Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

ADDITIONAL MATHEMATICS **0606/12**

Paper 1 **May/June 2022**

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. Any blank pages are indicated.

DC (CJ/FC) 303920/4

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

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

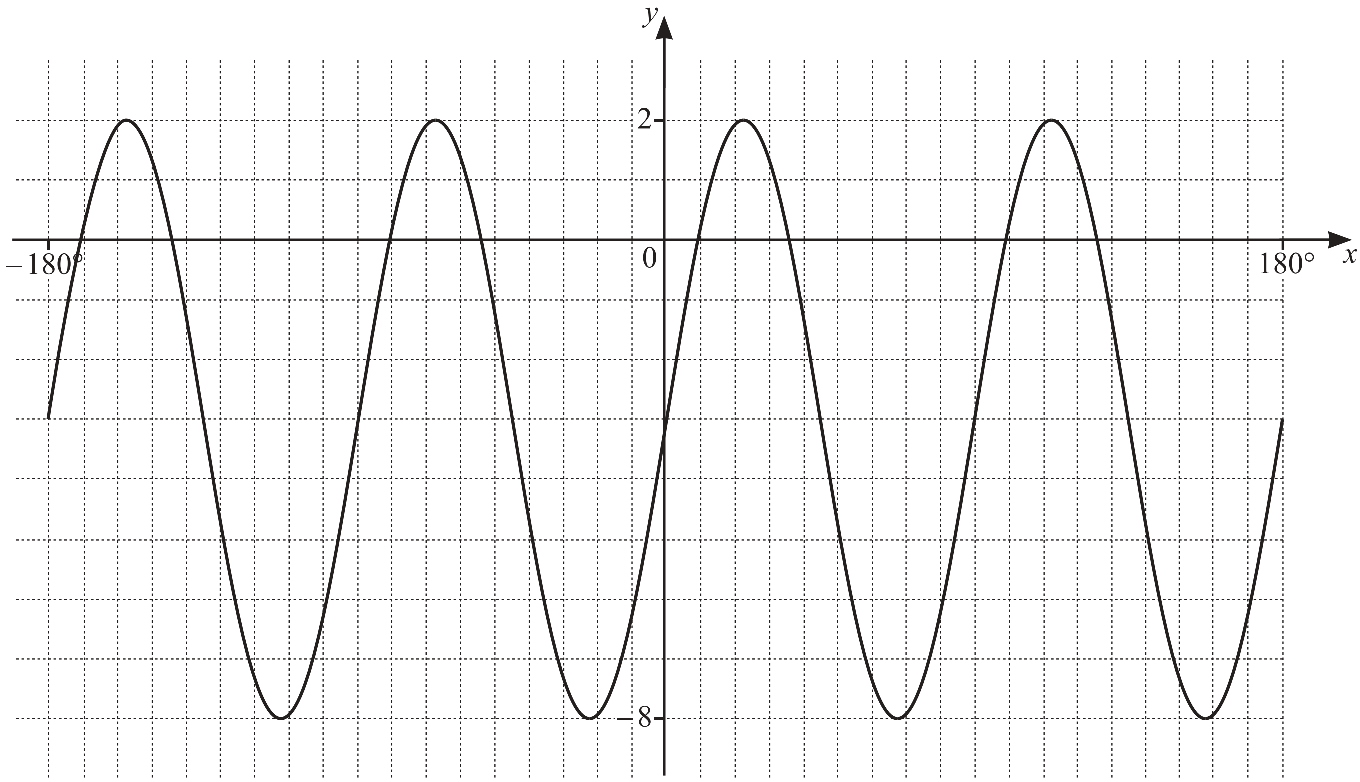
Formulae for ΔABC

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

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

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

1



The diagram shows the graph of $y = a\sin bx + c$, where a, b and c are integers, for $-180° \leqslant x \leqslant 180°$. Find the values of a, b and c. [3]

2 Given that $x = \sec^2\theta$ and $y + 2 = \cot^2\theta$, find y in terms of x. [4]

3 Variables x and y are such that, when $\lg(2y+1)$ is plotted against x^2, a straight line graph passing through the points (1, 1) and (2, 5) is obtained.

(a) Find y in terms of x. [4]

(b) Find the value of y when $x = \frac{\sqrt{3}}{2}$. [1]

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

4 **(a)** Find the unit vector in the same direction as $\begin{pmatrix} -15 \\ 8 \end{pmatrix}$. [2]

(b) Given that $\begin{pmatrix} 2a \\ -5 \end{pmatrix} + \begin{pmatrix} 4b-12 \\ 3 \end{pmatrix} = 4\begin{pmatrix} b-a \\ a+2b \end{pmatrix}$, find the values of a and b. [3]

5 The first three terms, in ascending powers of x, in the expansion of $\left(1+\frac{x}{6}\right)^{12}(2-3x)^3$ can be written in the form $8+px+qx^2$, where p and q are constants. Find the values of p and q. [8]

6 The polynomial $\mathrm{p}(x) = 6x^3 + ax^2 + 6x + b$, where a and b are integers, is divisible by $2x - 1$. When $\mathrm{p}(x)$ is divided by $x - 2$, the remainder is 120.

(a) Find the values of a and b. [4]

(b) Hence write down the remainder when $\mathrm{p}(x)$ is divided by x. [1]

(c) Find the value of $\mathrm{p}''(0)$. [2]

7 **(a)** Show that $\dfrac{2}{2x+3}-\dfrac{1}{x-1}+\dfrac{1}{(x-1)^2}$ can be written as $\dfrac{8-3x}{(x-1)^2(2x+3)}$. [2]

(b) Find $\displaystyle\int_2^a \frac{8-3x}{(x-1)^2(2x+3)}\,\mathrm{d}x$ where $a > 2$. Give your answers in the form $c+\ln d$, where c and d are functions of a. [6]

8 **(a)** A team of 6 people is to be chosen from 10 people. Two of the people are sisters who must not be separated. Find the number of different teams that can be formed. [3]

(b) A 6-character password is to be chosen from the following characters.

Digits	2	4	8
Letters	x	y	z
Symbols	*	#	!

No character may be used more than once in any password. Find the number of different passwords that may be chosen if

(i) there are no other restrictions, [1]

(ii) the password starts with two letters and ends with two digits. [3]

9 The normal to the curve $y = \dfrac{\ln(3x^2 + 2)}{x+1}$, at the point A on the curve where $x = 0$, meets the x-axis at point B. Point C has coordinates $(0, 3\ln 2)$. Find the gradient of the line BC in terms of $\ln 2$. [9]

10 **(a)** Given the simultaneous equations

$$\lg x + 2\lg y = 1,$$

$$x - 3y^2 = 13,$$

(i) show that $x^2 - 13x - 30 = 0$. [4]

(ii) Solve these simultaneous equations, giving your answers in exact form. [2]

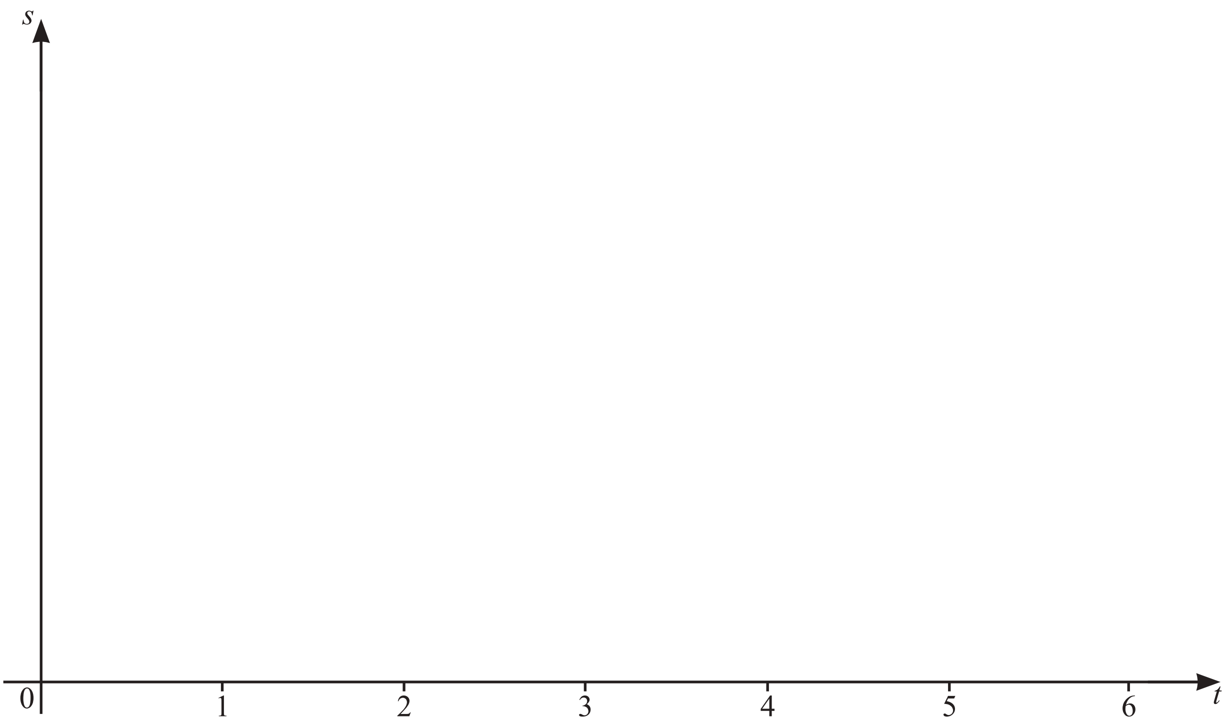
(b) Solve the equation $\log_a x + 3\log_x a = 4$, where a is a positive constant, giving x in terms of a. [5]

11 In this question all lengths are in kilometres and time is in hours.

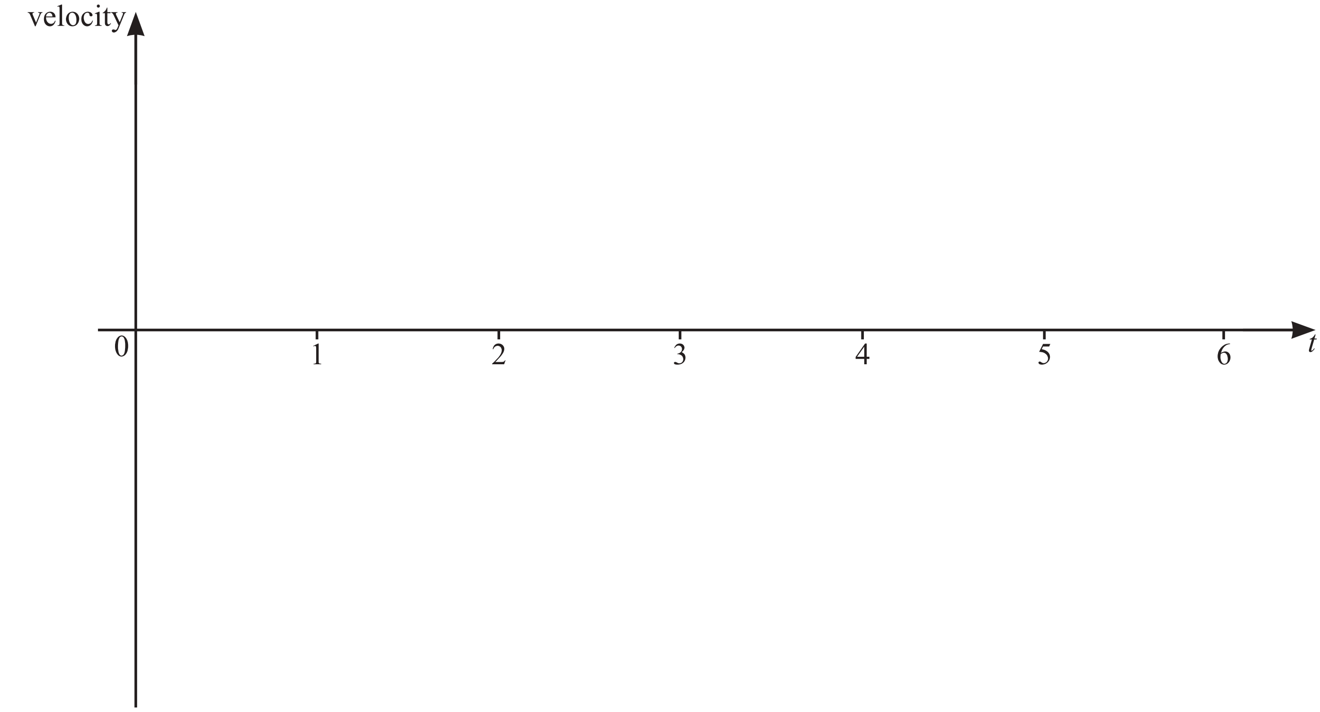
A particle P moves in a straight line such that its displacement, s, from a fixed point at time t is given by $s = (t+2)(t-5)^2$, for $t \geqslant 0$.

(a) Find the values of t for which the velocity of P is zero. [4]

(b) On the axes, draw the displacement–time graph for P for $0 \leqslant t \leqslant 6$, stating the coordinates of the points where the graph meets the coordinate axes. [2]



(c) On the axes below, draw the velocity–time graph for P for $0 \leqslant t \leqslant 6$, stating the coordinates of the points where the graph meets the coordinate axes. [2]



(d) **(i)** Write down an expression for the acceleration of P at time t. [1]

(ii) Hence, on the axes below, draw the acceleration–time graph for P for $0 \leqslant t \leqslant 6$, stating the coordinates of the points where the graph meets the coordinate axes. [2]