



Cambridge O Level

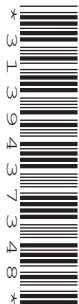
CANDIDATE
NAME

CENTRE
NUMBER

--	--	--	--	--

CANDIDATE
NUMBER

--	--	--	--



ADDITIONAL MATHEMATICS

4037/12

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.

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 $u_n = ar^{n-1}$

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

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

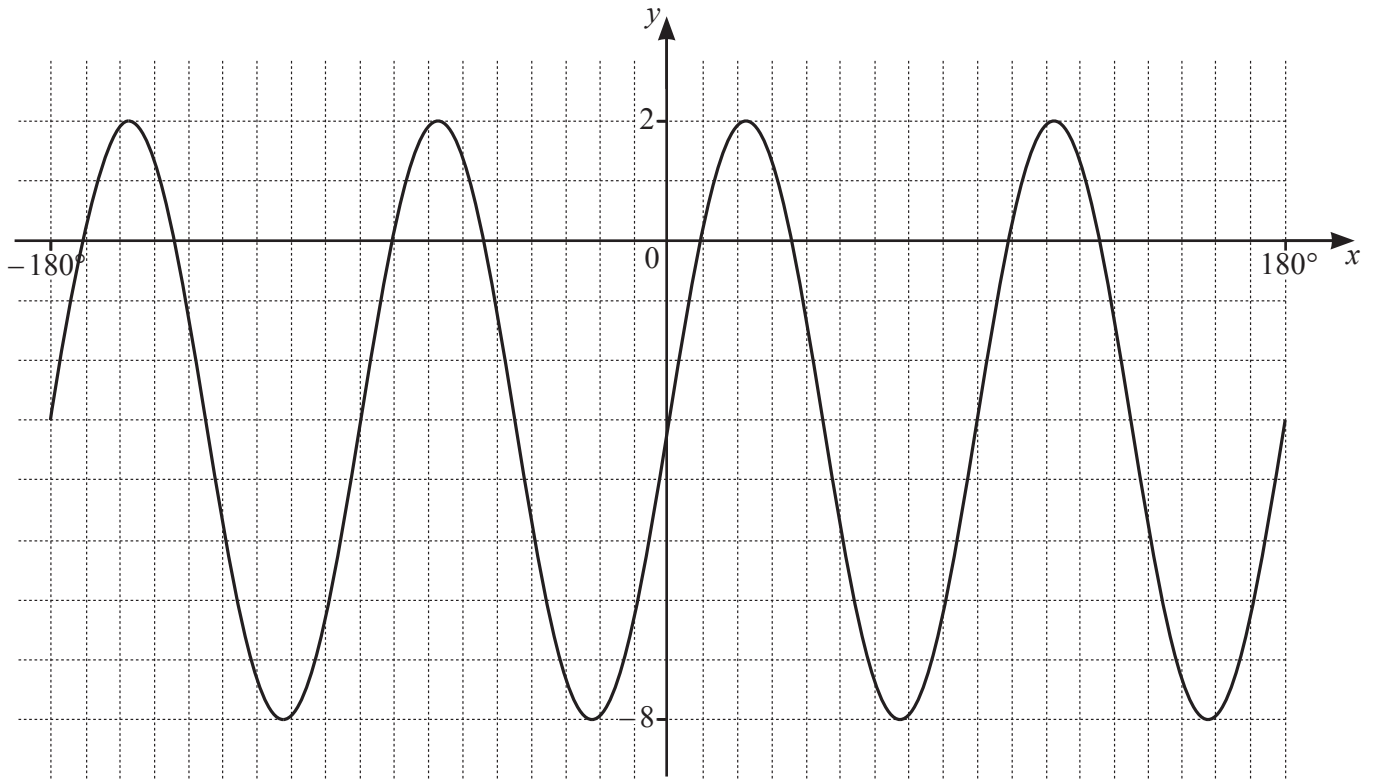
2. TRIGONOMETRY*Identities*

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

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



The diagram shows the graph of $y = a \sin bx + c$, where a , b and c are integers, for $-180^\circ \leq x \leq 180^\circ$. 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 $p(x) = 6x^3 + ax^2 + 6x + b$, where a and b are integers, is divisible by $2x - 1$. When $p(x)$ 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 $p(x)$ is divided by x . [1]

(c) Find the value of $p''(0)$. [2]

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

(b) Find $\int_2^a \frac{8-3x}{(x-1)^2(2x+3)} dx$ 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 $y = \frac{\ln(3x^2 + 2)}{x + 1}$, 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]

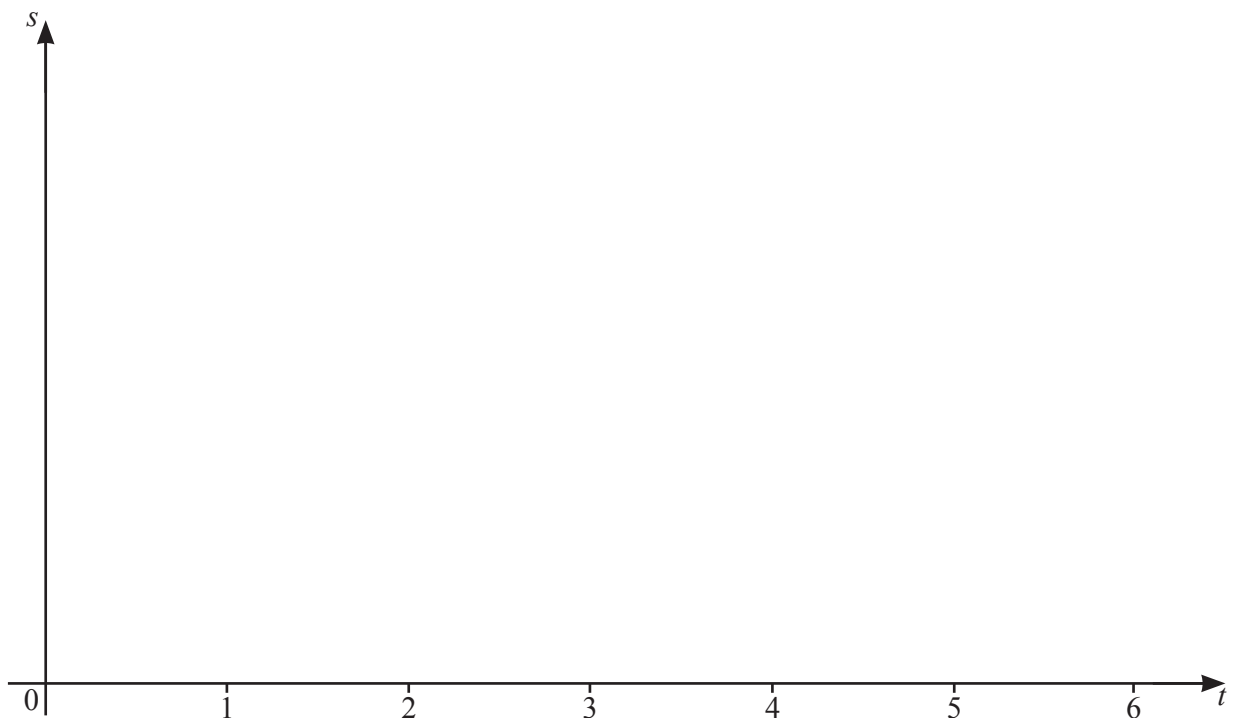
(b) Solve the equation $\log_a x + 3 \log_x a = 4$, where a is a positive constant, giving x in terms of a . [5]

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

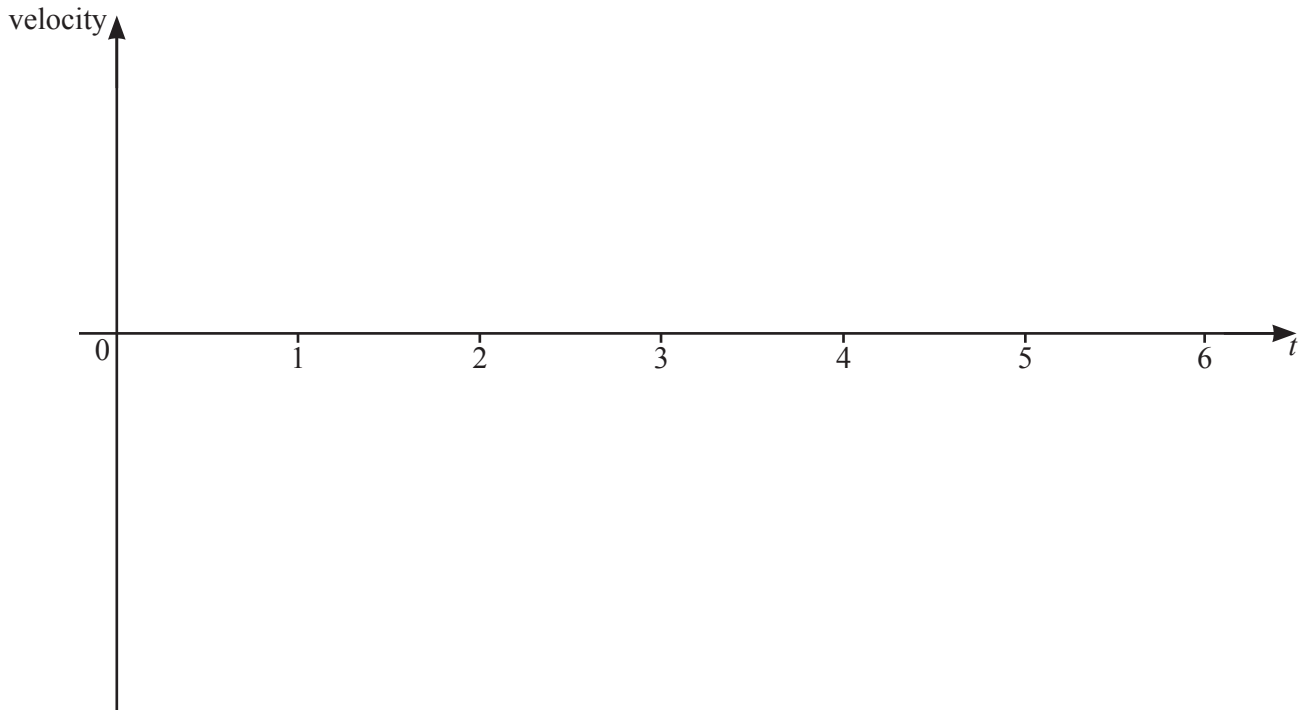
A particle P moves in a straight line such that its displacement, s , from a fixed point at time t is given by $s = (t+2)(t-5)^2$, for $t \geq 0$.

(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 $0 \leq t \leq 6$, stating the coordinates of the points where the graph meets the coordinate axes. [2]

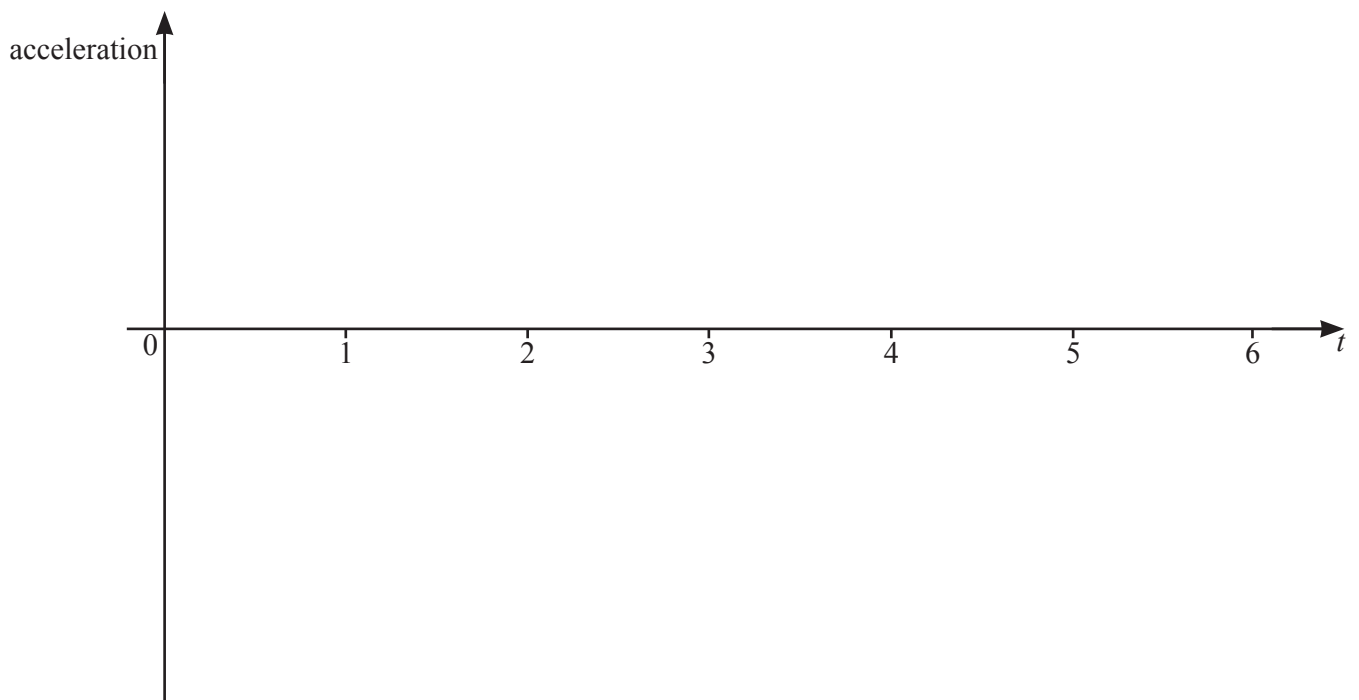


- (c) On the axes below, draw the velocity–time graph for P for $0 \leq t \leq 6$, stating the coordinates of the points where the graph meets the coordinate axes. [2]



- (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 $0 \leq t \leq 6$, stating the coordinates of the points where the graph meets the coordinate axes. [2]



BLANK PAGE

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.