

Cambridge International AS & A Level

CANDIDATE NAME					
CENTRE NUMBER			CANDIDATE NUMBER		

MATHEMATICS 9709/22

Paper 2 Pure Mathematics 2

May/June 2023

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 [].

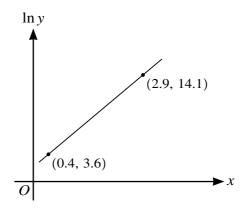
This document has 12 pages.

1	Solve	the ec	uation

$\sec^2\theta + 5\tan^2\theta = 9 + 17\sec\theta$

for $0^{\circ} < \theta < 360^{\circ}$.	[5]
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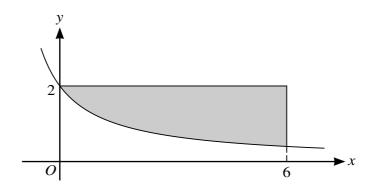
2



The variables x and y satisfy the equation $y = Ae^{(A-B)x}$, where A and B are constants. The graph of $\ln y$ against x is a straight line passing through the points (0.4, 3.6) and (2.9, 14.1), as shown in the diagram.

Find the values of A and B correct to 3 significant figures.	[5]
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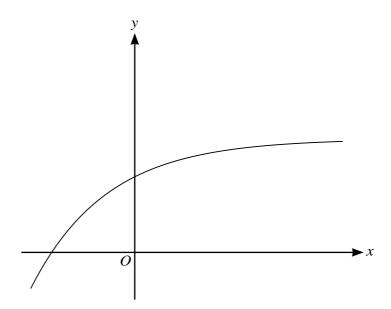
3



The diagram shows part of the curve $y = \frac{6}{2x+3}$. The shaded region is bounded by the curve and the lines x = 6 and y = 2.

ind the exact area of the shaded region, giving your answer in the form $a - \ln b$, where a and b are itegers. [5]

4 (a)



The diagram shows the graph of $y = 3 - e^{-\frac{1}{2}x}$.

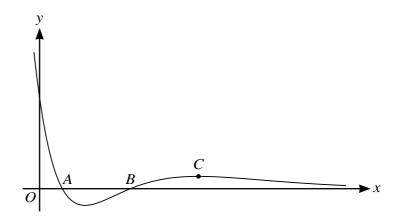
On the diagram, sketch the graph of y = |5x - 4|, and show that the equation $3 - e^{-\frac{1}{2}x} = |5x - 4|$ has exactly two real roots. [2]

It is given that the two roots of $3 - e^{-\frac{1}{2}x} = |5x - 4|$ are denoted by α and β , where $\alpha < \beta$.

(b)	Show by calculation that α lies between 0.36 and 0.37.	[2]
		•••••

(c)	Use the iterative formula $x_{n+1} = \frac{1}{5} \left(7 - e^{-\frac{1}{2}x_n}\right)$ to find β correct to 4 significant figures. result of each iteration to 6 significant figures.	Give the

5



The diagram shows the curve with equation $y = e^{-\frac{1}{2}x}(x^2 - 5x + 4)$. The curve crosses the *x*-axis at the points *A* and *B*, and has a maximum at the point *C*.

(a)	Find the exact gradient of the curve at B .	[5]
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(b)	Find the exact coordinates of C .	[4]
		••••••

6 (a)	Show that $4\sin(\theta + \frac{1}{3}\pi)\cos(\theta - \frac{1}{3}\pi) \equiv \sqrt{3} + 2\sin 2\theta$.	[4]
(b)	Find the exact value of $4 \sin \frac{17}{24} \pi \cos \frac{1}{24} \pi$.	[2

Find the exact value of $\int_0^{\frac{1}{8}\pi} 4\sin(2x + \frac{1}{3}\pi)\cos(2x - \frac{1}{3}\pi)$	

7 A curve has parametric equations

$$x = \frac{2t+3}{t+2}$$
, $y = t^2 + at + 1$,

where a is a constant. It is given that, at the point P on the curve, the gradient is 1.

•	(a)	Show	that the	value	of t at t	P	satisfies	the	equation
٠,	(a)	SHOW	mat mc	varuc	or i at i	L	sausiics	uic	Cquation

$2t^3 + (a+8)t^2 + (4a+8)t + 4a - 1 = 0.$	[4]
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	••••••
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(b)	It is	given	that	(t+1)) is	a fa	ctor	of
(\mathbf{D})	11 15	grvcn	mai	$(\iota + 1)$	113	ara	CtOI	OI

$2t^3 + (a+8)t^2 + (4a+8)t + 4a - 1.$	
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	Find the value of a .	[2]
(c)	Hence show that P is the only point on the curve at which the gradient is 1.	[3]

Additional Page

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

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