OXFORD AQA

INTERNATIONAL QUALIFICATIONS

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I declare this is my own work.

# INTERNATIONAL AS
# MATHEMATICS

## (9660/MA01) Unit P1 Pure Mathematics

Monday 6 January 2025 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.

**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** | |

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

**1 (a)** The expression

$$\left(\frac{25m^2}{16}\right)^{-\frac{3}{2}}$$

can be written in the form

$$am^b$$

where $a$ and $b$ are constants and $m > 0$

**1 (a) (i)** Find the value of $a$

Circle your answer.

**[1 mark]**

$\frac{64}{125}$ $\frac{16}{25}$ $\frac{25}{16}$ $\frac{125}{64}$

**1 (a) (ii)** Find the value of $b$

Circle your answer.

**[1 mark]**

$-3$ $-\frac{1}{2}$ $\frac{1}{2}$ $3$

*Do not write outside the box*

**1 (b)** It is given that

$$\frac{27^{2y}}{9^{\frac{1}{2}x}} = \frac{1}{9\sqrt{3}}$$

Express $y$ in terms of $x$

**[3 marks]**

$y =$ _____

5

**Turn over for the next question**

*Do not write outside the box*

**2** The line $l_1$ has equation $8x - 5y = 14$

**2 (a)** Verify that $l_1$ passes through the point $A(8, 10)$

**[1 mark]**

**2 (b)** The line $l_2$ has equation $7x + 2y = -26$

The lines $l_1$ and $l_2$ intersect at the point $B$

Find the exact distance $AB$

**[3 marks]**

Answer _____

*Do not write outside the box*

**2 (c)** The line $l_3$ passes through the points $P(-2,5)$ and $Q(3,k+7)$ where $k$ is a constant.

The lines $l_1$ and $l_3$ are parallel.

**2 (c) (i)** Find the value of $k$

**[3 marks]**

$k =$ _____

**2 (c) (ii)** Find the equation of $l_3$

Give your answer in the form $ax+by+c=0$ where $a$, $b$ and $c$ are integers.

**[2 marks]**

Answer _____

**9**

*Do not write outside the box*

**3** George is saving money to buy an electric car.

In the first month he saves $240

Each month after the first month he will save $8 more than he did the previous month.

George will save for 36 months.

**3 (a)** The amount of money George will save each month forms a sequence.

State, with a reason, the name given to this type of sequence.

**[2 marks]**

Name _____

Reason _____

**3 (b)** Find the amount of money George will save in the 22nd month.

**[2 marks]**

Answer _____

**3 (c)** Find the total amount of money George will have saved at the end of the 36 months.

**[2 marks]**

Answer _____

*Do not write outside the box*

**3 (d)** Mabel is also saving money to buy an electric car.

In the first month she saves $264

Each month after the first month she will save $4 more than she did the previous month.

It will take Mabel $n$ months to save $15 400 in total.

Find the value of $n$

**[3 marks]**

$n =$ _____

9

**Turn over for the next question**

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**4** It is given that

$$f(x) = x^3 - 4x + 15$$

**4 (a)** Use the Factor Theorem to show that $(x+3)$ is a factor of $f(x)$

**[2 marks]**

**4 (b)** Express $f(x)$ in the form $f(x) = (x+3)(x^2 + bx + c)$ where $b$ and $c$ are constants.

**[2 marks]**

$f(x) =$ _____

*Do not write outside the box*

**4 (c)** Use your answer to **part (b)** to show that the equation $\mathrm{f}(x)=0$ has exactly one real root.

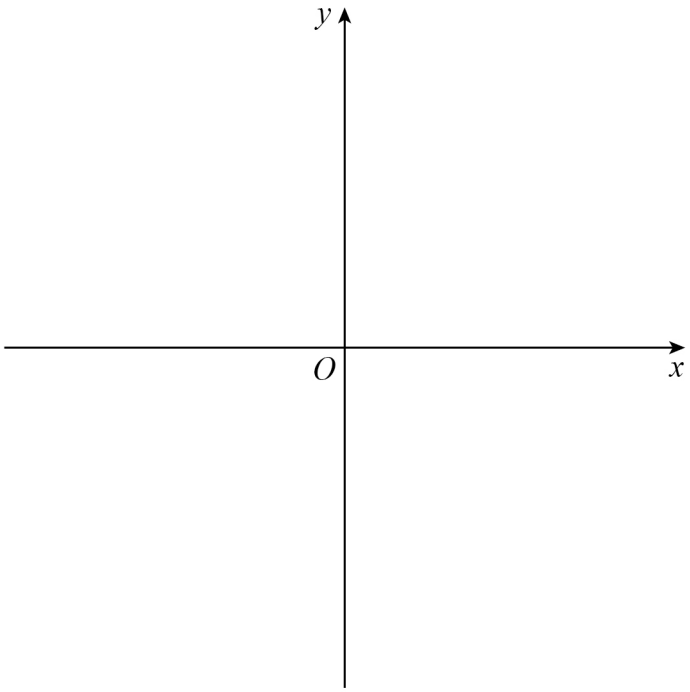
**[2 marks]**

**4 (d)** It is given that $\mathrm{f}$ is a decreasing function when $x=0$

Sketch the graph of $y=\mathrm{f}(x)$ on the axes below.

Show on your graph the values of any intercepts with the axes.

**[3 marks]**




**9**

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**5 (a)** By rationalising the denominator show that

$$\frac{7x\sqrt{x}+14x-3\sqrt{x}-6}{\sqrt{x}+2}=ax+b$$

where $a$ and $b$ are integers and $x>4$

**[5 marks]**

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**5 (b)** Hence find

$$\int \left( \frac{7x\sqrt{x} + 14x - 3\sqrt{x} - 6}{\sqrt{x} + 2} \right) \left( x^2\sqrt{x} - 4 \right) \mathrm{d}x$$

**[3 marks]**

Answer _____

8

**Turn over ►**

*Do not write outside the box*

**6 (a)** The first four terms of the binomial expansion of $(1+3x)^9$ in ascending powers of $x$ are

$$1+27x+ax^2+bx^3$$

where $a$ and $b$ are integers.

Find the value of $a$ and the value of $b$

**[3 marks]**

$a =$ _____ $b =$ _____

**6 (b)** Use your answer to **part (a)** to show that $\left(\frac{17}{20}\right)^9$ is approximately equal to $\frac{353}{2000}$

**[4 marks]**

*Do not write outside the box*

**6 (c)** Use the result given in **part (b)** to find an approximate value for $\left(\frac{17}{10}\right)^9$

**[2 marks]**

Answer _____

9

**Turn over for the next question**

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**7** A curve has equation

$$y = ax^3 + bx^2 + cx^{-\frac{3}{2}} \quad \text{for} \quad x > 0$$

where $a$, $b$ and $c$ are constants.

**7 (a) (i)** Find $\frac{\mathrm{d}y}{\mathrm{d}x}$

**[2 marks]**

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

**7 (a) (ii)** Find $\frac{\mathrm{d}^2y}{\mathrm{d}x^2}$

**[2 marks]**

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

*Do not write outside the box*

**7 (b)** In the case where $a$, $b$ and $c$ are positive constants, the curve has exactly one stationary point $P$

Determine whether $P$ is a minimum point or a maximum point.

Fully justify your answer.

**[2 marks]**

**7 (c)** In a different case where $a$, $b$ and $c$ are positive constants **and** $a = b = c$, determine whether the gradient of the curve is positive or negative at the point where $x = 1$

**[3 marks]**

**9**

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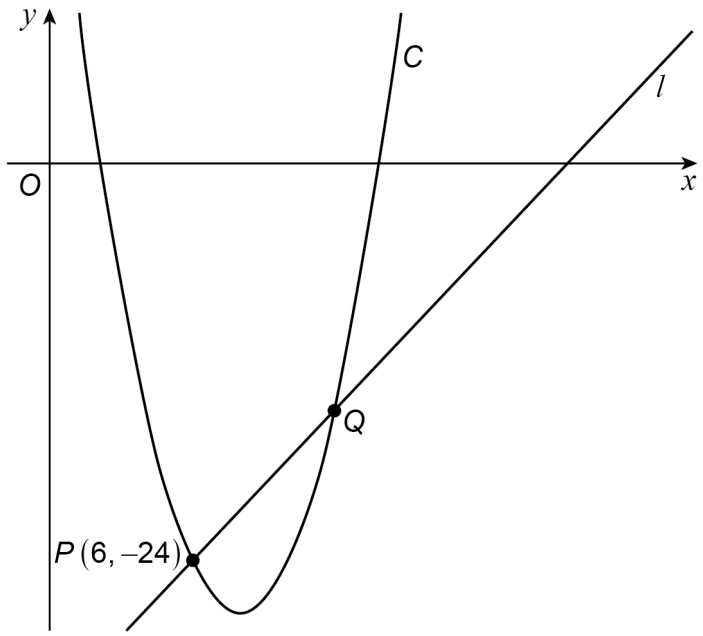
**8** A curve $C$ and a line $l$ are shown in the diagram below.




The equation of $C$ is $y = \frac{3}{4}x^2 - 12x + 21$

The equation of $l$ is $y = \frac{3}{2}x - 33$

The line $l$ intersects $C$ at the points $P(6, -24)$ and $Q$

**8 (a)** Show that $l$ is **not** the normal to $C$ at $P$

**[4 marks]**

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**8 (b) (i)** Show that the $x$-coordinates of $P$ and $Q$ satisfy the equation

$$x^2 - 18x + 72 = 0$$

**[2 marks]**

**8 (b) (ii)** Hence find the coordinates of $Q$

**[2 marks]**

Answer _____

**Question 8 continues on the next page**

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**8 (c)** Find $\int\left(\frac{3}{4}x^2 - 12x + 21\right)\mathrm{d}x$

**[2 marks]**

Answer _____

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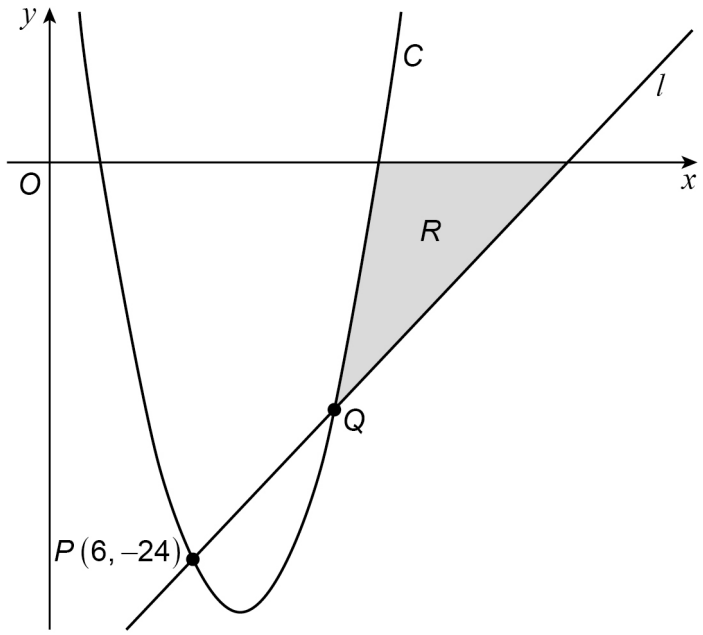
**8 (d)** The shaded region $R$ is bounded by the curve $C$, the line $l$ and the $x$-axis, as shown in the diagram below.




The curve $C$ intersects the $x$-axis at the points $(2,0)$ and $(14,0)$

Find the area of the shaded region $R$

**[4 marks]**

Answer _____

**14**

**Turn over ►**

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**9** A geometric series has first term $a$ and common ratio $r$

The second term of the series is $-48$

The sum to infinity of the series exists and is equal to $200$

**9 (a)** Show that $r = -\frac{1}{5}$ and find the value of $a$

Fully justify your answer.

**[5 marks]**

$a =$ _____

*Do not write outside the box*

**9 (b)** The $n$th term of this series is $u_n$

Show that for any positive integer $k$

$$\sum_{n=1}^{2k} \frac{625}{8} u_n = b^c \left(1 - b^{dk}\right)$$

where $b$, $c$ and $d$ are constants and $b$ is prime.

**[3 marks]**

8

**END OF QUESTIONS**

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**ANSWER IN THE SPACES PROVIDED**

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| Question number | **Additional page, if required.**<br>**Write the question numbers in the left-hand margin.** |
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