



# Cambridge IGCSE™

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**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.

**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*

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

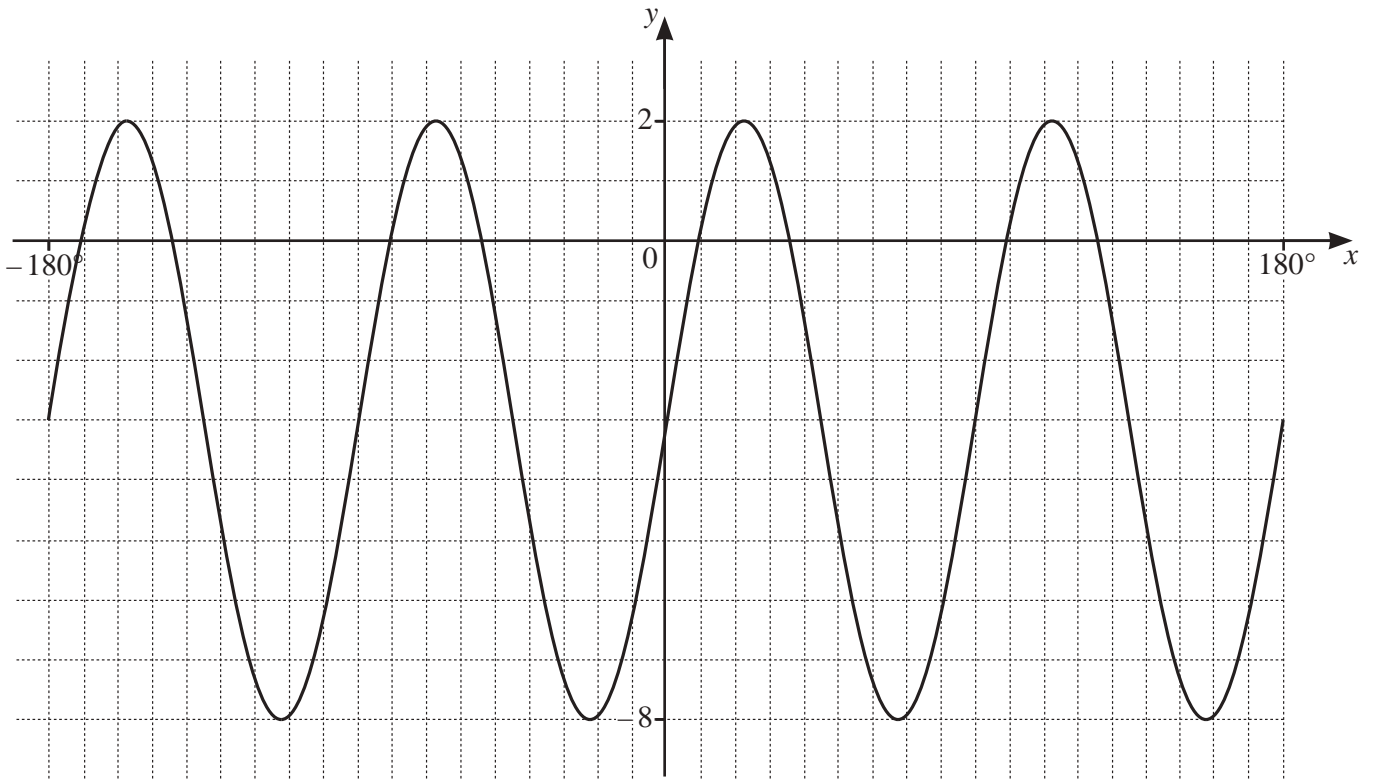
*Formulae for  $\triangle ABC$* 

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

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

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

1



The diagram shows the graph of  $y = a \sin bx + c$ , where  $a$ ,  $b$  and  $c$  are integers, for  $-180^\circ \leq x \leq 180^\circ$ . 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]

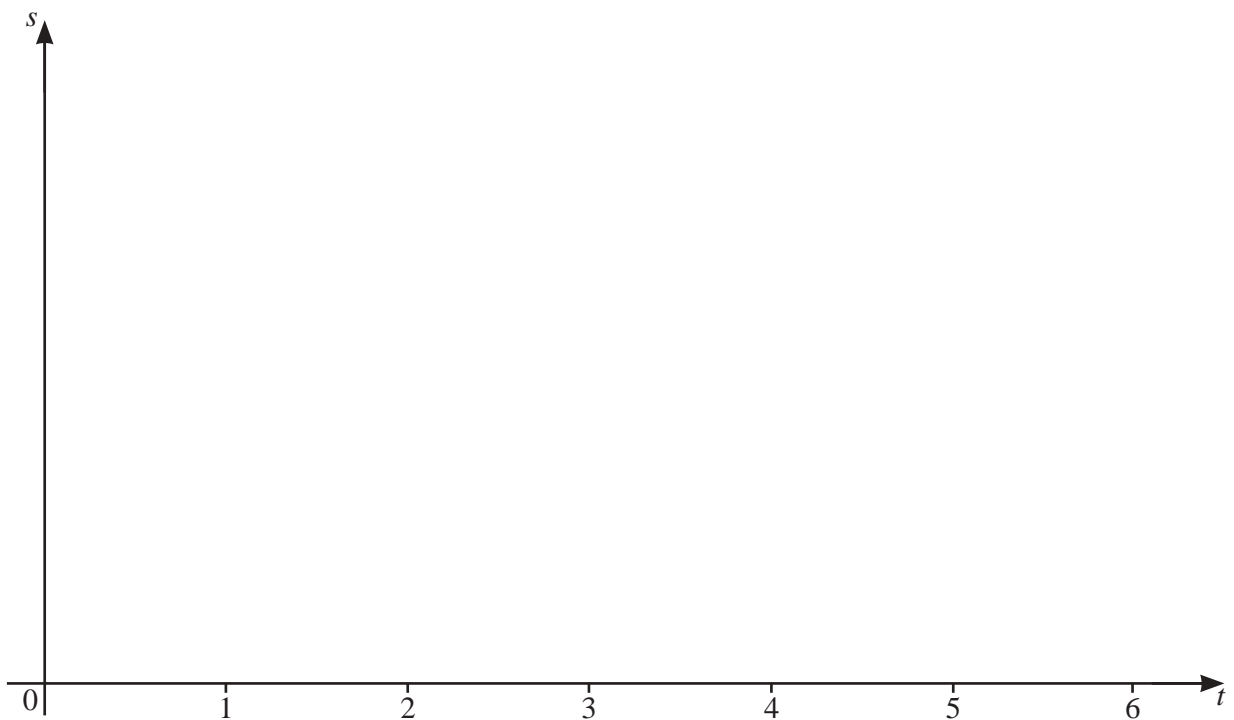
(b) Solve the equation  $\log_a x + 3 \log_x a = 4$ , where  $a$  is a positive constant, giving  $x$  in terms of  $a$ . [5]

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

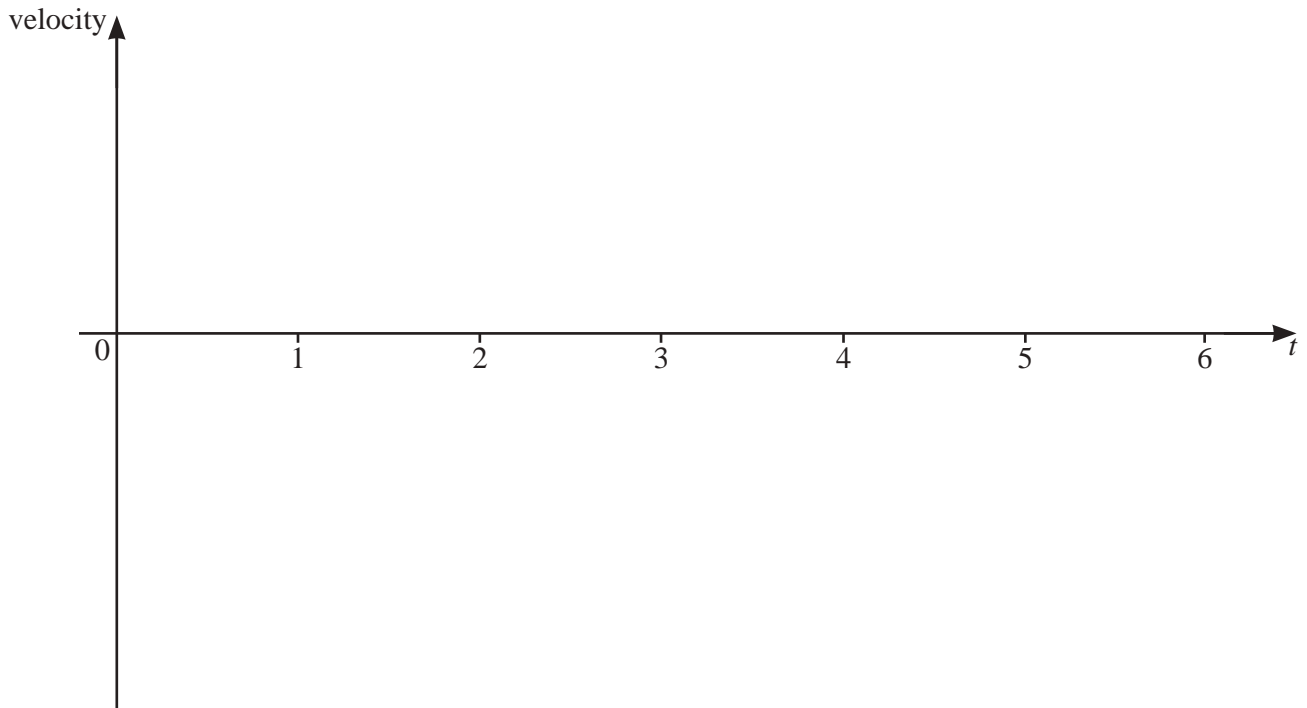
A particle  $P$  moves in a straight line such that its displacement,  $s$ , from a fixed point at time  $t$  is given by  $s = (t+2)(t-5)^2$ , for  $t \geq 0$ .

(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]

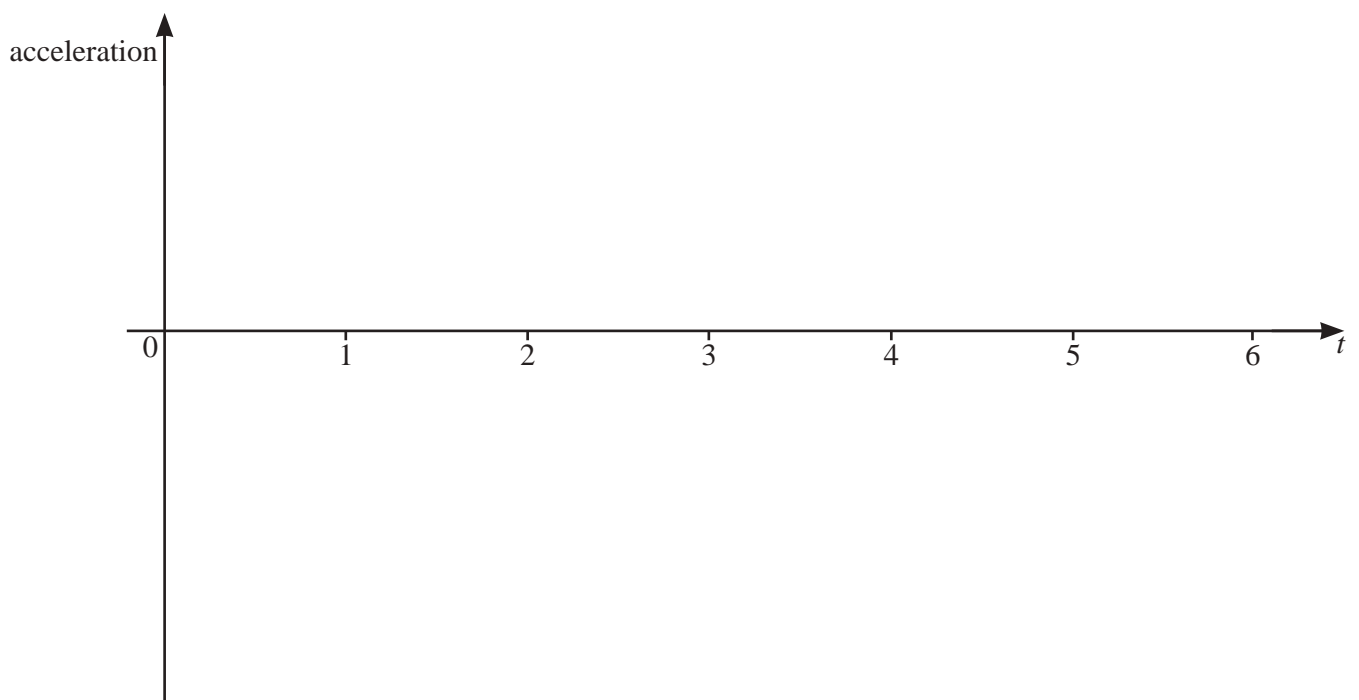


- (c) On the axes below, draw the velocity–time graph for  $P$  for  $0 \leq t \leq 6$ , stating the coordinates of the points where the graph meets the coordinate axes. [2]



- (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]



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