



# Cambridge IGCSE™

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**ADDITIONAL MATHEMATICS**

**0606/12**

Paper 1

**October/November 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*      $u_n = ar^{n-1}$

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

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

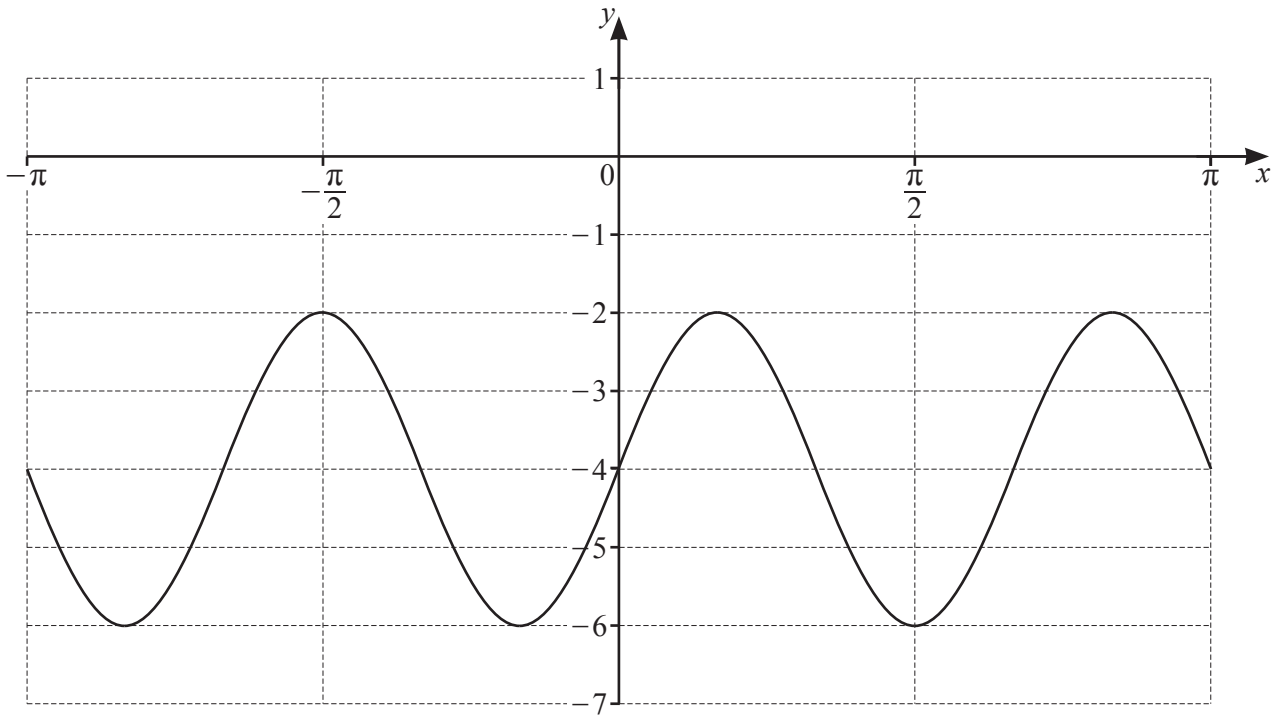
**2. TRIGONOMETRY***Identities*

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

*Formulae for  $\triangle ABC$* 

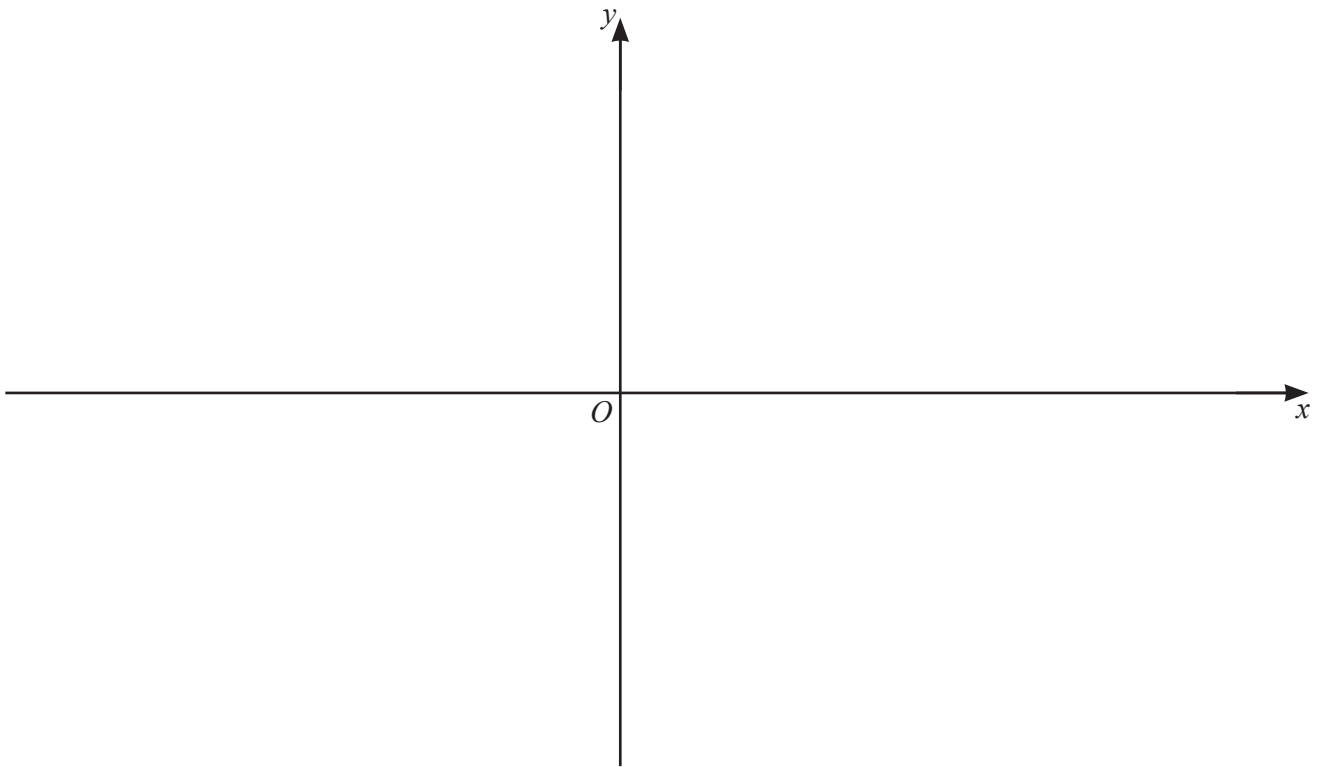
$$\begin{aligned} \frac{a}{\sin A} &= \frac{b}{\sin B} = \frac{c}{\sin C} \\ a^2 &= b^2 + c^2 - 2bc \cos A \\ \Delta &= \frac{1}{2}bc \sin A \end{aligned}$$

1



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

- 2 (a) On the axes, draw the graph of  $y = |3x^2 + 13x - 10|$ , stating the coordinates of the points where the graph meets the axes. [4]



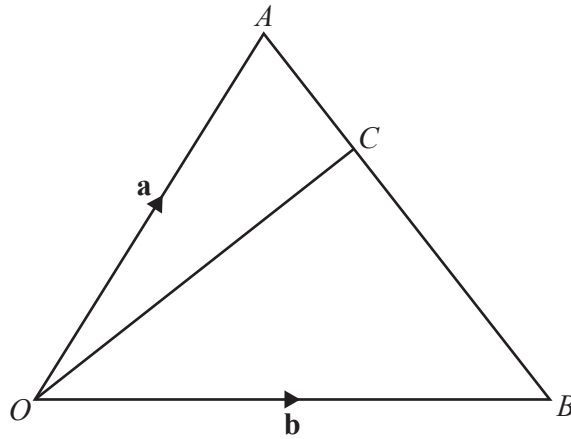
- (b) Find the set of values of the constant  $k$  such that the equation  $k = |3x^2 + 13x - 10|$  has exactly 2 distinct roots. [4]

3 Write  $\frac{\sqrt{(9p^2q)} \times r^{-3}}{(2p)^3 q^{-1} \sqrt[5]{r}}$  in the form  $kp^a q^b r^c$ , where  $k$ ,  $a$ ,  $b$  and  $c$  are constants. [4]

4 Solve the equation  $3 \sin\left(2x + \frac{\pi}{4}\right) = \sqrt{3} \cos\left(2x + \frac{\pi}{4}\right)$ , for  $0 \leq x \leq \pi$ . [5]

- 5 (a) Find the vector with magnitude 200 in the direction of  $\begin{pmatrix} 7 \\ -24 \end{pmatrix}$ . [2]

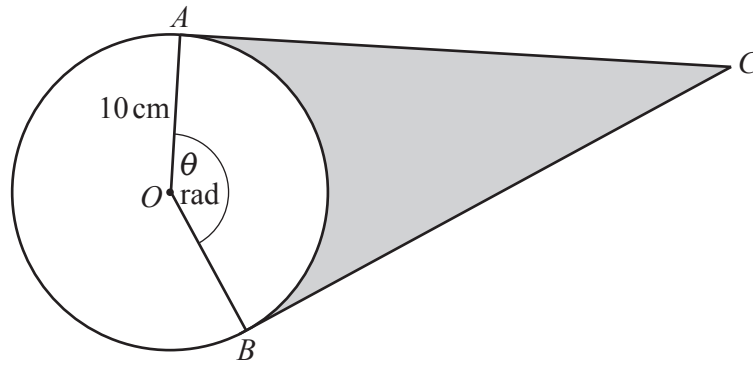
(b)



The diagram shows triangle  $AOB$  such that  $\vec{OA} = \mathbf{a}$ , and  $\vec{OB} = \mathbf{b}$ . The point  $C$  lies on the line  $AB$  such that  $AC : CB = 1 : 3$ . Find the vector  $\vec{OC}$  in terms of  $\mathbf{a}$  and  $\mathbf{b}$ , giving your answer in its simplest form. [3]

- (c) Given the vector equation  $p\begin{pmatrix} 2 \\ 1 \end{pmatrix} + q\begin{pmatrix} 2 \\ 4 \end{pmatrix} = 5\begin{pmatrix} -p+1 \\ p+q \end{pmatrix}$ , find the values of  $p$  and  $q$ . [3]

- 6 A group of 15 people includes 3 brothers. A team of 6 people is to be chosen from this group. The three brothers must not be separated. Find the number of possible teams that can be chosen. [3]



The diagram shows a circle, centre  $O$ , radius  $10\text{ cm}$ . The points  $A$  and  $B$  lie on the circumference of the circle. The tangent at  $A$  and the tangent at  $B$  meet at the point  $C$ . The angle  $AOB$  is  $\theta$  radians. The length of the minor arc  $AB$  is  $28\text{ cm}$ .

(a) Find the value of  $\theta$ . [1]

(b) Find the perimeter of the shaded region. [3]



(c) Find the area of the shaded region.

[3]

10

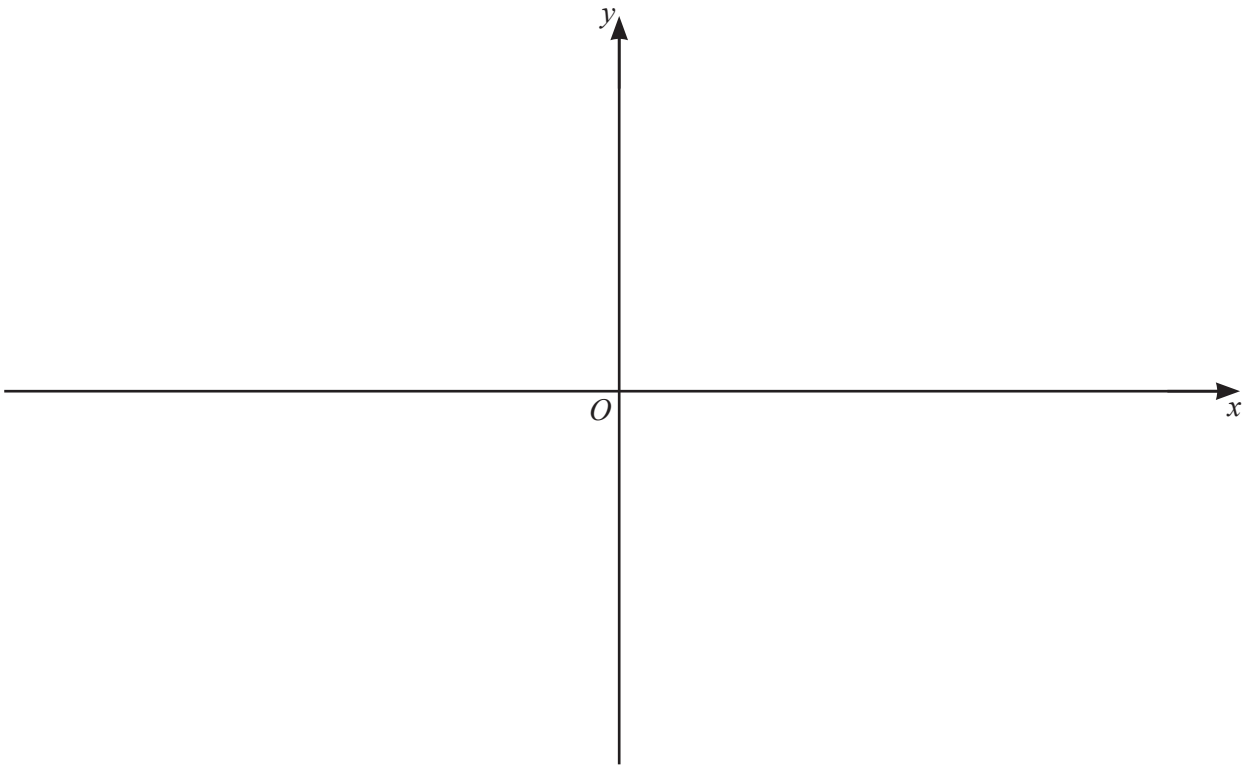
8 A function  $f(x)$  is such that  $f(x) = \ln(2x+3) + \ln 4$ , for  $x > a$ , where  $a$  is a constant.

(a) Write down the least possible value of  $a$ . [1]

(b) Using your value of  $a$ , write down the range of  $f$ . [1]

(c) Using your value of  $a$ , find  $f^{-1}(x)$ , stating its range. [4]

- (d) On the axes below, sketch the graphs of  $y = f(x)$  and  $y = f^{-1}(x)$ , stating the exact intercepts of each graph with the coordinate axes. Label each of your graphs. [4]



9 (a) Show that  $\frac{1}{2x+1} - \frac{1}{(2x+1)^2} + \frac{4}{4x-1} = \frac{24x^2 + 14x + 4}{(2x+1)^2(4x-1)}$ . [2]

(b) Hence find  $\int_{\frac{1}{2}}^1 \frac{24x^2 + 14x + 4}{(2x+1)^2(4x-1)} dx$ , giving your answer in the form  $\frac{1}{2} \ln p + q$ , where  $p$  and  $q$  are rational numbers. [7]

10 The first three terms of an arithmetic progression are  $\lg x$ ,  $\lg x^5$ ,  $\lg x^9$ , where  $x > 0$ .

(a) Show that the sum to  $n$  terms of this arithmetic progression can be written as  $n(pn - 1)\lg x$ ,  
where  $p$  is an integer. [4]

(b) Hence find the value of  $n$  for which the sum to  $n$  terms is equal to  $4950 \lg x$ . [2]

(c) Given that this sum to  $n$  terms is also equal to  $-14850$ , find the exact value of  $x$ . [2]

11 A particle  $P$  moves in a straight line such that,  $t$  seconds after passing through a fixed point  $O$ , its displacement,  $s$  metres, is given by  $s = \frac{(2t+1)^{\frac{3}{2}}}{t+1} - 1$ .

(a) Show that the velocity of  $P$  at time  $t$  can be written in the form  $\frac{(2t+1)^{\frac{1}{2}}}{(t+1)^2}(a+bt)$ , where  $a$  and  $b$  are integers to be found. [5]

(b) Show that  $P$  is never at instantaneous rest after passing through  $O$ . [1]

- 12 The first three terms, in descending powers of  $x$ , of the expansion of  $\left(ax + \frac{2}{5}\right)^5 \left(1 - \frac{b}{x}\right)^2$ , can be written as  $32x^5 - 160x^4 + cx^3$ , where  $a$ ,  $b$  and  $c$  are constants. Find the exact values of  $a$ ,  $b$  and  $c$ . [9]

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