



Cambridge International AS & A Level

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MATHEMATICS**9709/21**

Paper 2 Pure Mathematics 2

October/November 2025**1 hour 15 minutes**

You must answer on the question paper.

You will need: List of formulae (MF19)

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- If additional space is needed, you should use the lined page at the end of this booklet; the question number or numbers must be clearly shown.
- You should use a calculator where appropriate.
- You must show all necessary working clearly; no marks will be given for unsupported answers from a calculator.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.

INFORMATION

- The total mark for this paper is 50.
- The number of marks for each question or part question is shown in brackets [].

This document has **16** pages. Any blank pages are indicated.

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1 Find $\int 6 \sin^2 x \, dx$.

[3]

[illegible]



2 Solve the equation $e^{2x}(e^{2x} - 8) = 48$.

[3]

This image shows a full page of white paper with horizontal dotted lines. The lines are evenly spaced and run across the width of the page, providing a guide for handwriting practice. There are no margins, text, or other markings on the page.



3 (a) Solve the equation $|2x - 3| = |5x + 2|$. [3]

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(b) Hence solve the equation $|2 \sec \theta - 3| = |5 \sec \theta + 2|$ for $\pi < \theta < 2\pi$. Give your answer correct to 3 significant figures. [3]

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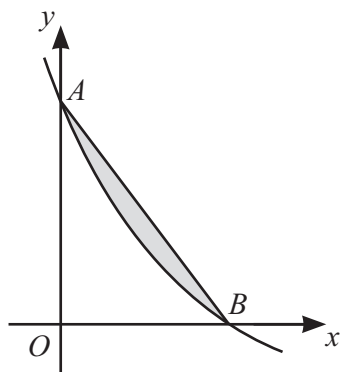




4 Solve the equation $\cot \theta \tan(\theta + 45^\circ) = 7$ for $0^\circ < \theta < 90^\circ$.

[5]

[illegible]



The diagram shows the curve with equation $y = 8e^{-\frac{1}{2}x} - 1$. The curve meets the axes at the points A and B . The shaded region is bounded by the curve and the line segment AB .

- (a) Show that the x -coordinate of B is $6 \ln 2$. [2]

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- (b) Find the area of the shaded region. Give your answer in the form $p \ln 2 - q$, where p and q are positive integers. [5]

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6 A curve has parametric equations

$$x = \tan \theta, \quad y = \sin \theta - 2 \sin^3 \theta,$$

for $0 < \theta < \frac{1}{2}\pi$.

(a) Show that $\frac{dy}{dx} = 6 \cos^5 \theta - 5 \cos^3 \theta$. [4]

This image shows a full page of a handwriting practice worksheet. It consists of multiple rows of horizontal dashed lines spaced evenly down the page, providing a guide for letter height and placement. The background is plain white, and there are no other markings or text present.



- (b) Find the equation of the normal to the curve at the point where it crosses the x -axis. Give your answer in the form $y = mx + c$, where m and c are exact constants. [5]

This image shows a full page of white paper designed for handwriting practice. It features approximately 20 evenly spaced horizontal dotted lines running across the width of the page. There are no margins, text, or other markings present.



7 The polynomial $p(x)$ is defined by

$$p(x) = 2x^4 + kx^3 + kx^2 + 17x + 18,$$

where k is a constant. It is given that $(x+2)$ is a factor of $p(x)$.

(a) Find the value of k .

[2]

It is given that the equation $p(x) = 0$ has exactly two real roots, denoted by α and β , where α is an integer and β is not an integer.

(b) State the value of α and show that β satisfies the equation $x = \sqrt[3]{-2x-4.5}$.

[4]

This image shows a full page of white paper with horizontal dashed lines, typical of primary school handwriting practice paper. The lines are evenly spaced and run across the entire width of the page. There are no margins, text, or other markings present.



(c) Show by calculation that $-1.4 < \beta < -1.0$.

[2]

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(d) Use an iterative formula, based on the equation in part (b), to find the value of β correct to 3 significant figures. Give the result of each iteration to 5 significant figures. [3]

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DO NOT WRITE IN THIS MARGIN

[6]

This image shows a full page of white paper with horizontal dotted lines, typical of primary school writing paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.



DO NOT WRITE IN THIS MARGIN

Handwriting practice area with 20 horizontal dotted lines.



[illegible]





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MATHEMATICS

9709/22

Paper 2 Pure Mathematics 2

October/November 2025

1 hour 15 minutes

You must answer on the question paper.

You will need: List of formulae (MF19)

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
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- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.

INFORMATION

- The total mark for this paper is 50.
- The number of marks for each question or part question is shown in brackets [].

This document has **12** pages. Any blank pages are indicated.



1 Solve the equation $\ln(3x+5) - \ln(x-2) = 4$. Give your answer in an exact form.

[4]

This image shows a full page of a worksheet designed for handwriting practice. It consists of approximately 20 horizontal rows. Each row is defined by two parallel dotted lines, creating a series of uniform gaps for writing. The entire page is otherwise blank, with no text or other markings.



2 Solve the equation $2 \tan^2 \theta + 3 \sec \theta = 18$ for $-180^\circ < \theta < 180^\circ$.

[5]

[illegible]



3 (a) Solve the inequality $|3x - 4| \leq |2x + 5|$.

[4]

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(b) Hence find the largest integer N satisfying the inequality $|3 \times 7^{0.01N} - 4| \leq |2 \times 7^{0.01N} + 5|$. [3]

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4 The polynomial $p(x)$ is defined by

$$p(x) = x^4 - 10x^3 + 20x^2 - 30x + 40.$$

- (a) Find the quotient when $p(x)$ is divided by $(x^2 + 3)$ and show that the remainder is -11 . [3]

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- (b) Hence find the real roots of the equation $p(x) + 11 = 0$. Give your answers in exact form. [3]

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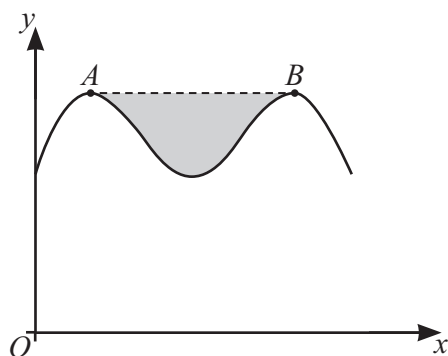
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The diagram shows the curve with equation $y = 4 \cos 2x + 8 \sin x$ for $0 \leq x \leq \pi$. The maximum points on the curve are denoted by A and B , and the shaded region is bounded by the line segment AB and the curve.

- (a) Find the coordinates of A and B .

[5]

[illegible]



(b) Find the exact area of the shaded region.

[6]

[illegible]



- 6 (a)** Given that $\int_{-2a}^a \left(\frac{1}{2}e^{2x} + \frac{1}{4}e^{-x} \right) dx = 5$, where a is a positive constant, show that

$$a = \frac{1}{2} \ln \left(10 + \frac{1}{2} e^{-a} + \frac{1}{2} e^{-4a} \right). \quad [4]$$

[illegible]

(b) Hence show by calculation that the value of a lies between 1.0 and 1.2.

[2]

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(c) Use the iterative formula

$$a_{n+1} = \frac{1}{2} \ln \left(10 + \frac{1}{2} e^{-a_n} + \frac{1}{2} e^{-4a_n} \right)$$

to find the value of a correct to 4 significant figures. Give the result of each iteration to 6 significant figures.

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7 A curve has equation $5x^2y + 4e^{2y} - 7x + 10 = 0$.

- (a) Find an expression in terms of x and y for $\frac{dy}{dx}$ and hence find the gradient of the curve at the point for which $y = 0$. [6]

[illegible]

- (b)** Show that there is no point on the curve at which the tangent is parallel to the y -axis. [2]

This image shows a single sheet of white paper with ten evenly spaced, horizontal dashed lines. The lines are thin and black, extending across the width of the page. There are no margins, text, or other markings on the paper.



Additional page

If you use the following page to complete the answer to any question, the question number must be clearly shown.

[illegible]



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MATHEMATICS

9709/23

Paper 2 Pure Mathematics 2

October/November 2025

1 hour 15 minutes

You must answer on the question paper.

You will need: List of formulae (MF19)

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
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INFORMATION

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1 Find $\int 6 \sin^2 x \, dx$.

[illegible]

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3 (a) Solve the equation $|2x - 3| = |5x + 2|$. [3]

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(b) Hence solve the equation $|2 \sec \theta - 3| = |5 \sec \theta + 2|$ for $\pi < \theta < 2\pi$. Give your answer correct to 3 significant figures. [3]

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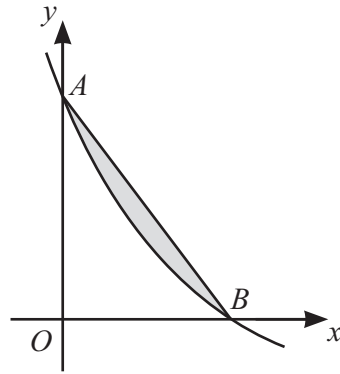




4 Solve the equation $\cot \theta \tan(\theta + 45^\circ) = 7$ for $0^\circ < \theta < 90^\circ$.

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The diagram shows the curve with equation $y = 8e^{-\frac{1}{2}x} - 1$. The curve meets the axes at the points A and B . The shaded region is bounded by the curve and the line segment AB .

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- (b) Find the area of the shaded region. Give your answer in the form $p \ln 2 - q$, where p and q are positive integers. [5]

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6 A curve has parametric equations

$$x = \tan \theta, \quad y = \sin \theta - 2 \sin^3 \theta,$$

for $0 < \theta < \frac{1}{2}\pi$.

(a) Show that $\frac{dy}{dx} = 6 \cos^5 \theta - 5 \cos^3 \theta$. [4]

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- (b) Find the equation of the normal to the curve at the point where it crosses the x -axis. Give your answer in the form $y = mx + c$, where m and c are exact constants. [5]

[illegible]



7 The polynomial $p(x)$ is defined by

$$p(x) = 2x^4 + kx^3 + kx^2 + 17x + 18,$$

where k is a constant. It is given that $(x+2)$ is a factor of $p(x)$.

(a) Find the value of k .

[2]

It is given that the equation $p(x) = 0$ has exactly two real roots, denoted by α and β , where α is an integer and β is not an integer.

(b) State the value of α and show that β satisfies the equation $x = \sqrt[3]{-2x-4.5}$.

[4]





(c) Show by calculation that $-1.4 < \beta < -1.0$.

[2]

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(d) Use an iterative formula, based on the equation in part (b), to find the value of β correct to 3 significant figures. Give the result of each iteration to 5 significant figures. [3]

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- 8** The equation of a curve is $y = 4e^{1-2x}\sqrt{3x-1}$.

Find the exact coordinates of the stationary point of the curve.

[6]

[illegible]

[illegible]

[illegible]





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MATHEMATICS**9709/25**

Paper 2 Pure Mathematics 2

October/November 2025**1 hour 15 minutes**

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INSTRUCTIONS

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(b) Hence solve the equation $|2 \sec \theta - 3| = |5 \sec \theta + 2|$ for $\pi < \theta < 2\pi$. Give your answer correct to 3 significant figures. [3]

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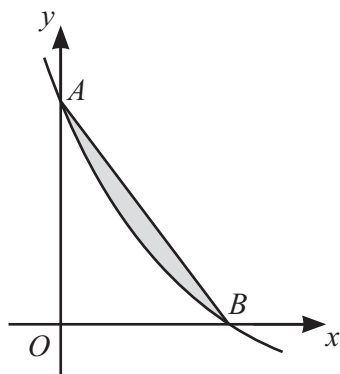




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- (a) Show that the x -coordinate of B is $6 \ln 2$. [2]

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