OXFORD
INTERNATIONAL
AQA EXAMINATIONS

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

Tuesday 14 January 2020 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 graphics 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.

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1 The equation

$$y = \left(4x^2 - x^{\frac{5}{2}}\right) \div \left(\frac{1}{4x}\right)^{\frac{1}{2}}$$

can be written in the form

$$y = ax^p - bx^q$$

where a, b, p and q are positive constants.

1 (a) (i) Find the value of p.

Circle your answer.

[1 mark]

1 $\quad \frac{3}{2} \quad \frac{5}{2} \quad$ 4

1 (a) (ii) Find the value of q.

Circle your answer.

[1 mark]

$\frac{5}{4} \quad$ 2 $\quad$ 3 $\quad$ 5

Do not write outside the box

1 (b) Find $\frac{\mathrm{d}y}{\mathrm{d}x}$

Fully simplify the coefficient of each term.

[2 marks]

$\frac{\mathrm{d}y}{\mathrm{d}x} =$ _____

4

Turn over for the next question

Do not write outside the box

2 Let $\mathrm{f}(x) = x^2 + bx + c$ where b and c are real numbers.

It is given that:

- the line $x = 5$ is the line of symmetry of the curve with equation $y = \mathrm{f}(x)$
- the discriminant of $\mathrm{f}(x)$ is zero.

2 (a) Find the value of b and the value of c.

[2 marks]

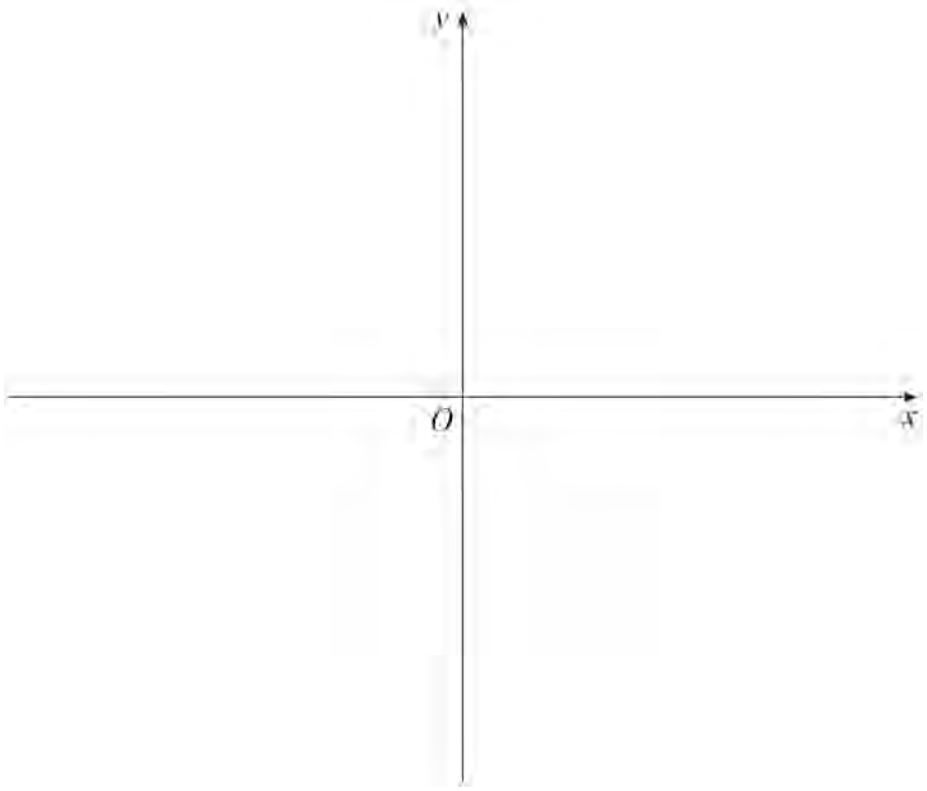
$b =$ _____ $c =$ _____

Do not write outside the box

2 (b) On the axes below, sketch the curve with equation $y = \mathrm{f}(x)$.

Show the coordinates of the vertex and the y-intercept on the graph.

[3 marks]



5

Turn over for the next question

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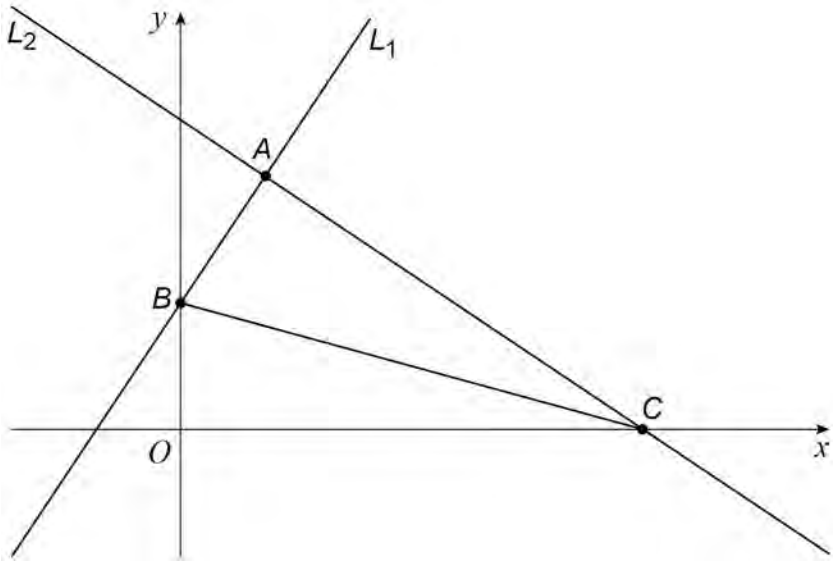
3 The lines L_1 and L_2 are shown in the diagram.

L_1 cuts the y-axis at the point B.

L_2 cuts the x-axis at the point C.



3 (a) L_1 has the equation

$$2y - 3x = 6$$

3 (a) (i) Find the gradient of L_1

[2 marks]

Answer _____

3 (a) (ii) Find the y-coordinate of B.

[1 mark]

Answer _____

Do not write outside the box

3 (b) *AB* and *AC* are two sides of a rectangle.

L_2 has the equation

$$y = mx + \frac{22}{3}$$

3 (b) (i) State the value of m.

[1 mark]

$m =$ _____

3 (b) (ii) Show that the x-coordinate of *C* is 11

[1 mark]

3 (c) The point *D* is the mid-point of *BC*.

Find an equation of the line which passes through *D* and is parallel to L_1

[3 marks]

Answer _____

8

Turn over ►

Do not write outside the box

4 (a) The expression $(2-x)^4$ can be written in the form $16-32x+ax^2-bx^3+x^4$ where a and b are positive integers.

Show that $a = 24$ and find the value of b.

[3 marks]

$b =$ _____

Do not write outside the box

4 (b) Using the expansion in part **(a)**, show that the value of $\left(2-\frac{1}{\sqrt{2}}\right)^4$ can be written in the form $\frac{p-q\sqrt{2}}{r}$ where p, q and r are integers.

[4 marks]

7

Turn over ►

Do not write outside the box

5 The equation of a curve *C* is given by

$$y = \frac{(x-1)(x-14)}{x}, \qquad x \neq 0$$

5 (a) Find an equation of the tangent to *C* at the point where $x = 2$

[7 marks]

Answer _____

Do not write outside the box

5 (b) P is the point on C where $x = -4$

Explain whether y is increasing or decreasing at P.

[2 marks]

9

Turn over for the next question

Do not write outside the box

6 Grady sells boxes of chocolates.

In the first month, Month 1, he sells 36 boxes.

Each month after Month 1, he sells 22 more boxes than he sold the previous month.

6 (a) (i) The number of boxes he sells each month forms a sequence.

State, with a reason, whether this is an arithmetic sequence or a geometric sequence.

[2 marks]

6 (a) (ii) Find an expression in terms of n for the number of boxes he sells in Month n.

[2 marks]

Answer _____

Do not write outside the box

6 (b) Grady makes £12 profit on each box of chocolates he sells.

Over the first N months, he makes a total profit of exactly £90 000

By forming and solving a quadratic equation, find the value of N.

[5 marks]

$N =$ _____

9

Turn over ►

Do not write outside the box

7 The gradient at any point (x, y) of a curve is given by

$$\frac{dy}{dx} = 3x^2 + ax - 36$$

where a is a constant.

The curve passes through the points $(1, -7)$ and $(3, -5)$

7 (a) Find the equation of the curve.

[7 marks]

$y =$ _____

Do not write outside the box

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

[1 mark]

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

7 (b) (ii) The curve has a minimum point *P*.

Find the x-coordinate of *P*.

[3 marks]

$x =$ _____

11

Turn over ►

Do not write outside the box

8 A geometric series has first term a, common ratio r and nth term u_n

The sum to infinity of the series is 425

The sum of the first two terms is 408

The series only contains positive terms.

8 (a) (i) Show that $r = \frac{1}{5}$

[4 marks]

8 (a) (ii) Find the value of a.

[2 marks]

$a =$ _____

Do not write outside the box

8 (b) Show that

$$\sum_{n=k}^{k+1} u_n = p\left(\frac{1}{q}\right)^{k-1}$$

where p and q are positive integers.

[4 marks]

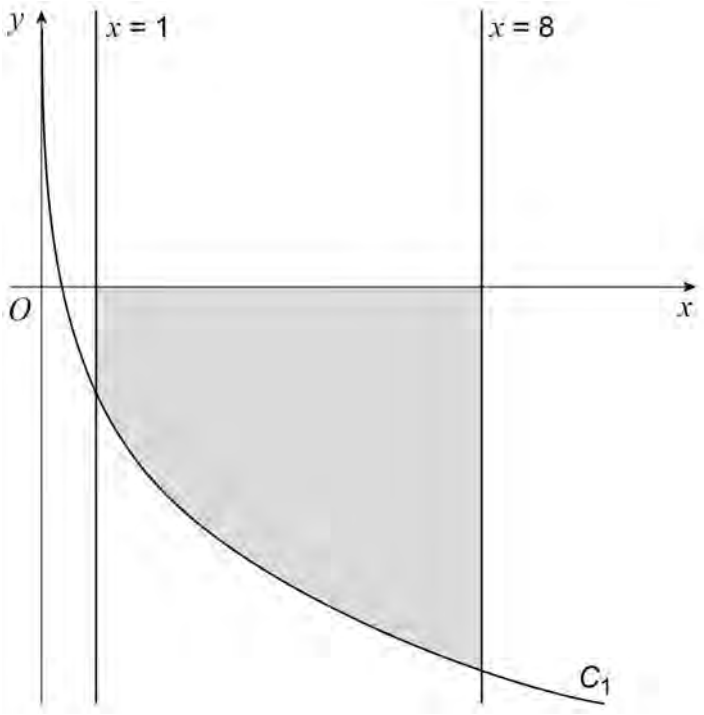
10

Do not write outside the box

9 The equation of the curve C_1 is

$$y = \left(x^{\frac{1}{3}} - 4 \right)^2 - 11, \qquad x \geq 0$$

C_1 and the lines $x = 1$ and $x = 8$ are shown in the diagram below.



9 (a) Find $\int \left(\left(x^{\frac{1}{3}} - 4 \right)^2 - 11 \right) \mathrm{d}x$

[3 marks]

Answer _____

Do not write outside the box

9 (b) Find the area of the shaded region bounded by the curve C_1, the lines $x = 1$, $x = 8$ and the x-axis.

[3 marks]

Answer _____

9 (c) The translation $\begin{bmatrix} 0 \\ -2 \end{bmatrix}$ maps the curve C_1 onto the curve C_2

9 (c) (i) Using your answer to part **(b)**, find the area of the region bounded by the curve C_2, the lines $x = 1$, $x = 8$ and the x-axis.

[2 marks]

Answer _____

9 (c) (ii) Find the equation of C_2

[1 mark]

Answer _____

9

Turn over ►

Do not write outside the box

10 A curve has the equation

$$y = 2x^2 + 4(p+3)x + 12p + q + 12$$

where p and q are constants.

The curve crosses the x-axis at two distinct points.

10 (a) Show that

$$2p^2 - q + 6 > 0$$

[3 marks]

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10 (b) The curve passes through the point $(0, 32)$.

Find the possible values of p.

[5 marks]

Answer _____

8

END OF QUESTIONS

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