



Cambridge IGCSE™

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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 $\triangle ABC$

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

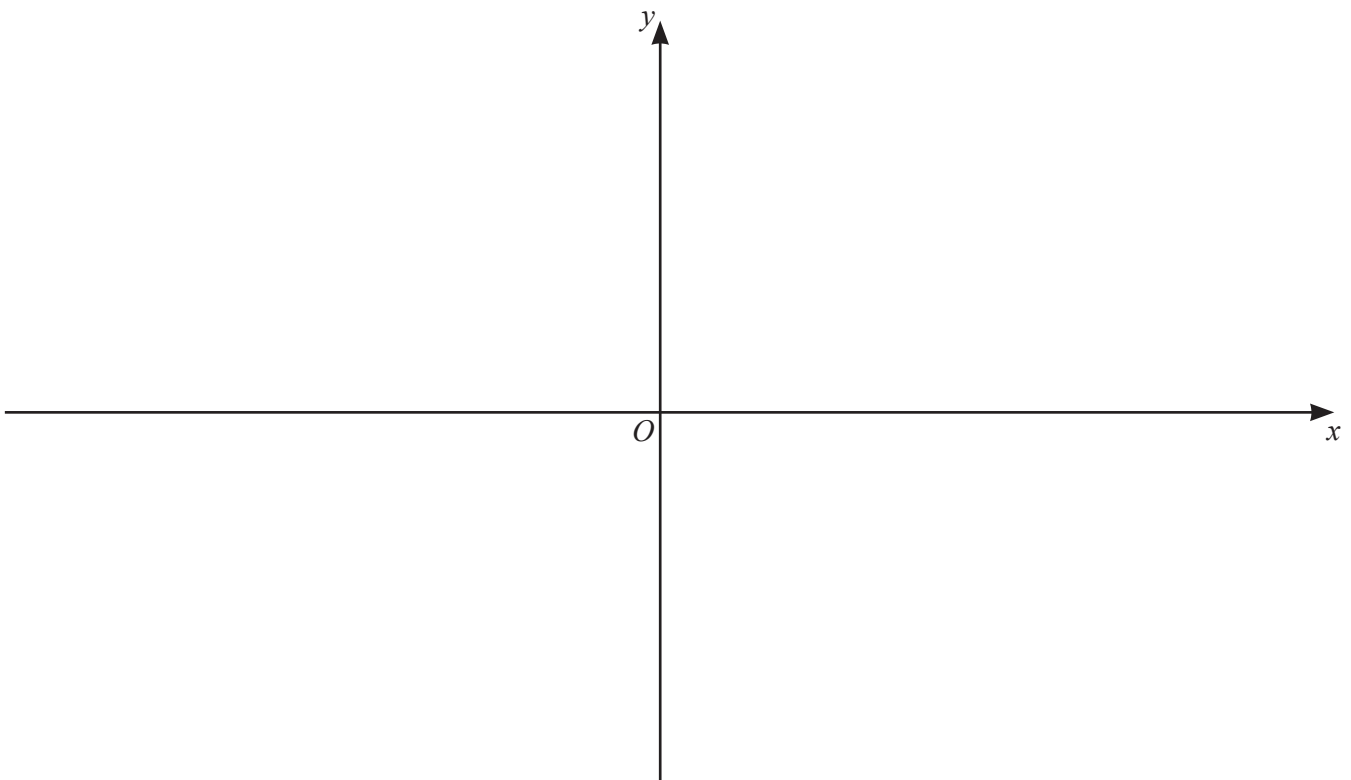
- 1 Find the exact values of k such that the straight line $y = 1 - k - x$ is a tangent to the curve $y = kx^2 + x + 2k$. [4]

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]

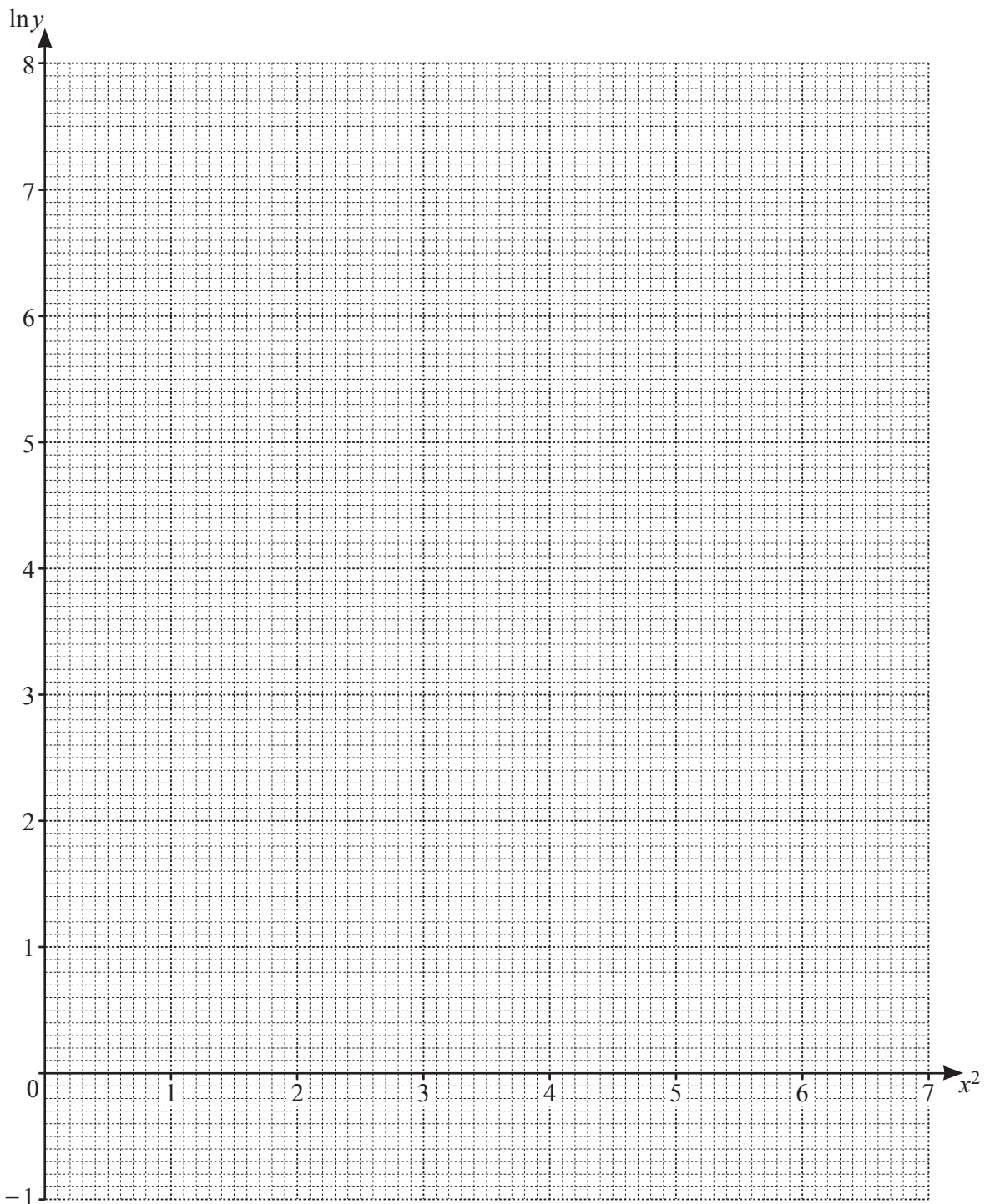
(b) Solve the equation $\log_3 x + \log_x 3 = \frac{5}{2}$. [5]

- 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.

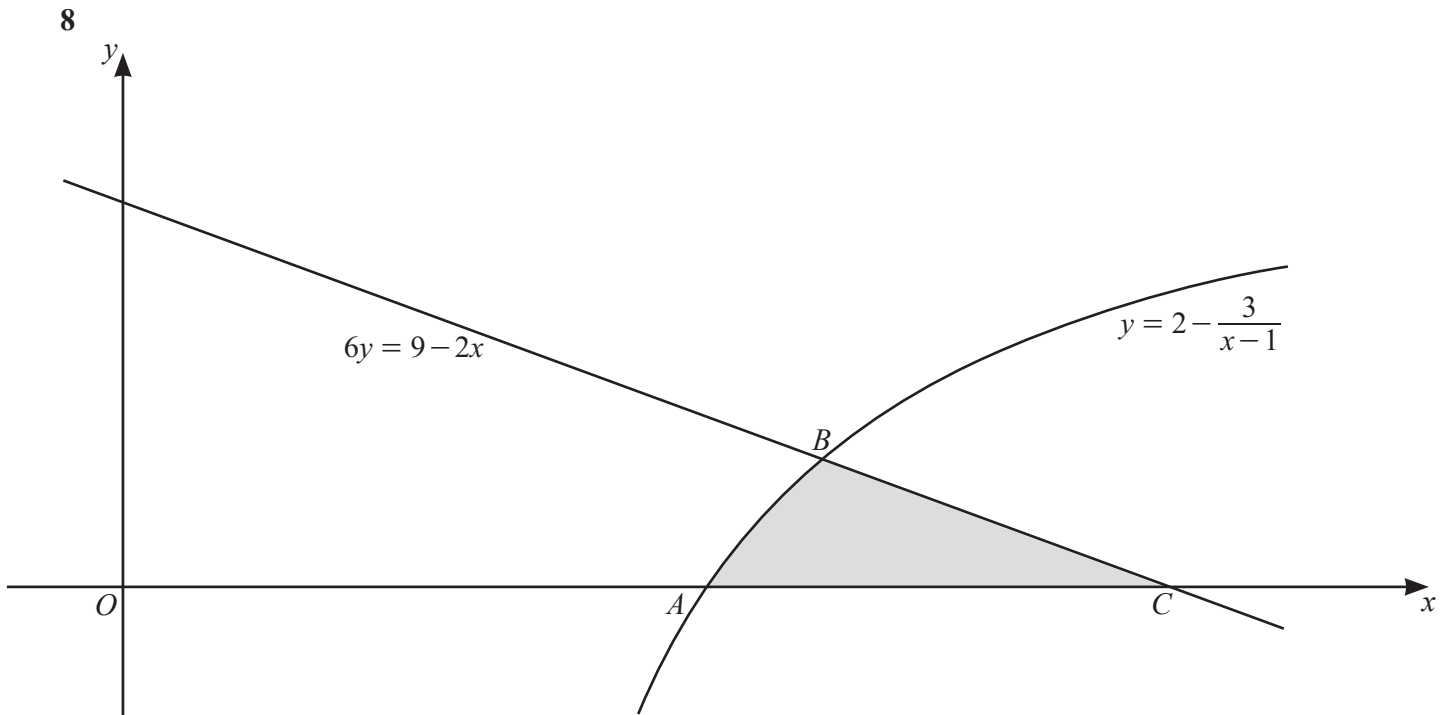
Letters	A	B	C	D	E
Numbers	9	8	7	6	5
Symbols	*	#	!		

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 $16 \times {}^n C_{12} = (n-10) \times {}^{n+1} C_{11}$, 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.

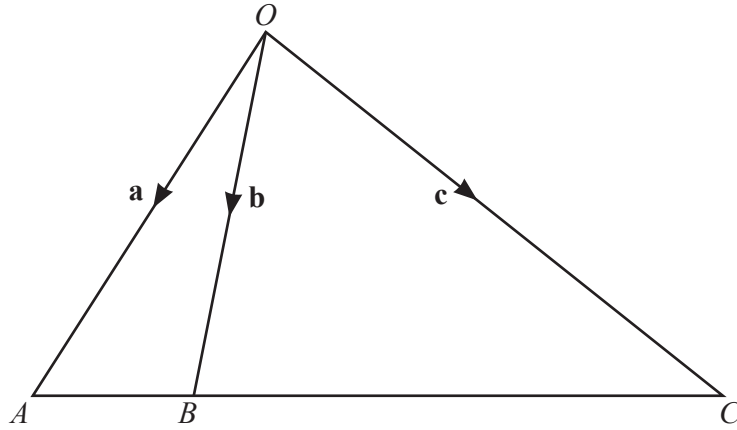
(a) A particle P has position vector $\begin{pmatrix} 2+12t \\ 5-5t \end{pmatrix}$ at a time t seconds, $t \geq 0$.

(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]

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