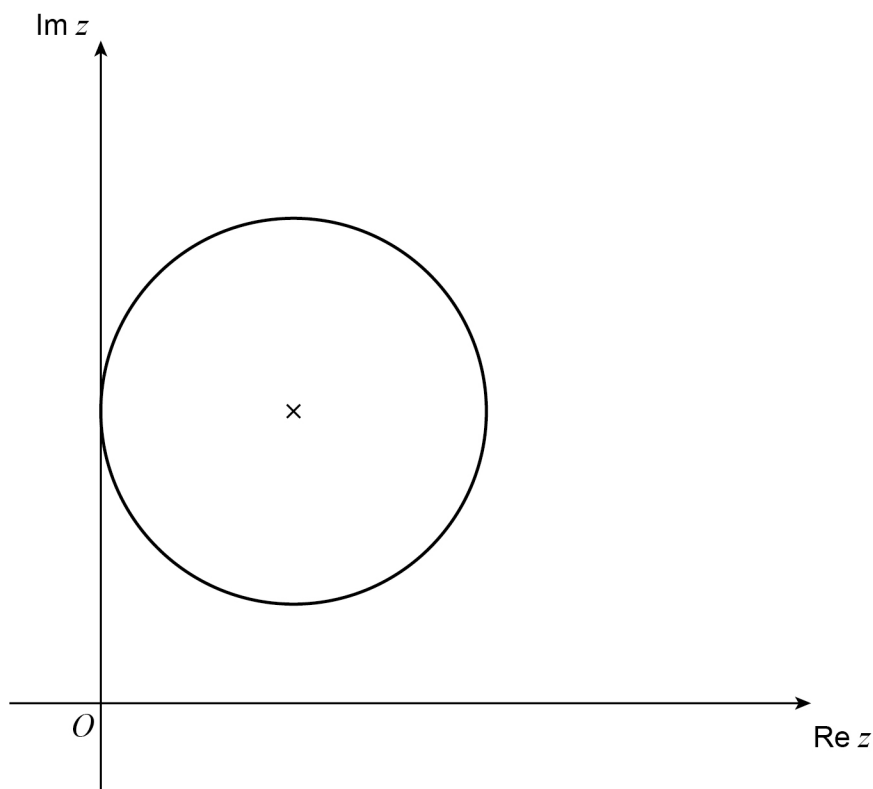
Answer _____

- 8 (b)** The circle C is drawn on the Argand diagram below.

On the Argand diagram:

- draw the half-line L
- draw the line OP
- label the point T

[3 marks]



[6 marks]

[illegible]

Answer _____

10



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ANSWER IN THE SPACES PROVIDED**



- 9** The locus of a point P is such that the distance from P to the point $(12, 0)$ is equal to the distance from P to the line $x = -12$

The locus of P is the curve C_1

- 9 (a)** Show that the equation of C_1 is

$$y^2 = 48x$$

[2 marks]

- 9 (b)** The translation by the vector $\begin{bmatrix} 5 \\ 4 \end{bmatrix}$ maps the curve C_1 onto the curve C_2

Find the equation of C_2

[2 marks]

Answer _____

Question 9 continues on the next page



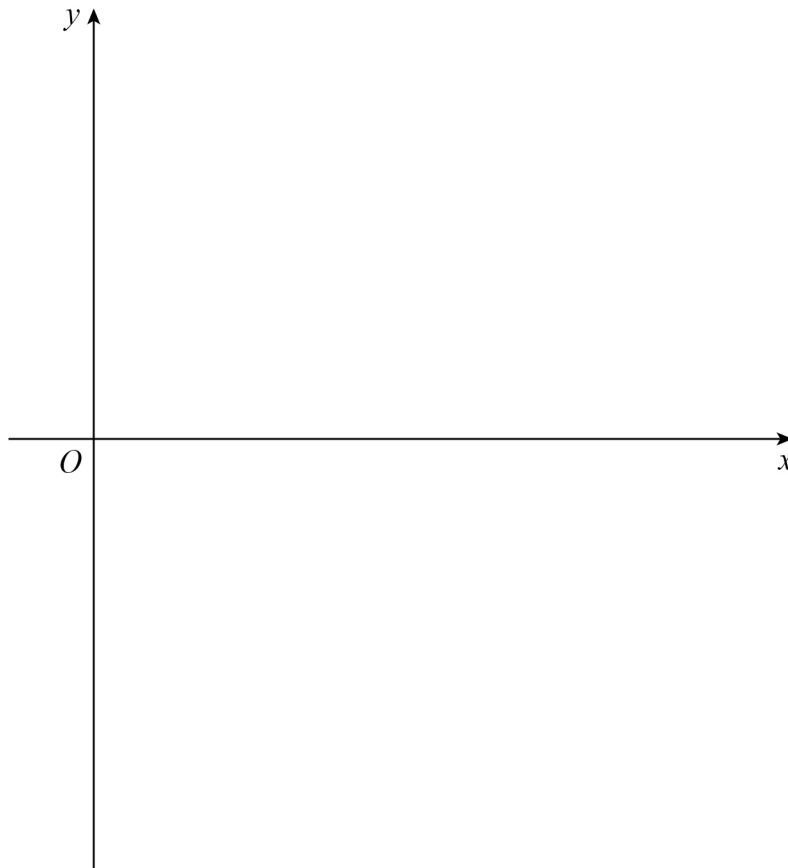
9 (c) The points Q and R both lie on C_2 such that

- the y -coordinate of Q is positive
- the y -coordinate of R is negative
- the line OQ is a tangent to C_2
- the line OR is a tangent to C_2

9 (c) (i) Sketch the curve C_2 and the lines OQ and OR

[You do **not** need to sketch the curve C_1]

[3 marks]



[8 marks]

[illegible]

Q
R

END OF QUESTIONS

15



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