OXFORD AQA
INTERNATIONAL QUALIFICATIONS

INTERNATIONAL AS
FURTHER MATHEMATICS

Further Pure Mathematics 1

Specimen paper 0X:00 GMT Time allowed: 1 hour 15 minutes

Materials
- For this paper you must have the OxfordAQA Pure Mathematics Examination Booklet (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.
- The final answer to questions requiring an algebraic expression should be given in simplified form, unless stated otherwise.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 60.

Advice
- Unless stated otherwise, you may quote formulae, without proof, from the booklet.
- Show all necessary working; otherwise, marks may not be awarded.

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

1 It is given that $z = x + \mathrm{i}y$ where x and y are real numbers.

1 (a) Find the real part and the imaginary part of

$$(z + 3\mathrm{i})(z^* + 3\mathrm{i})$$

Give your parts in terms of x and y

[3 marks]

Real part = _____ Imaginary part = _____

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1 (b) It is given that

$$(z + 3\mathrm{i})(z^* + 3\mathrm{i}) = 56 + 24\mathrm{i}$$

Use your answer to **part (a)** to find all possible complex numbers z

[4 marks]

Answer _____

Turn over for the next question

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2 The locus of a point P is such that the distance from P to the point $(11, 0)$ is equal to the distance from P to the line $x = 6$

The locus of P is the curve C_1

2 (a) Find the equation of C_1

Give your answer in the form $y^2 = a(bx - c)$ where a, b and c are prime numbers.

[3 marks]

Answer _____

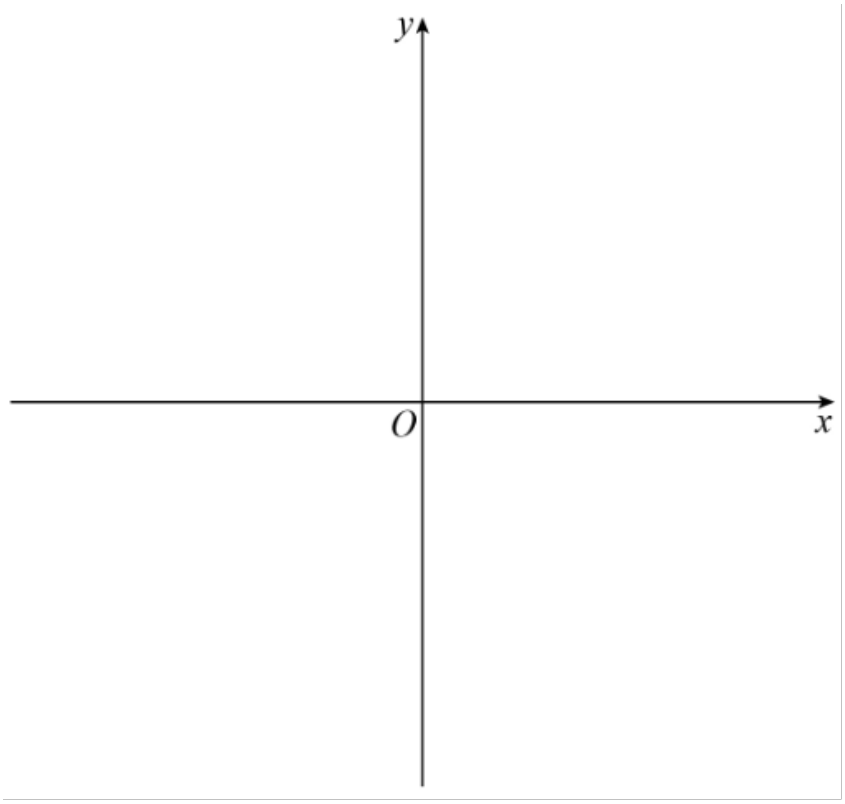
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2 (b) Sketch the graph of C_1 on **Figure 1**

Include the coordinates of any points where C_1 intersects the axes.

[2 marks]

Figure 1



2 (c) The translation by the vector $\begin{bmatrix} 4 \\ 2 \end{bmatrix}$ maps a curve C_2 onto the curve C_1

Find an equation for C_2

[2 marks]

Answer _____

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3 (a) Show that

$$\frac{5}{r+2}-\frac{5}{r+3}=\frac{5}{(r+2)(r+3)}$$

[1 mark]

3 (b) Use the method of differences to show that

$$\sum_{r=1}^{n}\frac{5}{(r+2)(r+3)}$$

can be written in the form $\frac{pn}{q(n+q)}$ where p and q are integers.

[4 marks]

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3 (c) Use your answer to **part (b)** to find the exact value of

$$\left(\sum_{r=1}^{\infty}\frac{5}{(r+2)(r+3)}\right)-\left(\sum_{r=1}^{300}\frac{5}{(r+2)(r+3)}\right)$$

[3 marks]

Answer _____

Turn over for the next question

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4 It is given that the equation $2x^2 - 5x + 4 = 0$ has roots α and β

4 (a) Find the value of $\alpha + \beta$ and the value of $\alpha\beta$

[2 marks]

$\alpha + \beta =$ _____ $\alpha\beta =$ _____

4 (b) Use your answers to **part (a)** to show that $\alpha^3 + \beta^3 = \frac{5}{8}$

[2 marks]

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4 (c) Find a quadratic equation, with integer coefficients, which has roots

$$\alpha + \frac{4\alpha}{\beta^2} \quad \text{and} \quad \beta + \frac{4\beta}{\alpha^2}$$

[7 marks]

Answer _____

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5 A curve C has equation

$$y = \frac{(x-2)(x-5)}{x(x-3)}$$

5 (a) (i) Write down the equations of the three asymptotes of C

[3 marks]

Asymptote 1 _____

Asymptote 2 _____

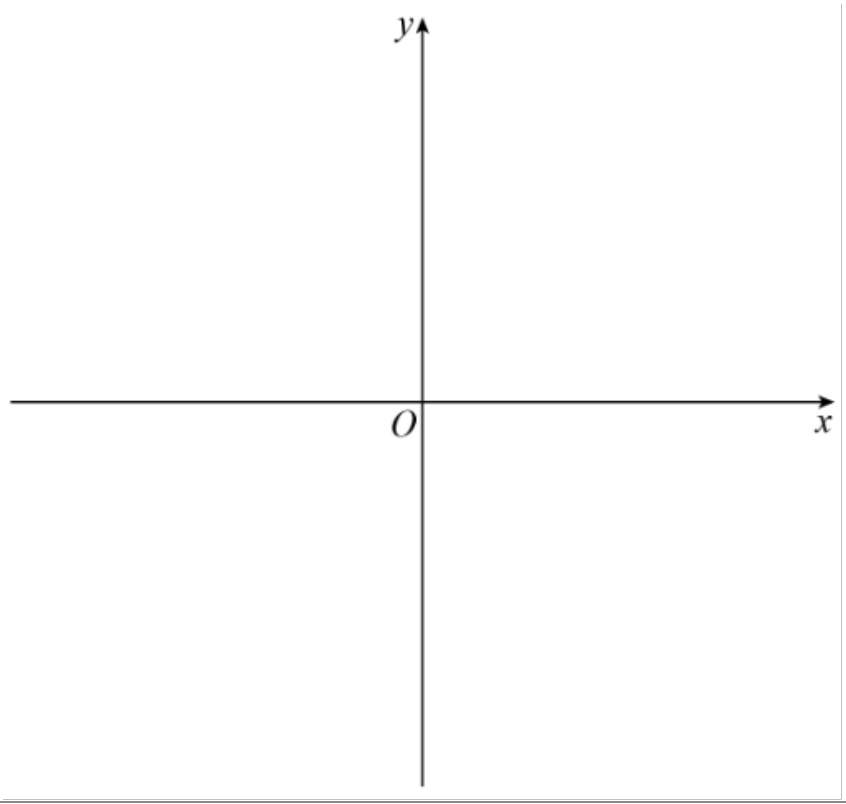
Asymptote 3 _____

5 (a) (ii) Sketch the graph of C on **Figure 2**

Include the coordinates of the points where C intercepts the x-axis.

[4 marks]

Figure 2



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5 (b) Solve the inequality

$$\frac{(x-2)(x-5)}{x(x-3)} < 0$$

[2 marks]

Answer _____

Turn over for the next question

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6 (a) Show that

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

where a and b are integers.

[6 marks]

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6 (b) Use your answer to **part (a)** to find the value of

$$\sum_{r=1}^{18} 4r\left(r^2 - 3r + 2\right)$$

[2 marks]

Answer _____

Turn over for the next question

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

$$|z - 9 - 7\mathrm{i}| = 3$$

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

$$\arg(z - 9) = \frac{\pi}{2}$$

The point P is the point on C with the greatest argument.

The line through the origin and P intersects L at the point Q

7 (a) Write down the complex number that represents the centre of C

[1 mark]

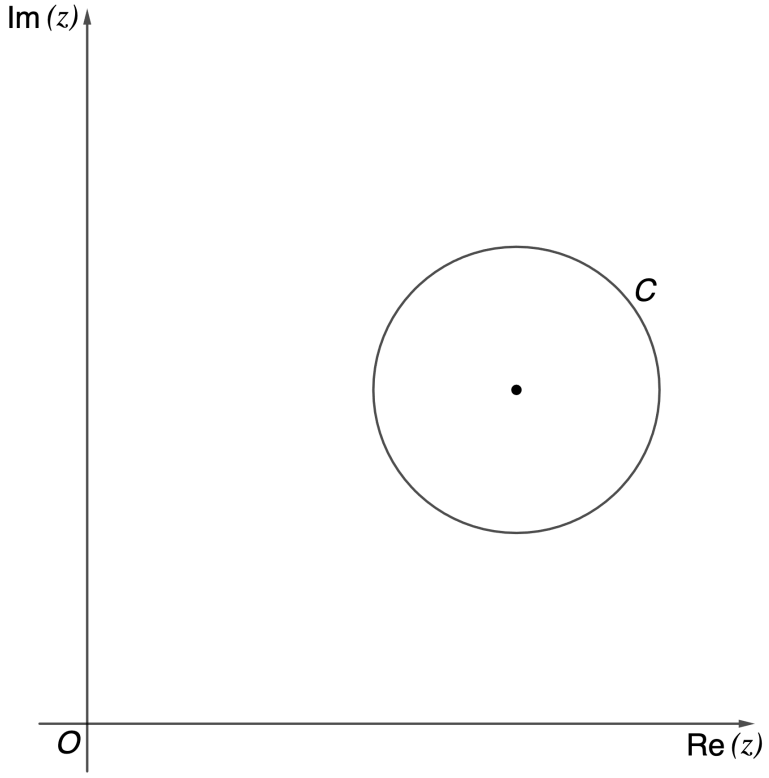
Answer _____

7 (b) **Figure 3** shows the circle C and its centre.

On **Figure 3**
- draw L
- draw the line through O and P
- label the point Q

[3 marks]

Figure 3



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7 (c) Find the complex number that represents the point Q

[6 marks]

Answer _____

END OF QUESTIONS

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