

Cambridge IGCSE™

CANDIDATE
NAME

CENTRE
NUMBER

--	--	--	--	--

CANDIDATE
NUMBER

--	--	--	--

ADDITIONAL MATHEMATICS

0606/12

Paper 1

February/March 2023

2 hours

You must answer on the question paper.

No additional materials are needed.

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.
- 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 80.
- The number of marks for each question or part question is shown in brackets [].

This document has **16** pages.

Mathematical Formulae**1. ALGEBRA***Quadratic Equation*

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \dots + \binom{n}{r}a^{n-r}b^r + \dots + b^n$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

Arithmetic series $u_n = a + (n-1)d$

$$S_n = \frac{1}{2}n(a + l) = \frac{1}{2}n\{2a + (n-1)d\}$$

Geometric series $u_n = ar^{n-1}$

$$S_n = \frac{a(1-r^n)}{1-r} \quad (r \neq 1)$$

$$S_\infty = \frac{a}{1-r} \quad (|r| < 1)$$

2. TRIGONOMETRY*Identities*

$$\begin{aligned}\sin^2 A + \cos^2 A &= 1 \\ \sec^2 A &= 1 + \tan^2 A \\ \operatorname{cosec}^2 A &= 1 + \cot^2 A\end{aligned}$$

Formulae for $\triangle ABC$

$$\begin{aligned}\frac{a}{\sin A} &= \frac{b}{\sin B} = \frac{c}{\sin C} \\ a^2 &= b^2 + c^2 - 2bc \cos A \\ \Delta &= \frac{1}{2}bc \sin A\end{aligned}$$

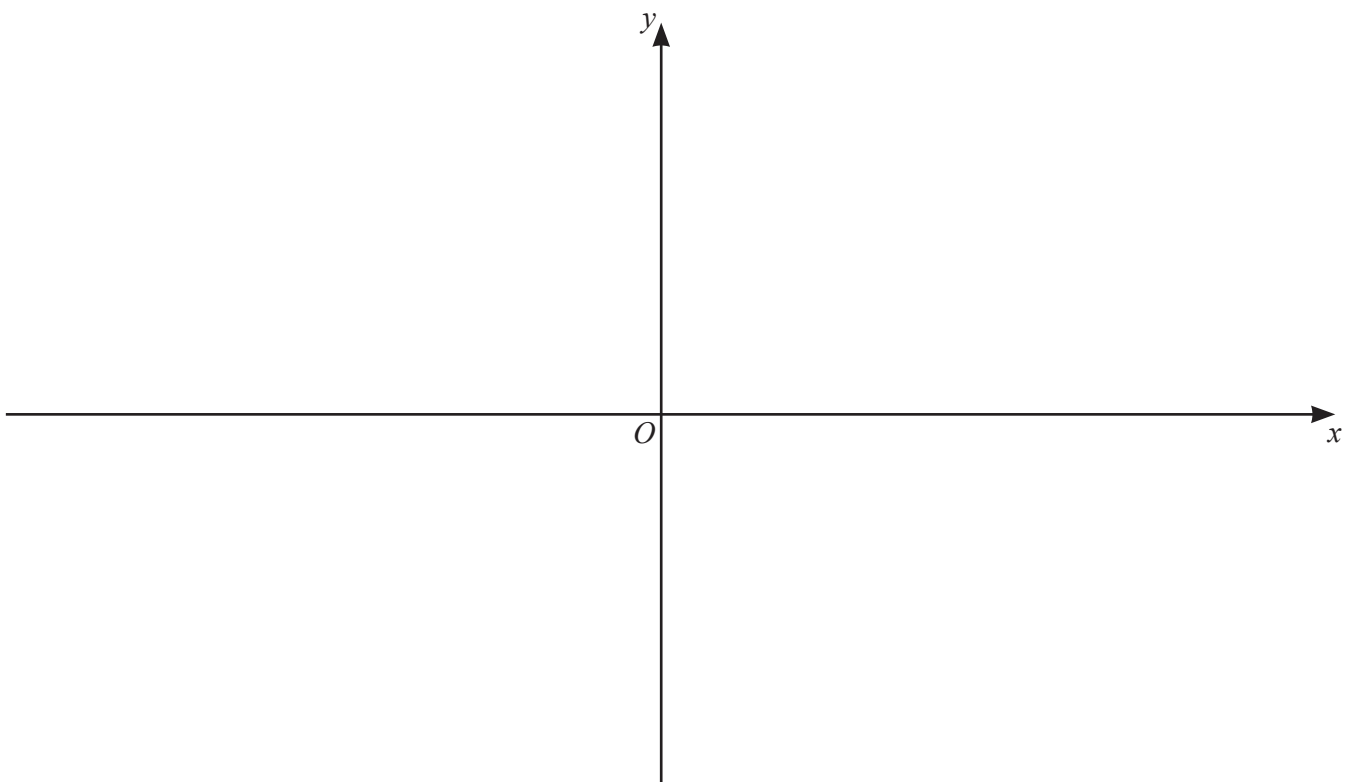
- 1 Find the exact values of k such that the straight line $y = 1 - k - x$ is a tangent to the curve $y = kx^2 + x + 2k$. [4]

2 A curve has equation $y = (5 - x)(x + 2)^2$.

(a) Find the x -coordinates of the stationary points on the curve.

[4]

(b) On the axes below, sketch the graph of $y = (5 - x)(x + 2)^2$, stating the coordinates of the points where the curve meets the axes. [3]



- (c) Find the values of k for which the equation $k = (5 - x)(x + 2)^2$ has one distinct root only. [3]

- 3 Find the coefficient of x^8 in the expansion of $(1-x^2)\left(2x-\frac{1}{x}\right)^{10}$. [5]

4 (a) Write $3 \lg x - 2 \lg y^2 - 3$ as a single logarithm to base 10. [3]

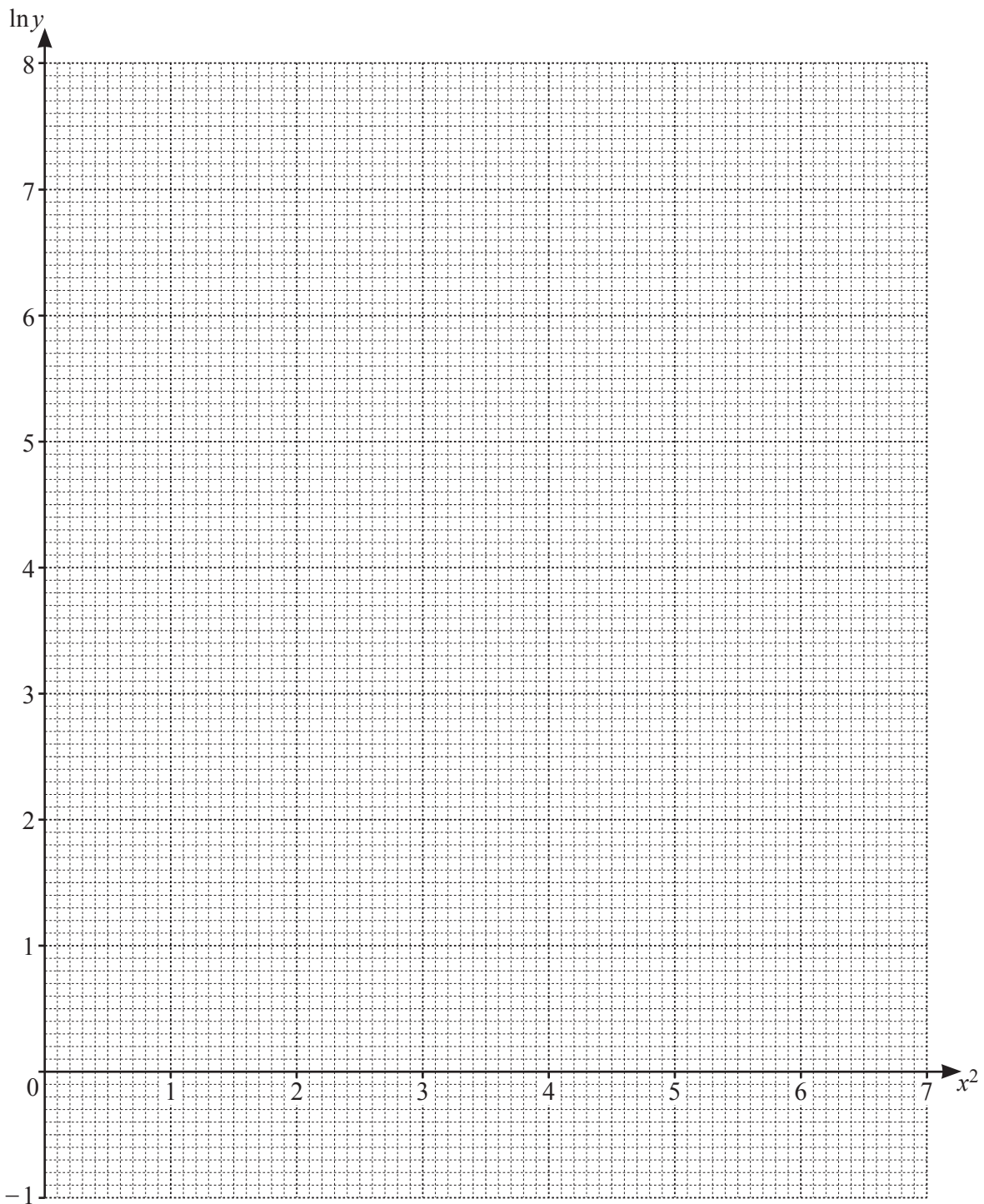
(b) Solve the equation $\log_3 x + \log_x 3 = \frac{5}{2}$. [5]

- 5 The table shows values of the variables x and y , which are related by an equation of the form $y = Ab^{x^2}$, where A and b are constants.

x	1	1.5	2	2.5
y	2.0	11.3	128	2896

- (a) Use the data to draw a straight line graph of $\ln y$ against x^2 .

[2]



(b) Use your graph to estimate the values of A and b . Give your answers correct to 1 significant figure. [5]

(c) Estimate the value of y when $x = 1.75$. [2]

(d) Estimate the positive value of x when $y = 20$. [2]

- 6 Given that $f''(x) = (5x+2)^{-\frac{2}{5}}$, $f'(6) = \frac{17}{3}$ and $f(6) = \frac{26}{3}$, find an expression for $f(x)$. [8]

- 7 (a) A 5-character password is to be formed from the following 13 characters.

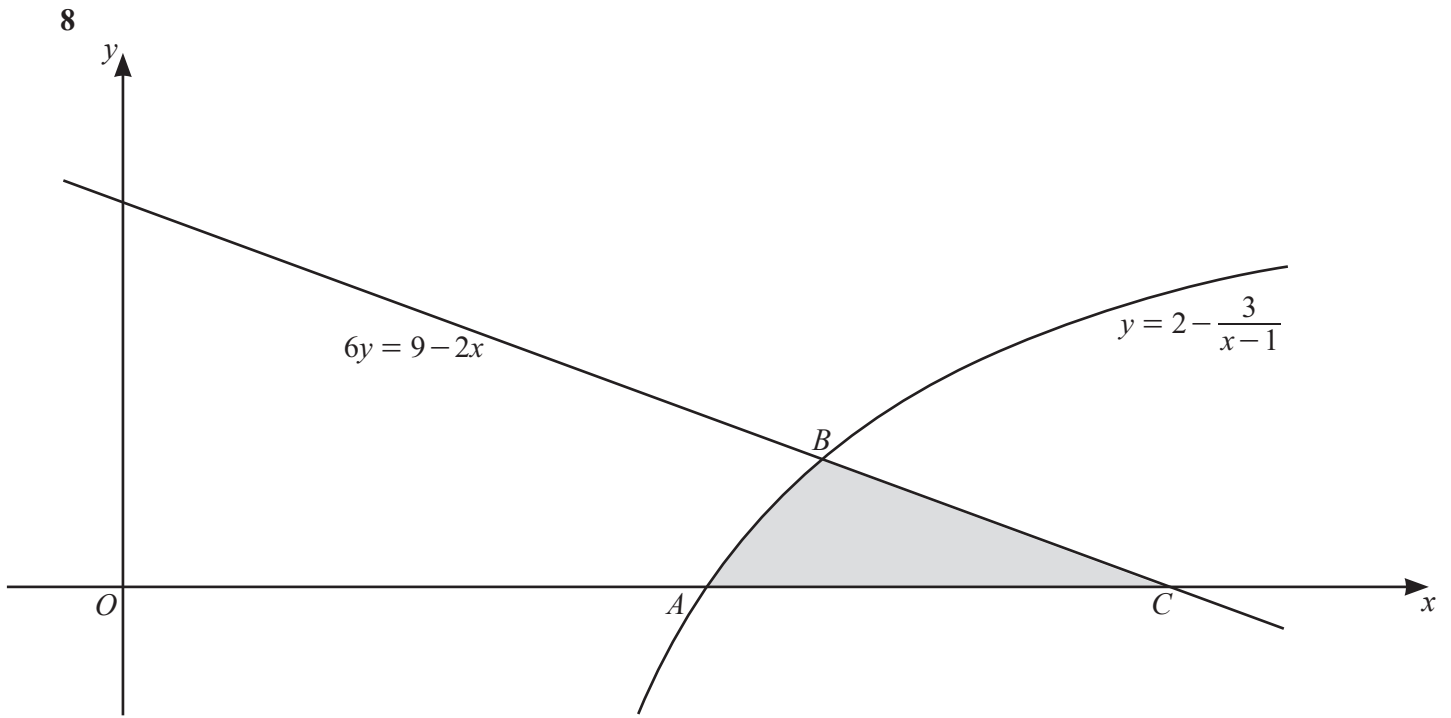
Letters	A	B	C	D	E
Numbers	9	8	7	6	5
Symbols	*	#	!		

No character may be used more than once in any password.

- (i) Find the number of possible passwords that can be formed. [1]

- (ii) Find the number of possible passwords that contain at least one symbol. [2]

- (b) Given that $16 \times {}^nC_{12} = (n-10) \times {}^{n+1}C_{11}$, find the value of n . [3]



The diagram shows part of the curve $y = 2 - \frac{3}{x-1}$ and the straight line $6y = 9 - 2x$. The curve intersects the x -axis at point A and the line at point B . The line intersects the x -axis at point C . Find the area of the shaded region ABC , giving your answer in the form $p + \ln q$, where p and q are rational numbers. [11]

Additional working space for Question 8.

9 In this question, all lengths are in metres.

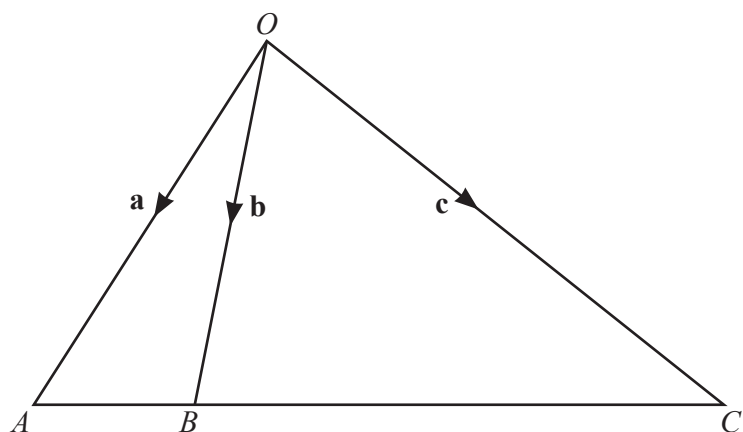
(a) A particle P has position vector $\begin{pmatrix} 2+12t \\ 5-5t \end{pmatrix}$ at a time t seconds, $t \geq 0$.

(i) Write down the initial position vector of P . [1]

(ii) Find the speed of P . [2]

(iii) Determine whether P passes through the point with position vector $\begin{pmatrix} 158 \\ -48 \end{pmatrix}$. [2]

(b)



The diagram shows the triangle OAC . The point B lies on AC such that $AB:AC = 1:4$. Given that $\vec{OA} = \mathbf{a}$, $\vec{OB} = \mathbf{b}$ and $\vec{OC} = \mathbf{c}$, find $\mathbf{c}$ in terms of $\mathbf{a}$ and $\mathbf{b}$. [3]

Question 10 is printed on the next page.

- 10 (a) It is given that $2 + \cos \theta = x$ for $1 < x < 3$ and $2 \operatorname{cosec} \theta = y$ for $y > 2$. Find y in terms of x .
[4]

- (b) Solve the equation $3 \cos \frac{\phi}{2} = \sqrt{3} \sin \frac{\phi}{2}$ for $-4\pi < \phi < 4\pi$. [5]

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge Assessment International Education is part of Cambridge Assessment. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which is a department of the University of Cambridge.