

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 5 January 2021 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	
10	
TOTAL	



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

1 A curve has equation $y = 6x^2 - 8x + 5$

1 (a) A line passes through two points on the curve, one where $x = \frac{2}{3}$
and the other where $x = \frac{2}{3} + h$

Find the gradient of this line, giving your answer in its simplest form.

[3 marks]

Answer _____



- 1 (b) Use your answer to **part (a)** to determine whether or not the point on the curve where $x = \frac{2}{3}$ is a stationary point.

[2 marks]

5

Turn over for the next question

Turn over ►



2

$$z - 4 = a\mathbf{i}(z + 5)$$

where a is a real number and $a \neq 0$

Find z in terms of a

Give your answer in the form $x+iy$ where x and y are real.

[5 marks]

[illegible]

Answer _____

5



By considering the derivative of $y = x^{-\frac{3}{2}}$ when $x = 9$ find an estimate for $\frac{1}{(\sqrt{9.02})^3}$

[6 marks]

[illegible]

Answer

6

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

[4 marks]

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Answer _____



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

[5 marks]

[illegible]

Answer _____



[4 marks]

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Answer _____

4



Show that

is a factor of

for all positive integers n

[5 marks]

[illegible]

5

Turn over ►



7 The integral I_n is defined as

$$I_n = \int_0^9 x^{n+0.5} dx$$

where n is an integer.

The integral I_n

- is an improper integral
- has a finite value

Three students, Ahmed, Brian and Catherine, attempt to find the value of n

Ahmed's answer is $n = 0$

Brian's answer is $n = -1$

Catherine's answer is $n = -2$

Only one of the three students is correct.

7 (a) For each student state, with a reason, whether or not their answer is correct.

[5 marks]

Ahmed _____

Brian _____



Catherine _____

7 (b) Hence find the finite value of the improper integral I_n

[1 mark]

Answer _____

6

Turn over for the next question

Turn over ►



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

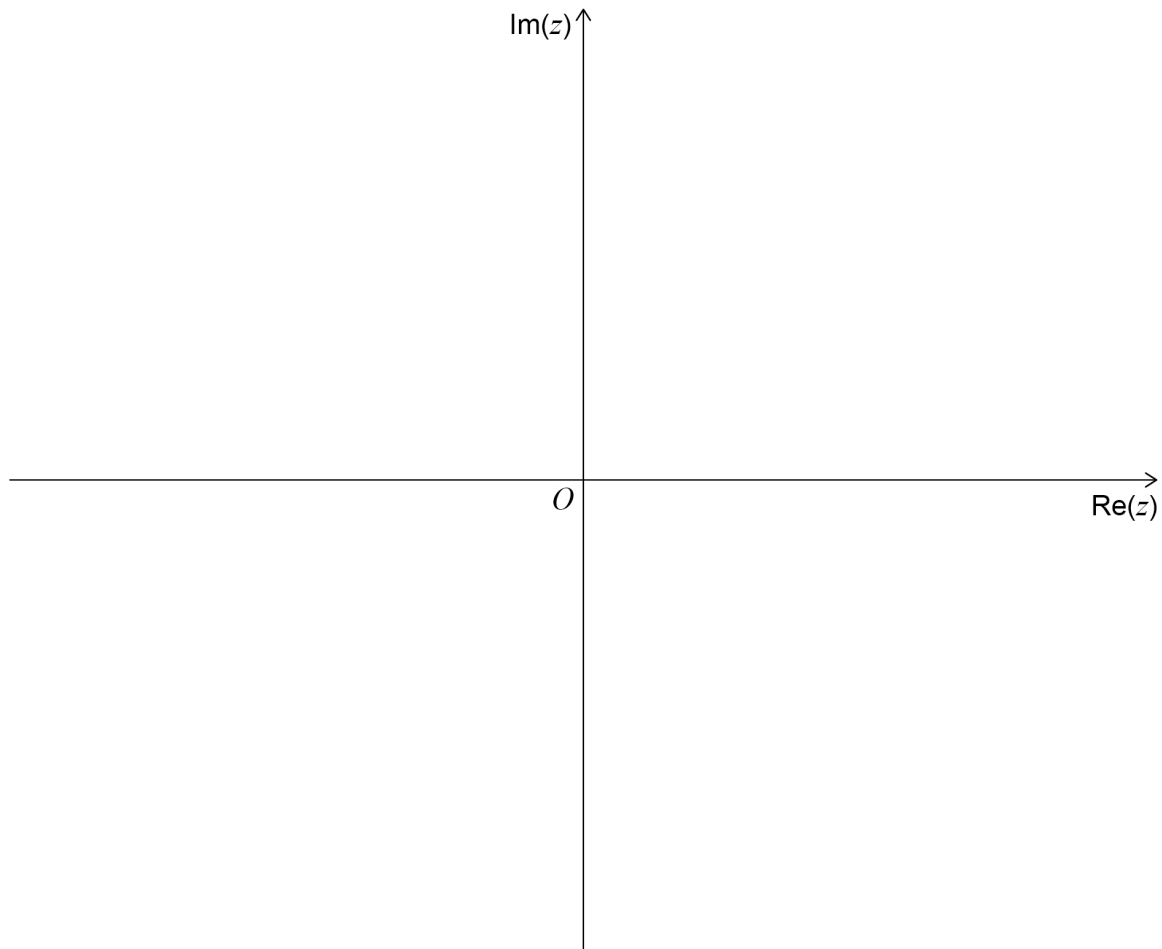
$$|z + 3 - 6i| = |z + 5 - 2i|$$

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

$$|z - 3 - 3i| = 5$$

- 8 (a)** Draw L and C on the Argand diagram.

[4 marks]



- 8 (b)** L and C intersect at the points P and Q

P and Q represent the complex numbers z_1 and z_2

Find z_1 and z_2

[5 marks]



Answer _____

- Find the exact value of the shortest distance from A to L

[5 marks]

Answer _____

14

Turn over ►



9

$$f(x) = \frac{x^2 - 8x}{x^2 - 3x - 18}$$

9

[3 marks]

Answer

9

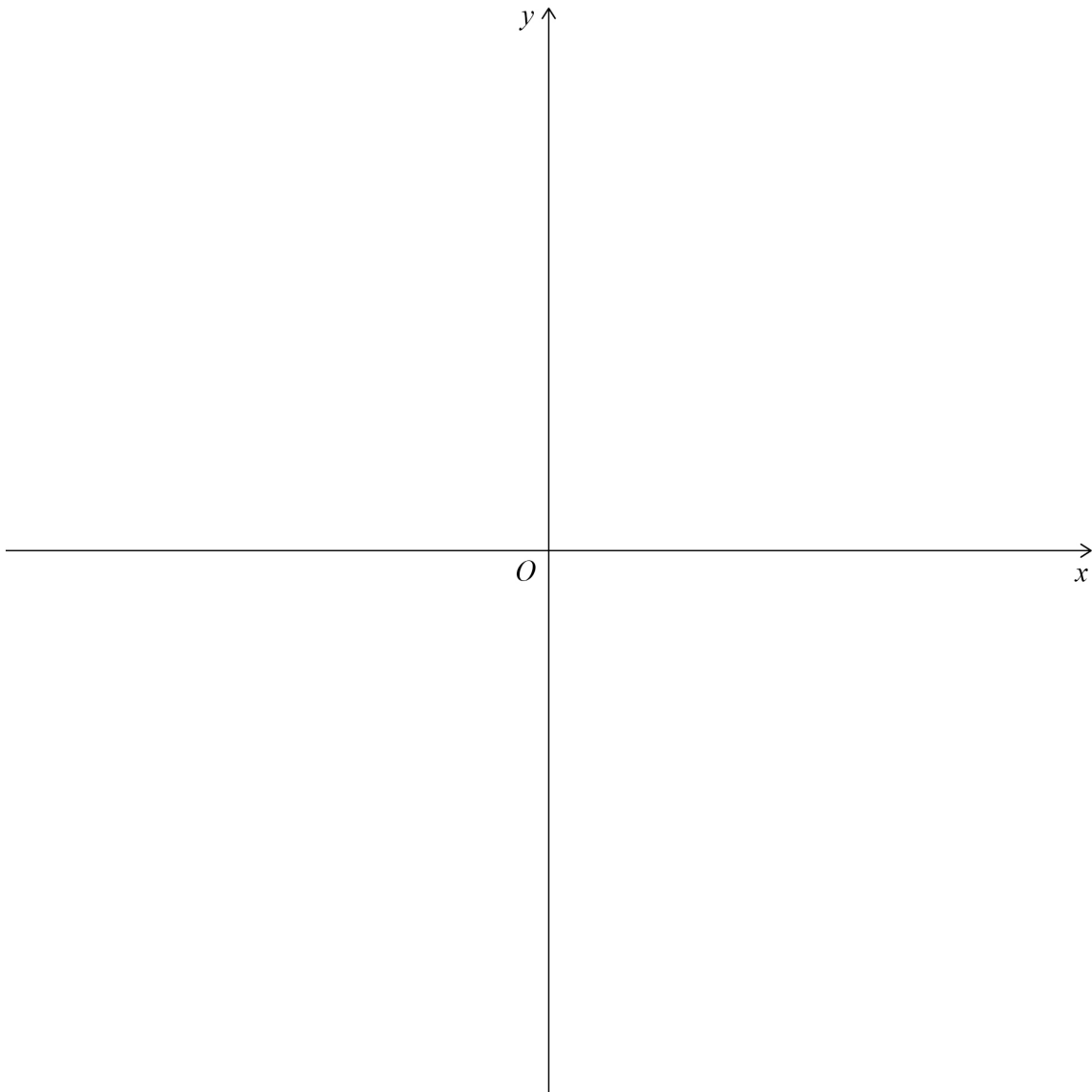
[5 marks]

[illegible]

9 (c) Sketch the graph of $y = f(x)$ on the axes below.

(You are given that the graph of $y = f(x)$ has no stationary points.)

[3 marks]



Turn over for the next question

Turn over ►



10 The hyperbola H_1 has equation $x^2 - 4y^2 = 1$

The hyperbola H_2 has equation $y^2 - 4x^2 = 1$

10 (a) Describe the transformation that maps H_1 onto H_2

[1 mark]

10 (b) Write down the equations of the asymptotes of H_1 and H_2

[2 marks]

Asymptotes of H_1 _____

Asymptotes of H_2 _____



10 (c)

$$c^2 = \frac{4m^2 - 1}{4}$$

[5 marks]

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Turn over ►



10 (d) When the line $y = mx + c$ is a tangent to H_2 then

$$c^2 = \frac{4 - m^2}{4}$$

Find the set of possible values of m in this case.

[2 marks]

Answer _____

10 (e) Find the equations of the four lines which are tangents to both H_1 and H_2

[3 marks]

Answer _____



10 (f) Find the area of the region enclosed by the lines found in **part (e)**.

[2 marks]

Answer _____

15

END OF QUESTIONS



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2 4



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