

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 MATHEMATICS

(9660/MA01) Unit P1 Pure Mathematics

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 graphic 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	
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6	
7	
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9	
10	
TOTAL	



J U N 2 2 M A 0 1 0 1

IB/G/Jun22/E9

MA01

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

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outside the
box

- 1 (a) The line L has equation

$$ax + 6y = 6$$

where a is a constant.

- 1 (a) (i) Find the value of a for which L passes through the point $(2, -2)$

Circle your answer.

[1 mark]

–9

–3

3

9

- 1 (a) (ii) Find the value of a for which L does not intersect the line with equation $5x + 2y = 6$

Circle your answer.

[1 mark]

–15

–5

5

15



2 The line J passes through the points $(-2, 1)$ and $(4, 13)$

2 (a) Find the equation of J

Give your answer in the form $y = mx + c$ where m and c are integers.

[3 marks]

$y =$ _____

2 (b) (i) Determine the number of distinct real solutions of the equation

$$3x^2 - 4x + 8 = 2x + 5$$

Justify your answer.

[3 marks]

Answer _____

2 (b) (ii) Describe the relationship between J and the curve with equation

$$y = 3x^2 - 4x + 8$$

[1 mark]



Under this transformation, the point $(2, 3 - \sqrt{7})$ on $y = f(x)$ is mapped to the point $(2, 9 + 5\sqrt{7})$

Full marks will not be awarded for calculator-only working in this question.

[illegible]

5



4 It is given that

$$f(x) = 4x^2 + 12x + 23$$

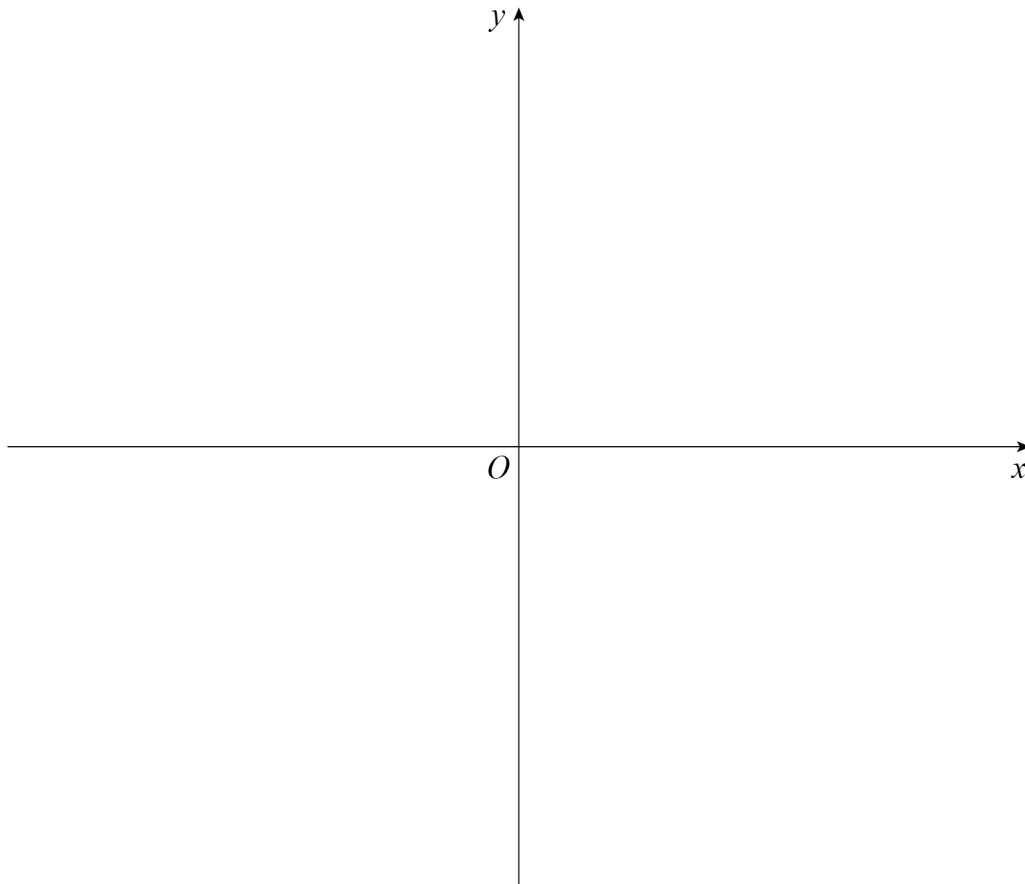
4 (a) Express $f(x)$ in the form $a(x+b)^2 + c$ where a , b and c are constants.

[3 marks]

Answer _____



- 4 (b)** Sketch the curve with equation $y = f(x)$ on the axes below, showing the coordinates of the vertex and the coordinates of any points where the curve crosses the axes.

[3 marks]

- 4 (c)** State the range of values of k for which the equation $f(x) = k$ has no real roots.

[1 mark]

Answer _____

- 4 (d)** Find the shortest distance between the curves with equations $y = f(x)$ and $y = -f(x)$

[1 mark]

Answer _____

Turn over ►

5 The n th term of a sequence is u_n

The sequence is defined by

$$u_{n+1} = k u_n + 15$$

where k is a non-zero constant.

The first term $u_1 = 25$

5 (a) Show that

$$u_3 = 25k^2 + 15k + 15$$

[3 marks]

5 (b) The third term $u_3 = 33$

5 (b) (i) Find the possible values of k

[2 marks]

Answer _____



5 (b) (ii) It is given that the sequence has only positive terms and converges to a limit T

Find the value of T

[2 marks]

$T =$ _____

7

Turn over for the next question

Turn over ►



6

$$p(x) = x^3 + 8x^2 + 14x - 8$$

6

Show that

$$m^3 - 7m + 6 = 0$$

[4 marks]

[illegible]

[2 marks]

$$m^3 - 7m + 6 = 0$$

[3 marks]

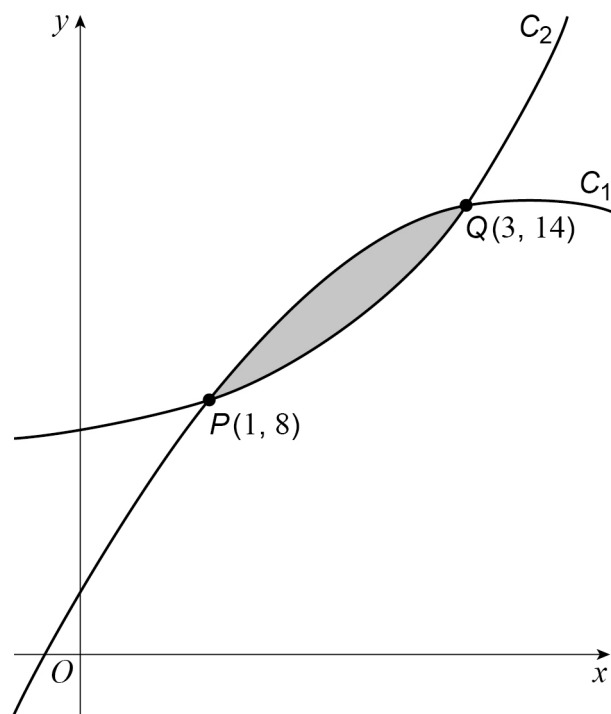
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Answer _____

Turn over ►



- 7 In the diagram below, curves C_1 and C_2 intersect at the points $P(1, 8)$ and $Q(3, 14)$.
The equation of C_1 is $y = 2 + 7x - x^2$
The equation of C_2 is $y = 6 + 2^x$



7 (a) (i) Find $\int (2 + 7x - x^2) dx$

[2 marks]

Answer

7 (a) (ii) Show that $\int_1^3 (2 + 7x - x^2) dx = 23\frac{1}{3}$

[2 marks]



- 7 (b)** Use the trapezium rule with four strips to find an approximate value for

$$\int_1^3 (6 + 2^x) dx$$

Give your answer to three decimal places.

[4 marks]

[illegible]

Answer

- 7 (c) (i)** Using your answers to **parts (a) and (b)**, find an approximate value for the area of the shaded region.

Give your answer to two decimal places.

[2 marks]

Answer _____

- 7 (c) (ii)** State, with a reason, whether your answer to **part (c)(i)** is an overestimate or an underestimate for the value of the area of the shaded region.

[2 marks]

8

$$y = 3x^{\frac{2}{3}} \left(x^2 - bx^{\frac{2}{3}} + 4x^{-\frac{2}{3}} \right)$$

where b is a constant, has a stationary point P at $x = 8$

8 (a) Find the value of b

[5 marks]

[illegible]
$$b =$$


- 8 (b) The tangent to the curve at P intersects the y -axis at the point $(0, c)$

Find the value of c

[2 marks]

$c =$ _____

7

Turn over for the next question

Turn over ►



The curve C has equation $y = 2x^2 - 10x + 13$

The line L has equation $x + 2y = 5$

9 (a) (i) Show that the y -coordinates of the points of intersection of L and C satisfy the equation

$$8y^2 - 21y + 13 = 0$$

[3 marks]

[illegible]

9 (a) (ii) Hence find the coordinates of the points of intersection of L and C

[3 marks]

Answer



[4 marks]

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Find the value of the x -coordinate of Q

[2 marks]

$x =$ _____

12

Turn over ►



The diagram below shows a pattern consisting of an infinite number of circles whose centres lie on a straight line.

A diagram consisting of three overlapping circles of decreasing size from left to right. The circles are light gray with black outlines. The first circle on the left is the largest, the middle one is medium-sized, and the third one on the right is the smallest. They are arranged horizontally and overlap slightly. To the right of the smallest circle, there are two small black dots, indicating a sequence.

The diameter of the largest circle is the first term.

Find the diameter of the largest circle when the common ratio $r = \frac{3}{5}$ and $S = 20$

[illegible]

Answer



10 (b) (i) Find the values of x for which the common ratio $r = \frac{3}{5}$

10 (b) (ii) Find the range of values of x for which S has a finite value.

[illegible]

END OF QUESTIONS

9



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2 4



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