OXFORD AQA

INTERNATIONAL QUALIFICATIONS

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

INTERNATIONAL AS
MATHEMATICS

(9660/MA01) Unit P1 Pure Mathematics

Wednesday 15 May 2024 07:00 GMT Time allowed: 1 hour 30 minutes

Materials
- For this paper you must have the OxfordAQA 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.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
TOTAL	

Advice
- Unless stated otherwise, you may quote formulae, without proof, from the booklet.
- Show all necessary working; otherwise marks may be lost.

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

1 (a) The nth term of a sequence is x_n where

$$x_{n+1} = x_n + 5$$

The fourth term $x_4 = 30$

1 (a) (i) Find the value of x_1

Circle your answer.

[1 mark]

5 10 15 20

1 (a) (ii) Find the value of n for which $x_n = 60$

Circle your answer.

[1 mark]

8 9 10 11

Do not write outside the box

1 (b) Two sequences are generated by the formulae

$$u_{n+1} = pu_n + 12 \quad \text{and} \quad t_{n+1} = 2pt_n + 3$$

where p is a constant.

The sequences have the same non-zero limit L as $n \to \infty$

Find the value of L and the value of p

[4 marks]

$L =$ _____ $p =$ _____

6

Do not write outside the box

2 (a) Given that $x \neq 0$ and $y \neq 0$ simplify

$$\frac{\left(3x^7 y^{\frac{2}{3}}\right)^6}{\sqrt{9x^4 y^{\frac{3}{2}}}}$$

Give your answer in the form

$$ax^b y^c$$

where a, b and c are constants.

[3 marks]

Answer _____

Do not write outside the box

2 (b) Given that $w > 0$ show that

$$\frac{\left(5+4\sqrt{w}\right)^2-\left(5-8\sqrt{w}\right)^2}{8\sqrt{w}}$$

can be written in the form $d+e\sqrt{w}$, where d and e are integers.

[3 marks]

6

Turn over for the next question

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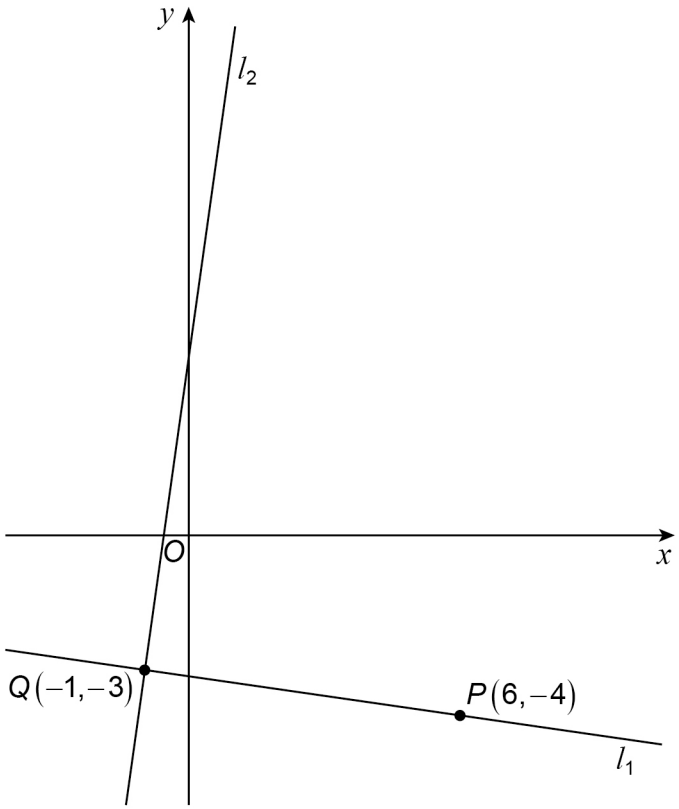
3 The diagram shows the lines l_1 and l_2 and the points $P(6,-4)$ and $Q(-1,-3)$



The line l_1 passes through the point P and intersects the line l_2 at the point Q

The lines l_1 and l_2 are perpendicular.

3 (a) Show that the equation of l_2 is

$$y = 7x + 4$$

[3 marks]

Do not write outside the box

3 (b) The point R lies on l_2

The x-coordinate of R is a where $a > 0$

The distance QR is $6\sqrt{10a}$

3 (b) (i) Show that

$$5a^2 - 26a + 5 = 0$$

[3 marks]

3 (b) (ii) Hence find the coordinates of the two possible positions of R

[3 marks]

Answer _____ and _____

9

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4 The third, fourth and sixth terms of a finite arithmetic series are

$$u_3 = p - 4 \ , \quad u_4 = 2p - 18 \quad \text{and} \quad u_6 = 5p - 67$$

where p is a constant.

4 (a) Show that $p = 21$

[2 marks]

4 (b) The last term of the series is $u_m = 990$

Find the value of m

[4 marks]

$m =$ _____

Do not write outside the box

4 (c) The sum of all the **even** terms of the series is S

Find the value of S

[3 marks]

$S =$ _____

9

Turn over for the next question

Do not write outside the box

5 The function f is given by

$$\mathrm{f}(x) = 3x^2 + (4k+5)x + 10k + a$$

where k and a are constants.

When $\mathrm{f}(x)$ is divided by $(x+5)$ the remainder is $59-17k$

5 (a) Use the Remainder Theorem to show that

$$a = 9 - 7k$$

[2 marks]

5 (b) The curve C has equation $y = \mathrm{f}(x)$

The line L has gradient 7 and intersects the y-axis at the point $(0, -3k)$

The curve C and the line L intersect at two distinct points.

Find the possible values of k

[8 marks]

Do not write outside the box

Answer _____

10

Do not write outside the box

6 The curve C has equation

$$y = 6x^2 + p$$

where p is a constant.

6 (a) Write down the coordinates of the vertex of C

[1 mark]

Answer _____

6 (b) The curve D has equation

$$y = 6x^2 - 48x + 103$$

By completing the square describe the single transformation which maps C onto D

[5 marks]

6

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7 (a) Show that

$$\left(12x^{\frac{4}{5}}+1\right)\left(x^{-\frac{4}{5}}-12\right)=x^{-\frac{4}{5}}-144x^{\frac{4}{5}}$$

[1 mark]

7 (b) Hence find $\int\left(12x^{\frac{4}{5}}+1\right)\left(x^{-\frac{4}{5}}-12\right)\mathrm{d}x$

Give your answer in the form

$$qx^{r}\left(1-sx^{t}\right)+c$$

where q, r, s and t are constants to be found, and c is the constant of integration.

[3 marks]

Answer _____

4

Turn over ►

Do not write outside the box

8 The curve C has equation $y = \mathrm{f}(x)$ where

$$\mathrm{f}(x) = \frac{k - 6\sqrt{x} + 5x}{\sqrt{x}} + \frac{9}{2}$$

where $x > 0$ and k is a constant.

The point P has x-coordinate $\frac{1}{4}$ and lies on C

8 (a) Show that the gradient of C at P is given by

$$5 - 4k$$

[4 marks]

Do not write outside the box

8 (b) The tangent to C at P is parallel to the line with equation $y = -43x + 9$

8 (b) (i) Show that $k = 12$

[1 mark]

8 (b) (ii) Find the equation of the tangent to C at P

Give your answer in the form $ax + by = c$ where a, b and c are integers.

[3 marks]

Answer _____

Question 8 continues on the next page

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8 (c) The curve C has one stationary point at Q

The x-coordinate of Q is $\frac{12}{5}$

Use the second derivative to determine whether Q is a maximum point or a minimum point.

[3 marks]

8 (d) State the values of x for which f is an increasing function.

[1 mark]

Answer _____

12

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9 A student is testing the accuracy of the trapezium rule by using it to estimate the value of the integral I where

$$I = \int_{0.5}^{1.5} \left(\frac{1}{4x^2} + \frac{x^3}{6} \right) \mathrm{d}x$$

9 (a) (i) Complete the table giving your values to four decimal places.

[2 marks]

x	0.5	0.75	1	1.25	1.5
$\frac{1}{4x^2} + \frac{x^3}{6}$		0.5148	0.4167		

9 (a) (ii) Hence use the trapezium rule with five ordinates (four strips) to find an estimate for I

Give your answer to three decimal places.

[3 marks]

Answer _____

Question 9 continues on the next page

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9 (b) (i) Find $\int\left(\frac{1}{4x^2}+\frac{x^3}{6}\right)\mathrm{d}x$

[2 marks]

Answer _____

9 (b) (ii) Hence find the exact value of $\int_{0.5}^{1.5}\left(\frac{1}{4x^2}+\frac{x^3}{6}\right)\mathrm{d}x$

[2 marks]

Answer _____

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9 (c) The student claims that the answer obtained in **part (a)(ii)** using the trapezium rule is within 5% of the exact value.

Use your answers to **parts (a)(ii)** and **(b)(ii)** to determine whether the student is correct.

[2 marks]

9 (d) Explain how to obtain an improved estimate for I using the trapezium rule.

[1 mark]

12

Turn over for the next question

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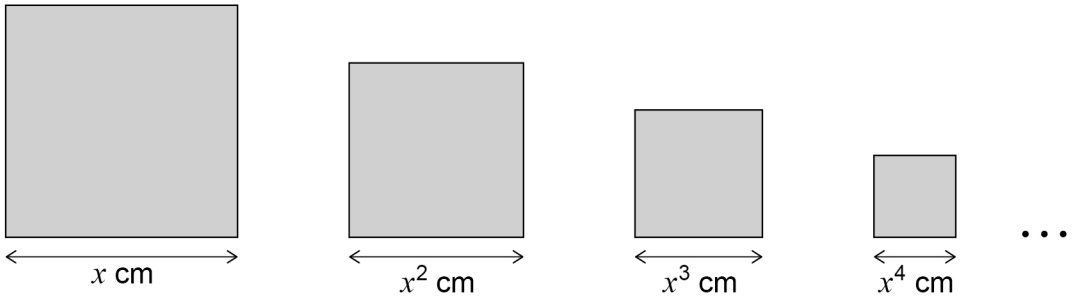
10 The diagram shows the first four squares of a sequence consisting of an infinite number of squares.

The squares have sides of **length** x cm, x^2 cm, x^3 cm, x^4 cm, …, where $0 < x < 1$



The **areas** of successive squares in the sequence form the terms of a geometric series.

The area, x^2, of the largest square is the first term.

The sum to infinity of the areas of the squares is $\frac{49}{32}$ cm^2

The sum to infinity of the **perimeters** of the squares is P cm

Find the value of P

[6 marks]

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$P =$ _____

6

END OF QUESTIONS

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