OXFORD
INTERNATIONAL
AQA EXAMINATIONS

Please write clearly in block capitals.

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I declare this is my own work.

INTERNATIONAL AS
MATHEMATICS

(9660/MA01) Unit P1 Pure Mathematics

Wednesday 17 May 2023 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	

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

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1 (a) It is given that

$$m = 8a^{\frac{4}{3}} \quad \text{and} \quad n = 2a^{\frac{1}{2}}$$

where a is a positive constant.

1 (a) (i) Find mn

Circle your answer.

[1 mark]

$10a^{\frac{2}{3}}$ $\quad$ $16a^{\frac{2}{3}}$ $\quad$ $10a^{\frac{11}{6}}$ $\quad$ $16a^{\frac{11}{6}}$

1 (a) (ii) Find $\sqrt{\frac{m}{n}}$

Circle your answer.

[1 mark]

$2a^{\frac{5}{12}}$ $\quad$ $\sqrt{6}\,a^{\frac{5}{12}}$ $\quad$ $2a^{\frac{5}{6}}$ $\quad$ $\sqrt{6}\,a^{\frac{5}{6}}$

Do not write outside the box

1 (b) (i) Find the value of p for which $500x^6 \times \left(5x^2\right)^p$ is constant for all non-zero values of x

[2 marks]

$p =$ _____

1 (b) (ii) Use the value of p found in **part (b)(i)** to calculate $500x^6 \times \left(5x^2\right)^p$

[1 mark]

Answer _____

5

Turn over for the next question

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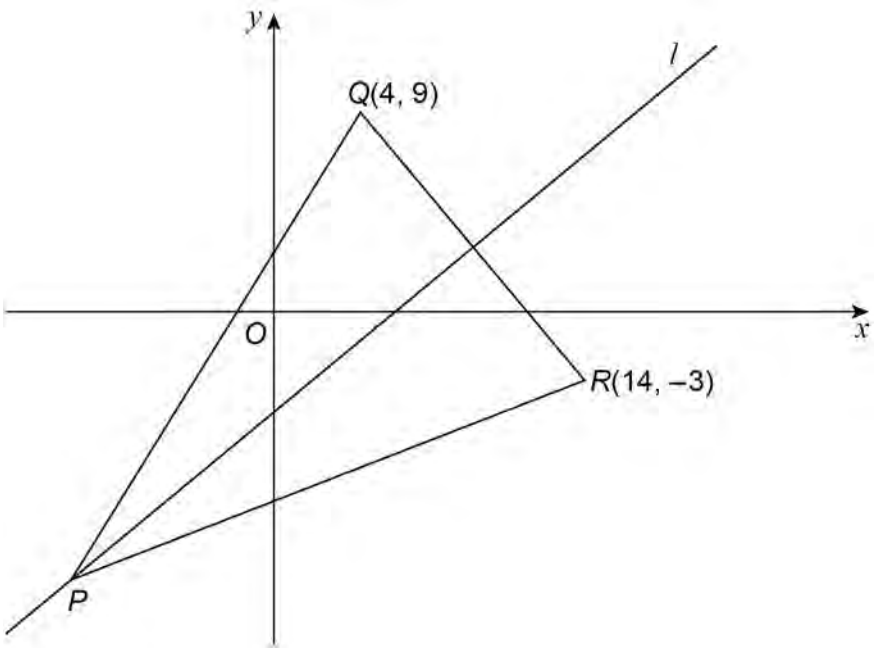
2 The line l and an isosceles triangle with vertices at the points P, Q and R are shown in the diagram.



The coordinates of Q are $(4, 9)$

The coordinates of R are $(14, -3)$

2 (a) Find the exact length of the line segment QR

[2 marks]

Answer _____

Do not write outside the box

2 (b) The line l is the line of symmetry of the isosceles triangle.

Show that l has the equation $y = \frac{5}{6}x - \frac{9}{2}$

[4 marks]

2 (c) The line with equation $y = \frac{1}{4}x + d$ intersects l at the point $(30, k)$ where k and d are constants.

Find the value of k and the value of d

[3 marks]

$k =$ _____ $d =$ _____

9

Do not write outside the box

3 An arithmetic sequence has first term a, common difference d and nth term u_n

The sum of the first n terms of the sequence is S_n

For this sequence $S_{30} - S_{10} = 522$

3 (a) Show that $10a + 195d = 261$

[3 marks]

3 (b) It is also given that $u_{36} = 5u_9 + 27$

Find a formula in terms of n for the nth term of the arithmetic sequence.

Give your answer in the form $u_n = pn - q$ where p and q are positive constants.

[5 marks]

Do not write outside the box

$u_n =$ _____

3 (c) Find the number of terms in the arithmetic sequence that have a value less than 140

[2 marks]

Answer _____

10

Do not write outside the box

4 (a) The first four terms in ascending powers of x of the binomial expansion of $(1+6x)^7$ are

$$1+ax+bx^2+7560x^3$$

where a and b are constants.

Find the value of a and the value of b

[3 marks]

$a =$ _____ $b =$ _____

Do not write outside the box

4 (b) In the expansion of

$$\left(\frac{1}{2}-kx\right)(1+6x)^7 \quad \text{where } k \text{ is a constant}$$

the coefficient of x^3 is 1512

Find the value of k

[3 marks]

$k =$ _____

6

Turn over for the next question

Do not write outside the box

5 (a) Use the trapezium rule with six ordinates (five strips) to find an approximate value for

$$\int_1^3 8^{\sqrt{x}}\ \mathrm{d}x$$

Give your answer to one decimal place.

[4 marks]

Answer _____

Do not write outside the box

5 (b) (i) Describe the transformation which maps the graph of $y = 8^{\sqrt{x}}$ onto the graph of

$$y = 8^{\left(\frac{1}{3} + \sqrt{x}\right)}$$

[3 marks]

5 (b) (ii) Use your answers to **part (a)** and **part (b)(i)** to find an approximate value for

$$\int_1^3 8^{\left(\frac{1}{3} + \sqrt{x}\right)} \, \mathrm{d}x$$

Give your answer to one decimal place.

[2 marks]

Answer _____

9

Do not write outside the box

6 The function f is given by

$$\mathrm{f}(x) = x^3 + ax^2 - 6bx + 7$$

where a and b are constants.

When $\mathrm{f}(x)$ is divided by $(x-4)$ the remainder is 23

6 (a) Use the Remainder Theorem to show that $2a - 3b = -6$

[2 marks]

6 (b) The value of the gradient of the tangent of the curve $y = \mathrm{f}(x)$ at the point where $x = -5$ is 21

Use the value of the gradient to find an equation of the form $pa + qb = r$ where $p,\ q$ and r are integers.

[3 marks]

Answer _____

Do not write outside the box

6 (c) Use your answers to **part (a)** and **part (b)** to find the value of a and the value of b

[1 mark]

$a =$ _____ $b =$ _____

6 (d) The function f is an increasing function when $x < -4$ or $x > 2$

The function g is given by $\mathrm{g}(x) = 9 + 48x + x^2 - \frac{1}{3}x^3$

Find all of the values of x for which **both** f and g are increasing functions.

[6 marks]

Answer _____

12

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7 A curve has the equation

$$y = x\left(x - 6x^{\frac{1}{3}}\right) + 16$$

where $x > -4$

7 (a) Find $\frac{dy}{dx}$

[2 marks]

$\frac{dy}{dx} =$ _____

7 (b) The curve has two stationary points P and Q

Show that the coordinates of P are $(0, 16)$ and find the coordinates of Q

[5 marks]

Q _____

Do not write outside the box

7 (c) (i) Find $\frac{\mathrm{d}^2y}{\mathrm{d}x^2}$

[1 mark]

$\frac{\mathrm{d}^2y}{\mathrm{d}x^2} =$

7 (c) (ii) Use your answers to **part (b)** and **part (c)(i)** to show that Q is a minimum.

[1 mark]

7 (d) (i) Explain why it is **not** possible to use the x-coordinate of P with your answer to **part (c)(i)** to determine whether P is a minimum or a maximum.

[1 mark]

7 (d) (ii) Calculate the values of the gradient of the curve at the points where $x = -0.1$ and $x = 0.1$ and hence deduce that P is a maximum.

[2 marks]

12

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8 Find the values of a for which

$$\int_{a^2}^{25a^2} \frac{6x + 5x^2}{x^2\sqrt{x}}\,\mathrm{d}x = 44$$

[7 marks]

Do not write outside the box

Answer _____

7

Turn over for the next question

Do not write outside the box

9 The first three terms of a geometric sequence are

$$u_1 = 27^{2p+1}, \quad u_2 = 3^{18p} \quad \text{and} \quad u_3 = 3^{6p+1}$$

where p is a constant.

9 (a) Show that $p = \frac{1}{6}$

[4 marks]

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9 (b) The nth term of the geometric sequence is u_n

Show that for any positive integer k

$$54\sum_{n=k+1}^{6k} u_n = b^{c-k}\left(1-b^{dk}\right)$$

where b, c and d are integers.

[6 marks]

10

END OF QUESTIONS

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