Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

ADDITIONAL MATHEMATICS **0606/11**

Paper 1 **October/November 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.

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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

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

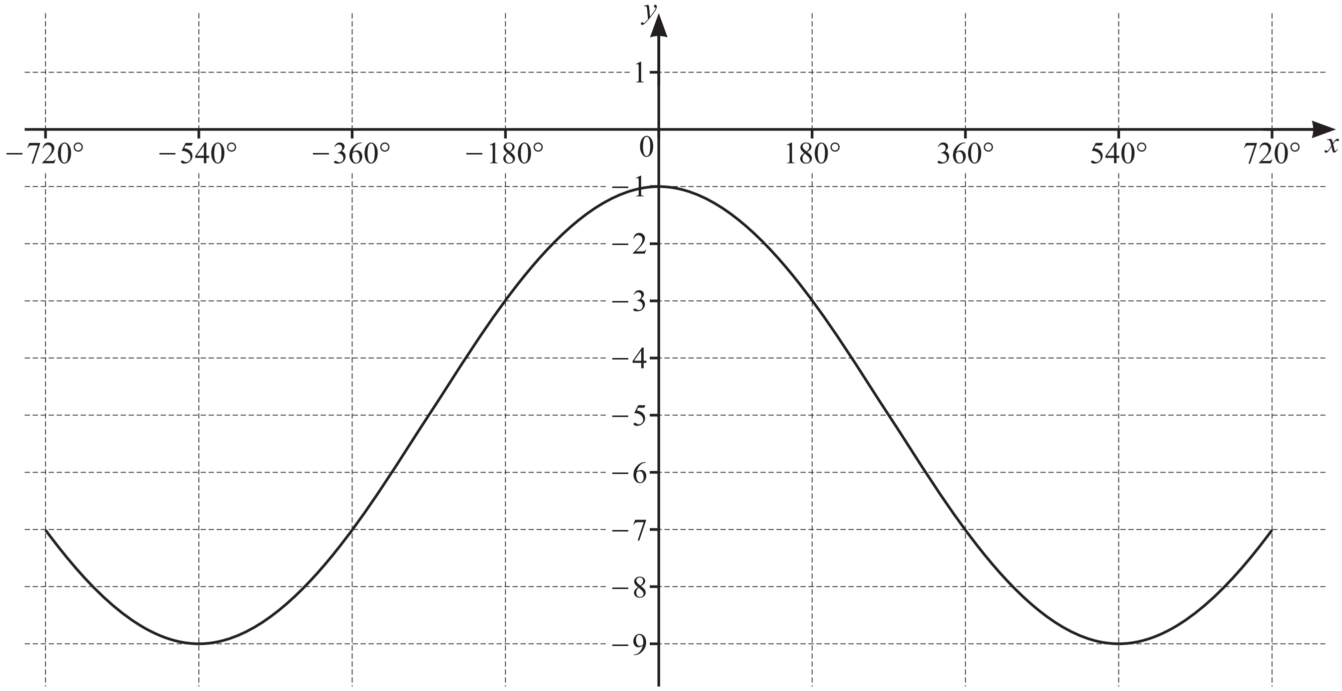
Formulae for ΔABC

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

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

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

1



The diagram shows part of the graph of $y = a\cos\left(\frac{x}{b}\right) + c$, where a, b and c are integers. Find the values of a, b and c. [3]

2 The polynomial $\mathrm{P}(x)$ is such that $\mathrm{P}(x) = ax^3 - 11x^2 + bx + c$, where a, b and c are integers. $\mathrm{P}(x)$ is divisible by x and has a remainder of $\frac{3}{2}$ when divided by $2x + 1$. It is also given that $\mathrm{P}'(2) = 18$.

(a) Find the values of a, b and c. [6]

(b) Hence write $\mathrm{P}(x)$ as a product of three linear factors. [2]

3 The point A has position vector $\begin{pmatrix} 2 \\ -6 \end{pmatrix}$. The point B has position vector $\begin{pmatrix} -3 \\ 6 \end{pmatrix}$.

(a) Find, in vector form, the displacement of B from A. [2]

(b) Find the distance AB. [1]

The point X is such that $3\overrightarrow{AB} = 2\overrightarrow{AX}$.

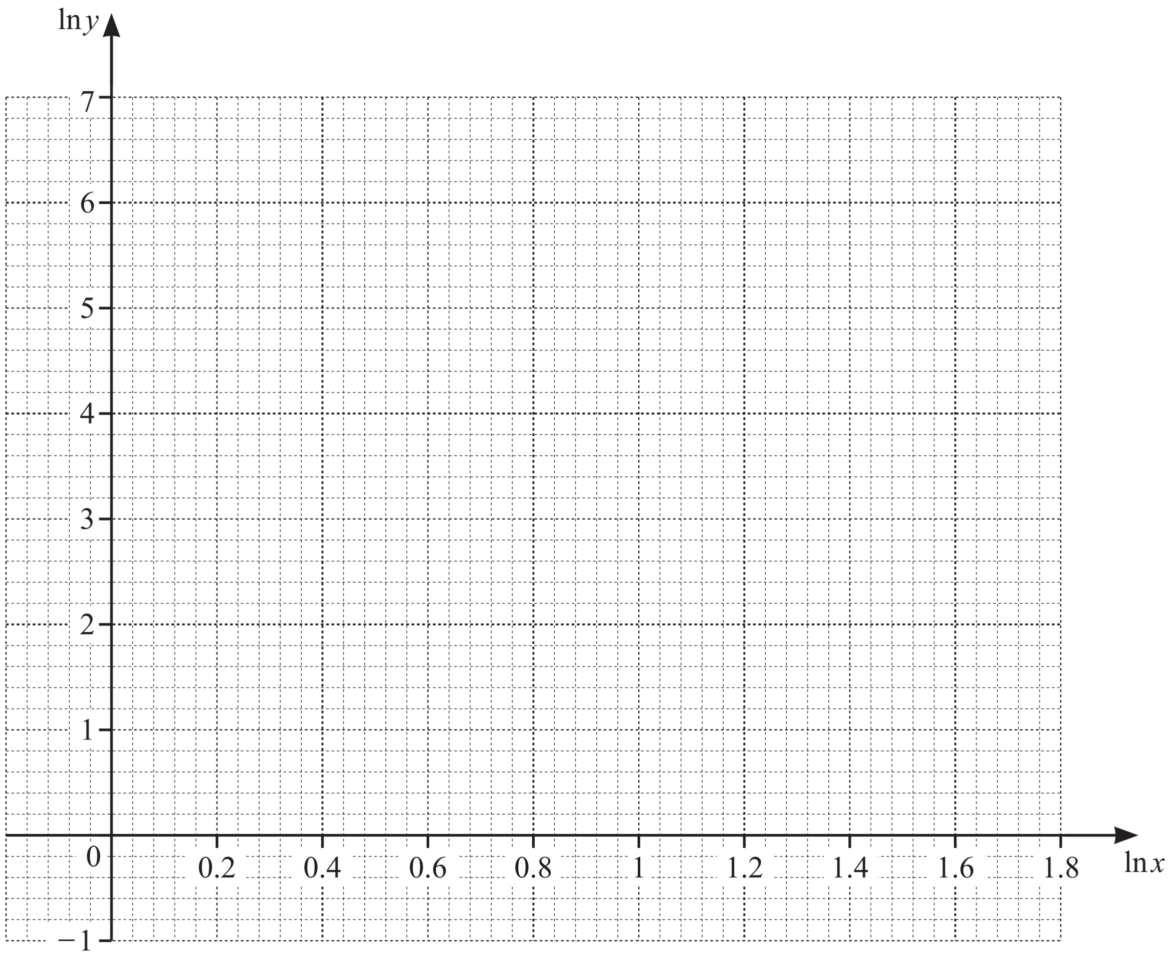
(c) Find the position vector of X. [2]

4

x	1	2	3	4	5
y	20	57	104	160	224

The table shows values of the variables x and y, which are related by the equation $y = Ax^b$, where A and b are constants.

(a) Use the data to draw a straight line graph of $\ln y$ against $\ln x$. [3]



(b) Use your graph to estimate the values of A and b. Give your answers correct to 2 significant figures. [4]

(c) Use your graph to estimate the value of y when $x = 3.5$. [2]

5 **(a)** A 4-digit code is to be formed from the digits 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9. No digit may be used more than once in any code. A code may start with 0.

(i) Find how many codes can be formed. [1]

(ii) Find how many codes form an odd number. [1]

(iii) Find how many codes form a number greater than 1000. [2]

(b) A team of 9 people is to be chosen from a group of 15 people. The group includes a family of 4 people who must not be separated. Find the number of teams that can be chosen. [3]

6 **(a)** Write $3\lg x - \frac{1}{2}\lg 4 + 2$ as a single logarithm to base 10. [3]

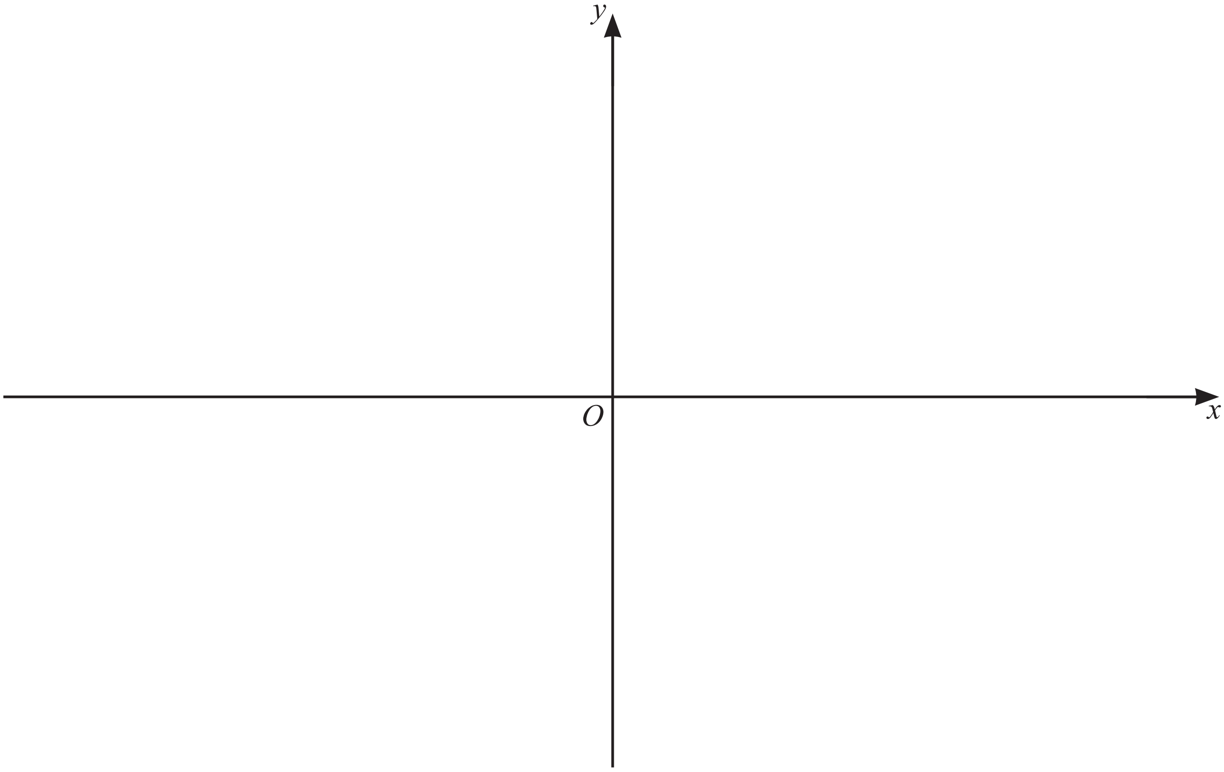
(b) Solve the equation $2\log_a 4 - 3\log_4 a - 5 = 0$, giving your answers in exact form. [5]

7 A curve has equation $y = \mathrm{f}(x)$, where $\mathrm{f}(x) = (2x+1)(3x-2)^2$.

(a) Show that $\mathrm{f}'(x)$ can be written in the form $2(3x-2)(px+q)$, where p and q are integers. [3]

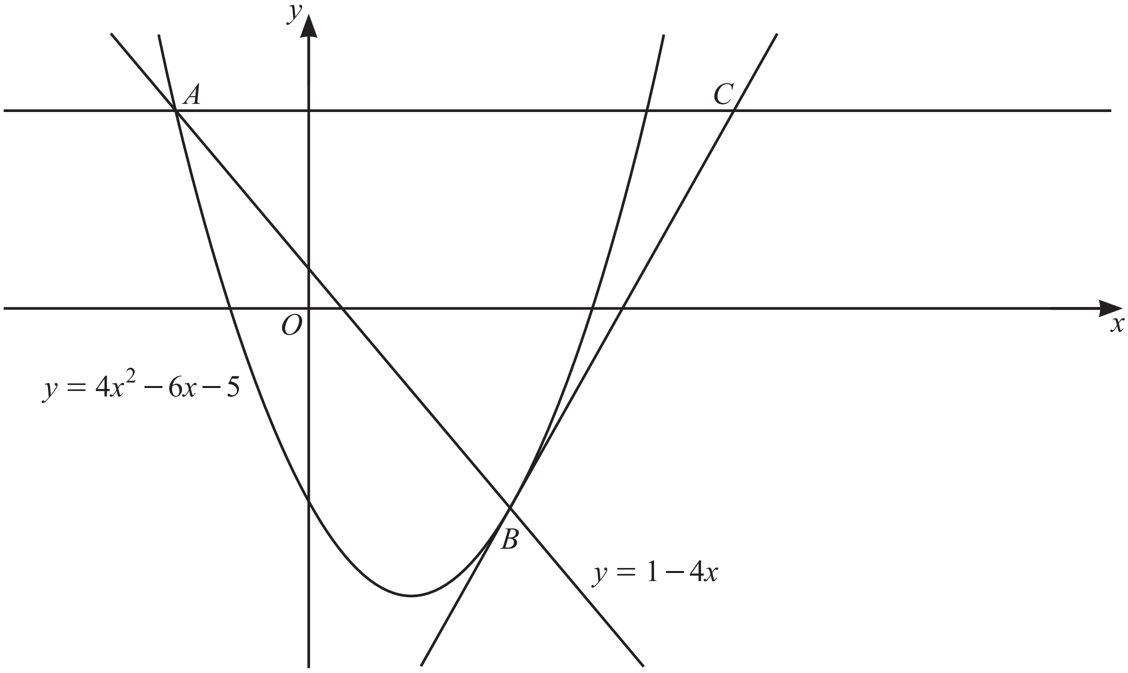
(b) Hence find the coordinates of the stationary points on the curve. [2]

(c) On the axes below, sketch the graph of $y = \mathrm{f}(x)$, stating the intercepts with the coordinate axes. [3]



(d) Find the values of k such that the equation $\mathrm{f}(x) = k$ has 3 distinct solutions. [2]

8



The diagram shows the line $y = 1 - 4x$ meeting the curve $y = 4x^2 - 6x - 5$ at the points A and B. The tangent to the curve at B meets the horizontal line through A at the point C. Find the x-coordinate of C, giving your answer correct to 2 decimal places. [10]

Additional working space for Question 8.

9 **(a)** The first three terms of an arithmetic progression are $-3\tan\frac{\theta}{2},\ -\tan\frac{\theta}{2},\ \tan\frac{\theta}{2}$, where $0 < \theta < \frac{\pi}{2}$.

(i) Given that the 12th term of this progression is equal to $\frac{19\sqrt{3}}{3}$, find the exact value of θ. [4]

(ii) Hence find the exact value of the sum to ten terms of this progression. [2]

(b) The first three terms of a geometric progression are $\frac{1}{16}\operatorname{cosec}^4\phi$, $\frac{1}{4}\operatorname{cosec}^2\phi$, 1, where $-\frac{\pi}{2} < \phi < \frac{\pi}{2}$.

(i) Given that the sum of the 3rd and 4th terms of this progression is equal to 4, find the possible values of ϕ. [4]

(ii) Determine whether or not this progression has a sum to infinity. [2]

Question 10 is printed on the next page.

10 **(a)** Given that $y = \dfrac{\sqrt{3x^2 - 2}}{x - 4}$, show that $\dfrac{dy}{dx}$ can be written in the form $\dfrac{Ax + B}{(x-4)^2\sqrt{3x^2 - 2}}$, where A and B are integers to be found. [5]

(b) Hence find, in terms of h, the approximate change in y when x increases from 3 to $3 + h$, where h is small. [3]