Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER | CANDIDATE NUMBER

7029106838

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

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

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

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

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

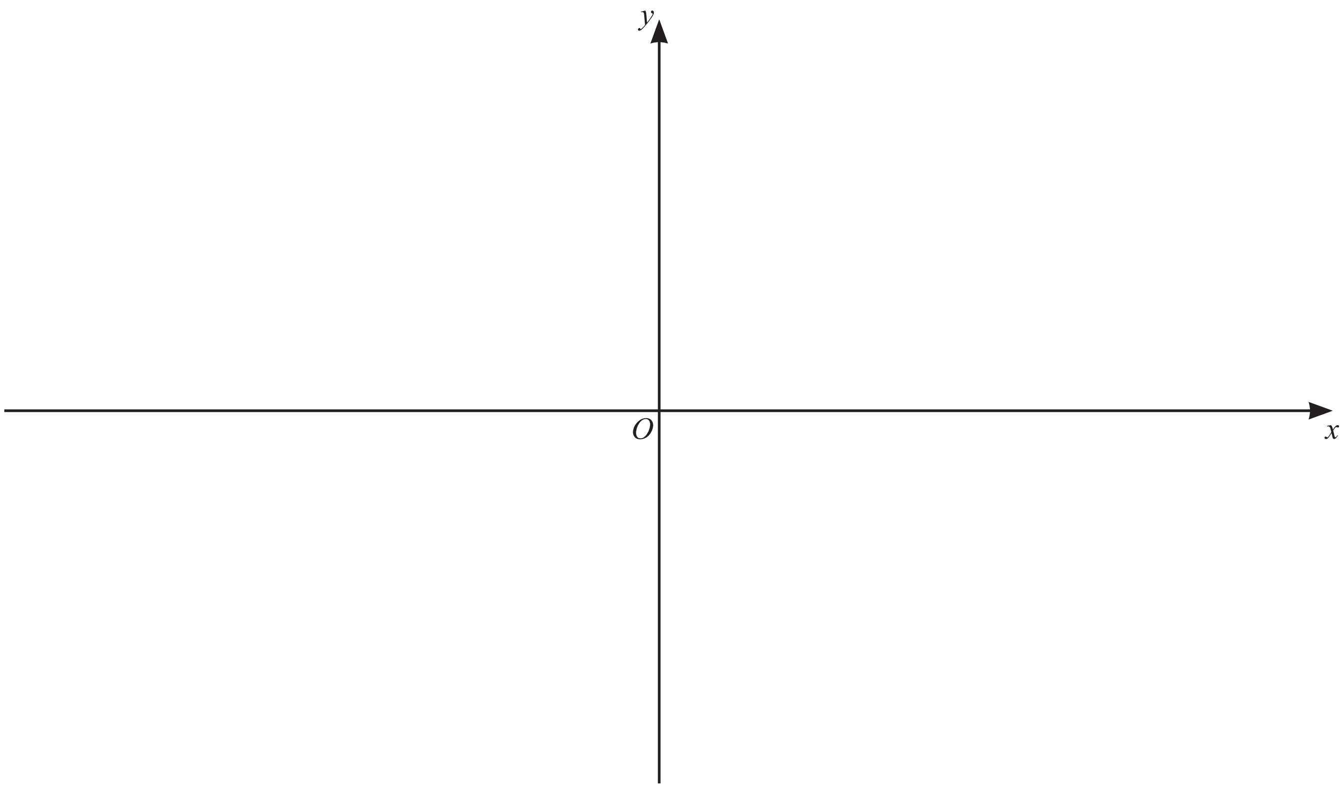
$$\Delta = \frac{1}{2}bc\sin A$$

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 $\left(1-x^2\right)\left(2x-\frac{1}{x}\right)^{10}$. [5]

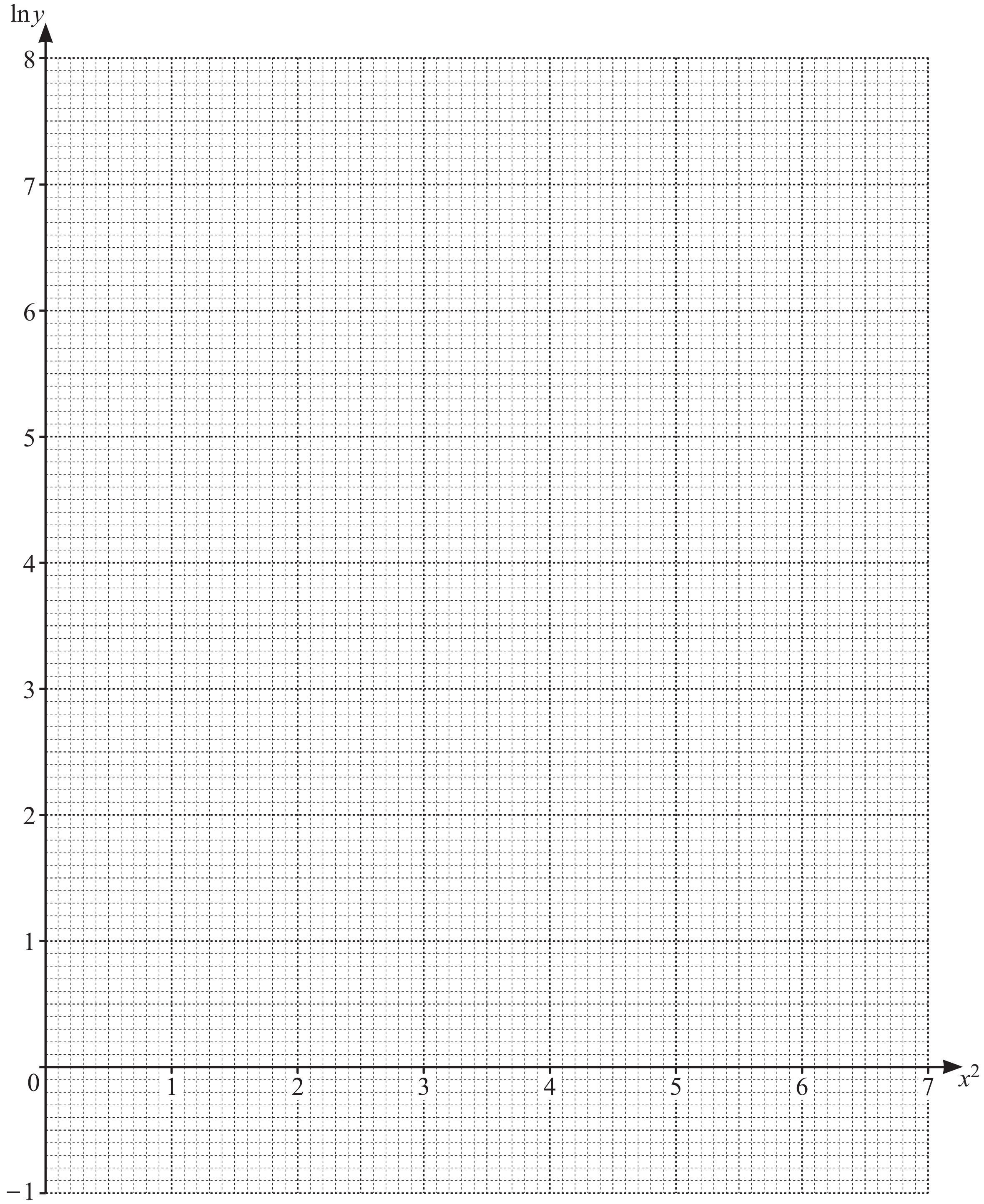
4 **(a)** Write $3\lg x - 2\lg y^2 - 3$ as a single logarithm to base 10. [3]

(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	*	#	!		

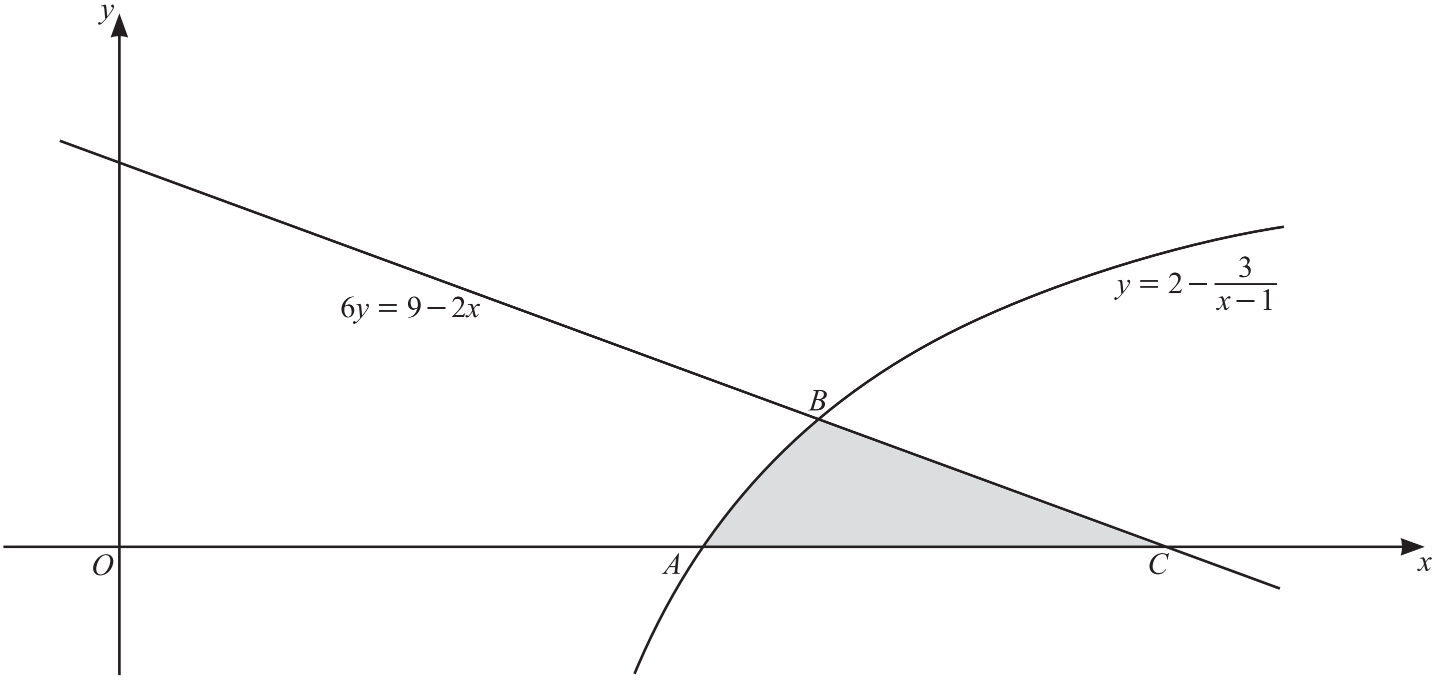
No character may be used more than once in any password.

(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]

8



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.

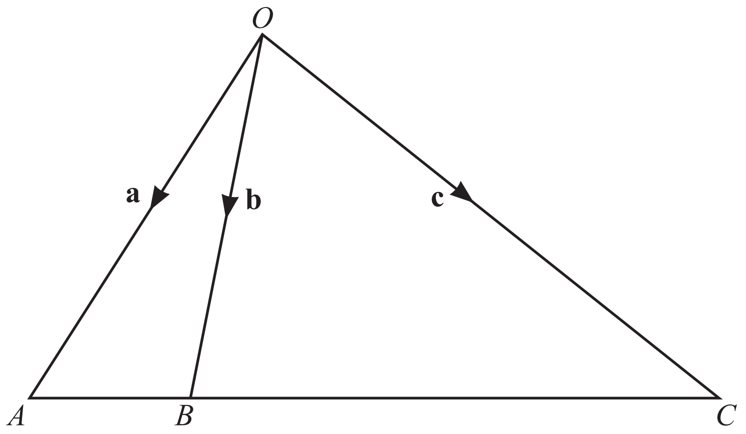
(a) A particle P has position vector $\begin{pmatrix} 2+12t \\ 5-5t \end{pmatrix}$ at a time t seconds, $t \geqslant 0$.

(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 $\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OB} = \mathbf{b}$ and $\overrightarrow{OC} = \mathbf{c}$, 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]