OXFORD AQA

INTERNATIONAL QUALIFICATIONS

Please write clearly in block capitals.

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

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Candidate signature _____

I declare this is my own work.

INTERNATIONAL A-LEVEL

MATHEMATICS

(9660/MA03) Unit P2 Pure Mathematics

Wednesday 7 January 2026 07:00 UK Time Time allowed: 2 hours 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 120.

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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12	
13	
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TOTAL	

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

1 A curve has equation $y = \ln(2x+1)$

The curve intersects the line $y = 5 - 6x$ at a single point where $x = \alpha$

1 (a) Show that α lies between 0.6 and 0.7

[2 marks]

1 (b) The equation $\ln(2x+1) = 5 - 6x$ can be rearranged into the form $x = \frac{1}{6}(5 - \ln(2x+1))$

Use the iterative formula

$$x_{n+1} = \frac{1}{6}(5 - \ln(2x_n + 1))$$

with $x_1 = 0.7$ to find the value of x_2 and the value of x_3

Give your values correct to three decimal places.

[2 marks]

$x_2 =$ _____ $x_3 =$ _____

4

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2 Describe a sequence of **two** geometrical transformations that maps the graph of $y = \sin\left(\frac{x}{4}\right)$ onto the graph of $y = 5\cos\left(\frac{x}{4}\right)$

[4 marks]

4

Turn over for the next question

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3 The functions f and g including their domains are defined as

$$\mathrm{f}(x) = 3\cos\left(\frac{x}{2}\right) \qquad \text{for } 0 \leq x \leq 2\pi$$

$$\mathrm{g}(x) = 1 - |x| \qquad \text{for all real values of } x$$

3 (a) Find the range of f

[2 marks]

Answer _____

3 (b) The inverse of f is f^{-1}

3 (b) (i) Find $\mathrm{f}^{-1}(x)$

[3 marks]

Answer _____

3 (b) (ii) Solve the equation $\mathrm{f}^{-1}(x) = \frac{3\pi}{2}$

[2 marks]

Answer _____

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3 (c) The composite function gf is denoted by h

3 (c) (i) Find $\mathrm{h}(x)$

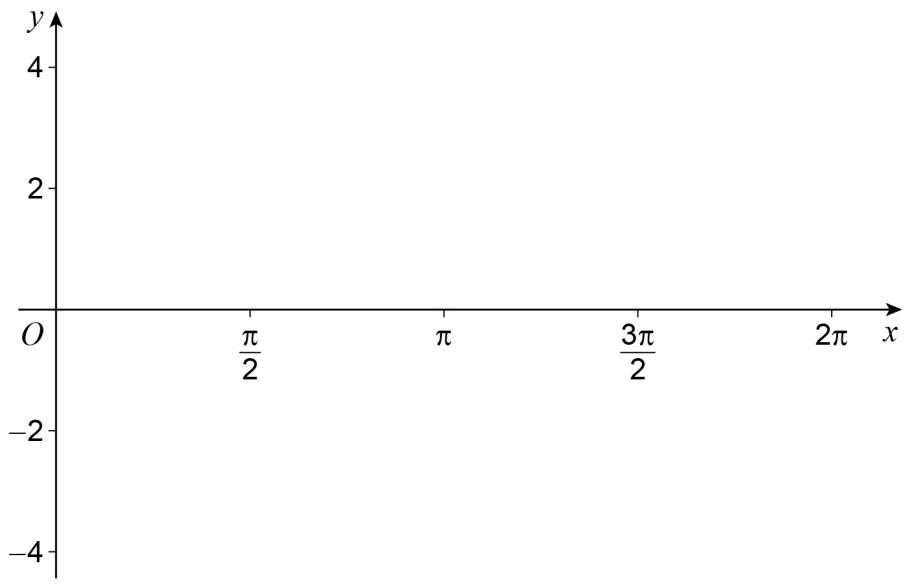
[1 mark]

Answer _____

3 (c) (ii) On **Figure 1** sketch the graph of $y = \mathrm{h}(x)$ for $0 \leq x \leq 2\pi$

[3 marks]

Figure 1



11

Turn over ►

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4 The line l_1 has equation $\mathbf{r} = \begin{bmatrix} 2 \\ 3 \\ 5 \end{bmatrix} + \lambda \begin{bmatrix} p \\ 1 \\ -1 \end{bmatrix}$ where p is a positive constant.

The line l_2 has equation $\mathbf{r} = \begin{bmatrix} -1 \\ 4 \\ q \end{bmatrix} + \mu \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}$ where q is a constant.

The lines l_1 and l_2 intersect.

The acute angle between l_1 and l_2 is 60°

4 (a) Find the value of p

[5 marks]

$p =$ _____

Do not write outside the box

4 (b) Find the value of q

[3 marks]

$q =$ _____

8

Turn over for the next question

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5 The polynomial $\mathrm{f}(x)$ is defined by

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

where a, b and c are constants.

When $\mathrm{f}(x)$ is divided by $(x-1)$ the remainder is 45

When $\mathrm{f}(x)$ is divided by $(x+1)$ the remainder is -5

When $\mathrm{f}(x)$ is divided by $(2x+1)$ the remainder is -9

5 (a) (i) Show that $b = 26$

[3 marks]

5 (a) (ii) Find the value of a and the value of c

[3 marks]

$a =$ _____ $c =$ _____

Do not write outside the box

5 (b) (i) Show that $\mathrm{f}(-2) = 0$

[1 mark]

5 (b) (ii) Hence show that $\dfrac{\mathrm{f}(x)}{(4x+1)(x+2)}$ can be written in the form

$$p(x+1) + \frac{q}{4x+1}$$

where p and q are constants.

[3 marks]

Answer _____

10

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6 (a) Use Simpson's rule with 4 strips to find an estimate for

$$\int_0^1 \sqrt{1-\left(\frac{1}{2}x^3\right)}\ \mathrm{d}x$$

Give your answer to four decimal places.

[4 marks]

Answer _____

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6 (b) Find the binomial expansion of $\sqrt{1-\left(\frac{1}{2}x^3\right)}$ up to and including the term in x^6

[2 marks]

Answer _____

6

Turn over for the next question

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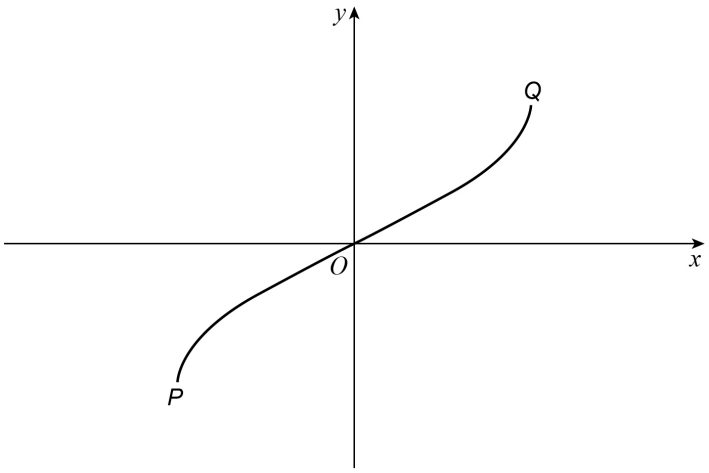
7 **Figure 2** shows the graph of $y = \sin^{-1}x$ where y is in radians and the end-points of the graph are P and Q

Figure 2



7 (a) Find the coordinates of P and the coordinates of Q

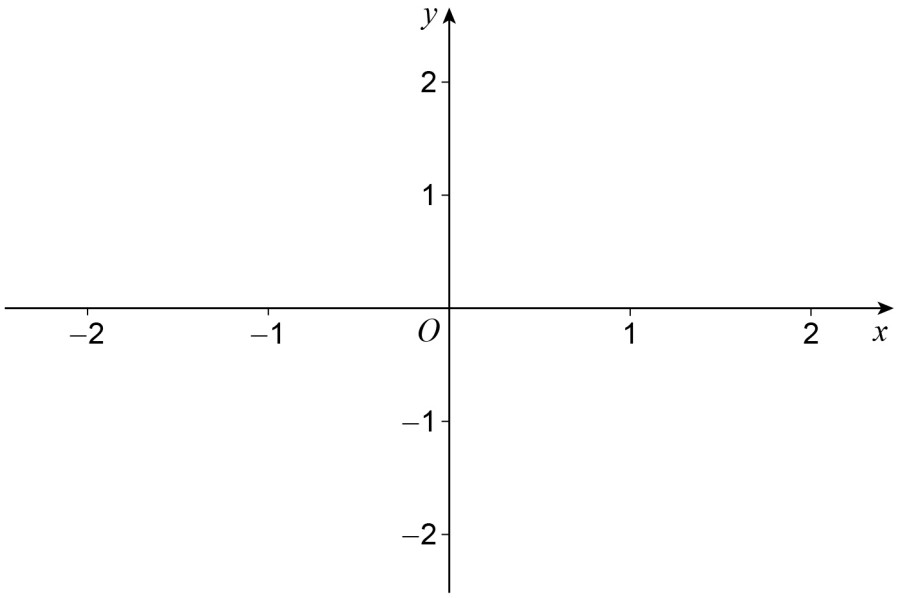
[1 mark]

P _____ Q _____

7 (b) On **Figure 3** sketch the graph of $y = \frac{1}{2}\sin^{-1}(x+1)$

[2 marks]

Figure 3



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7 (c) (i) Express the equation $y = \frac{1}{2}\sin^{-1}(x+1)$ in the form $x = f(y)$

[2 marks]

Answer _____

7 (c) (ii) Hence find the value of $\frac{dx}{dy}$ when $y = \frac{\pi}{12}$

Give your answer in an exact form.

[2 marks]

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

7

Turn over for the next question

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8 (a) It is given that $8\sin\theta + 15\cos\theta = 17\sin(\theta + 62°)$ correct to the nearest degree.

It is also given that the maximum value of $17\sin(\theta + 62°)$ is 17

8 (a) (i) Find the smallest positive value of the angle θ at which this maximum occurs.

[1 mark]

Answer _____

8 (a) (ii) Find the minimum value of $\dfrac{34}{34 - (8\sin\theta + 15\cos\theta)}$

[1 mark]

Answer _____

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8 (b) Solve the equation

$$\tan^2(2y - 0.7) + 9 = 6\sec(2y - 0.7) \quad \text{for} \quad 0 < y < \pi$$

Give all values of y in the interval to two decimal places.

[5 marks]

Answer _____

7

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9 Find $\int \frac{14}{2-x-6x^2}\,\mathrm{d}x$

Give your answer in the form $2\ln\left|\mathrm{f}\left(x\right)\right|+c$ where c is the constant of integration.

[6 marks]

Answer _____

6

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10 A curve C has equation $4x + y = (x - y)^2$

The curve C has exactly one stationary point at D

10 (a) Show that $\frac{dy}{dx} = \frac{2x - 2y - 4}{1 + 2x - 2y}$

[3 marks]

10 (b) Find the coordinates of D

[4 marks]

Answer _____

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10 (c) By differentiating $\frac{2x-2y-4}{1+2x-2y}$ with respect to x determine the nature of this stationary point.

[5 marks]

12

Turn over for the next question

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11 A curve is defined by the parametric equations

$$x = \frac{2pt}{t-1} \quad \text{and} \quad y = \frac{pt^2}{t-1}$$

where $t \neq 1$ and p is a non-zero constant.

11 (a) Find $\frac{\mathrm{d}y}{\mathrm{d}x}$ in terms of t

[3 marks]

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

11 (b) Find an equation for the tangent to the curve at the point where $t = 3$

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

[4 marks]

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Answer _____

11 (c) Find a Cartesian equation of the curve.

Give your answer in the form $y = \frac{1}{2}\mathrm{f}(x)$

[4 marks]

Answer _____

11

Turn over ►

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12 (a) It is given that $y = \dfrac{5x}{5x+3}$

Use the quotient rule to show that $\dfrac{dy}{dx} = \dfrac{n}{(5x+3)^2}$ where n is an integer.

[2 marks]

12 (b) A curve has equation $y = x\ln(5x+3)$

12 (b) (i) Find $\dfrac{dy}{dx}$

[3 marks]

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

12 (b) (ii) Find an equation for the normal to the curve at the point where $x = 1$

Give your answer in an exact form.

[3 marks]

Answer _____

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12 (c) (i) Use the substitution $u = 5x + 3$ to find $\int \frac{5x}{5x+3}\,\mathrm{d}x$

[4 marks]

Answer _____

12 (c) (ii) Find $\int \ln(5x+3)\,\mathrm{d}x$

[4 marks]

Answer _____

16

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13 It is given that $y = \mathrm{f}(x)$ satisfies the differential equation

$$\left(1 + \sin^2 x\right) \frac{\mathrm{d}y}{\mathrm{d}x} = \mathrm{e}^{-0.5y} \sin 2x$$

It is also given that $y = 4$ when $x = 0$

Find the exact value of y when $x = \frac{\pi}{4}$

[8 marks]

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Answer _____

8

Turn over for the next question

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14 (a) (i) It is given that $y = \dfrac{1}{\cos x}$

Use the quotient rule to show that $\dfrac{\mathrm{d}y}{\mathrm{d}x} = \sec x \tan x$

[2 marks]

14 (a) (ii) It is given that $y = \ln(\sec x + \tan x)$

Show that $\dfrac{\mathrm{d}y}{\mathrm{d}x} = \sec x$

[2 marks]

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14 (b) The region bounded by the curve $y = \tan x + 2\sin x$, the lines $x = 0$ and $x = \frac{\pi}{6}$, and the x-axis is rotated through 2π radians about the x-axis to form a solid.

Use the result in **part (a)(ii)** to find the exact value of the volume of this solid.

Give your answer in the form $\frac{\pi}{6}\left(\pi + a - \sqrt{b} + c\ln 3\right)$ where a, b and c are integers.

[6 marks]

Answer _____

10

END OF QUESTIONS

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