



# Cambridge IGCSE™

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**ADDITIONAL MATHEMATICS**

**0606/11**

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*

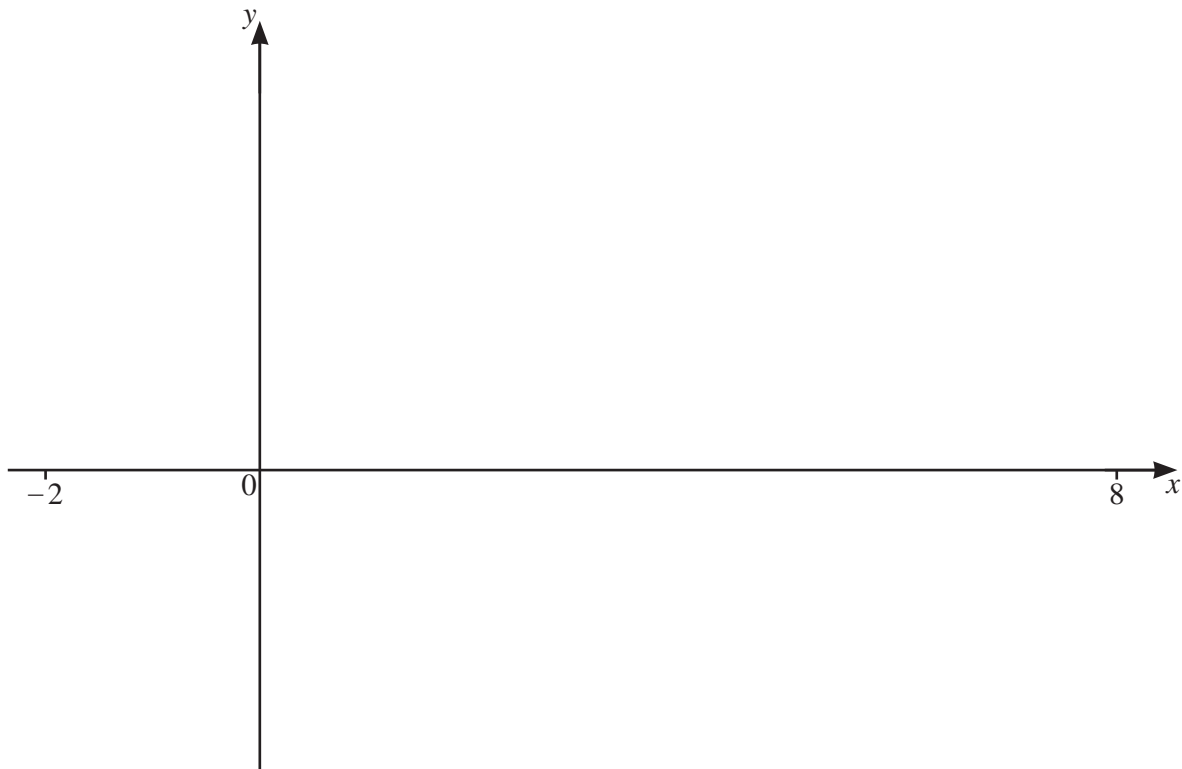
$$\begin{aligned} \sin^2 A + \cos^2 A &= 1 \\ \sec^2 A &= 1 + \tan^2 A \\ \operatorname{cosec}^2 A &= 1 + \cot^2 A \end{aligned}$$

*Formulae for  $\triangle ABC$* 

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

3

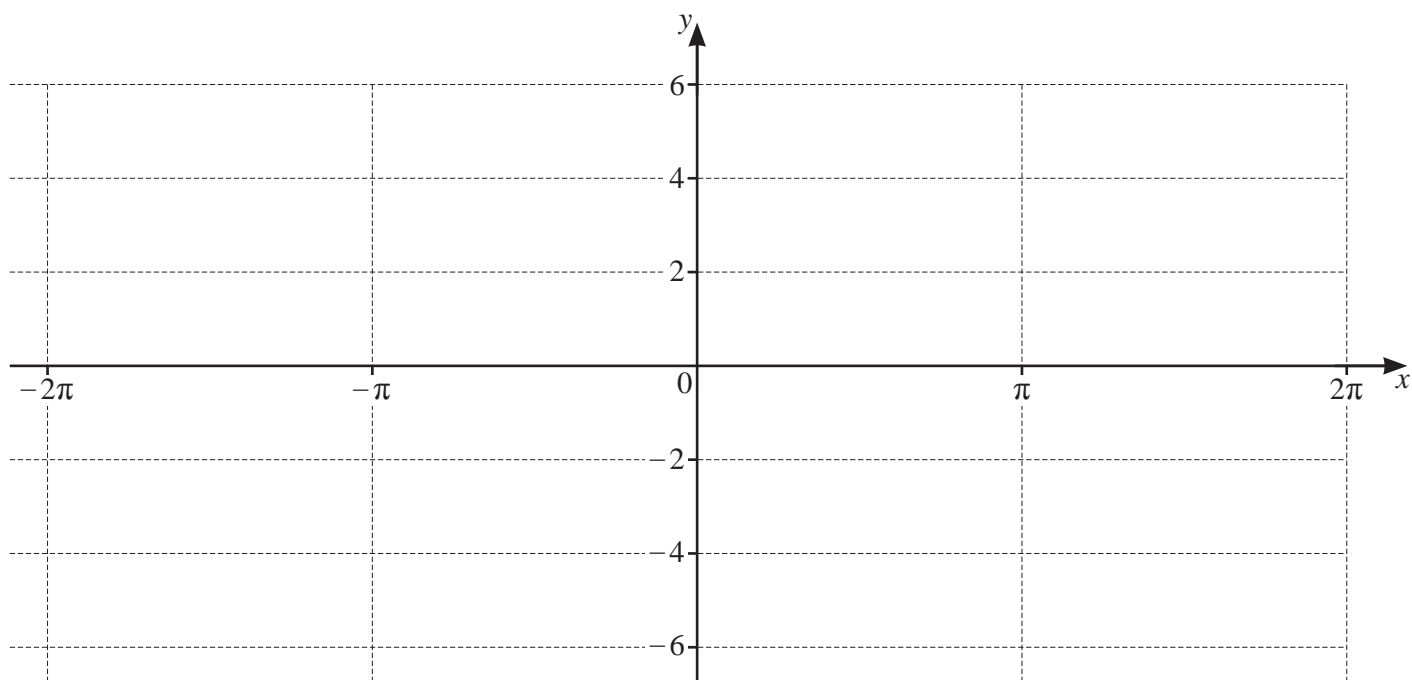
- 1 (a) On the axes, sketch the graphs of  $y = |2x + 1|$  and  $y = |5 - 3x|$  for  $-2 \leq x \leq 8$ . State the coordinates of the points where these graphs meet the coordinate axes. [3]



- (b) Solve the equation  $|2x + 1| = |5 - 3x|$ . [3]

4

- 2 (a) On the axes, sketch the graph of  $y = 5 \sin \frac{x}{2} + 1$  for  $-2\pi \leq x \leq 2\pi$ . [3]



- (b) Write down the amplitude of  $5 \sin \frac{x}{2} + 1$ . [1]

- (c) Write down the period of  $5 \sin \frac{x}{2} + 1$ . [1]

- 3 When  $y^3$  is plotted against  $\ln x$ , a straight line graph is obtained, passing through the points (1, 5) and (6, 15). Find  $y$  in terms of  $x$ . [4]

6

**4 DO NOT USE A CALCULATOR IN THIS QUESTION.**

Solve the equation  $(\sqrt{5} - 1)x^2 - 2x - (\sqrt{5} + 1) = 0$ , giving your answers in the form  $a + b\sqrt{5}$ , where  $a$  and  $b$  are constants. [6]

5 An arithmetic progression is such that the fourth term is 25 and the ninth term is 50.

(a) Find the first term and the common difference.

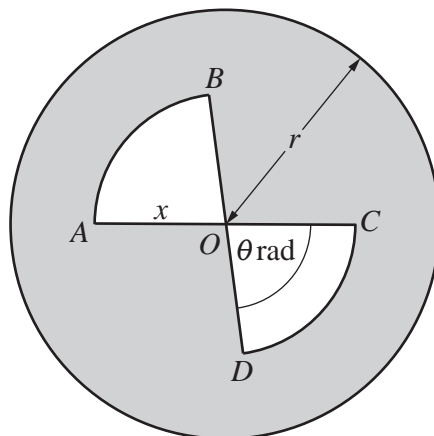
[3]

(b) Find the least number of terms for which the sum of the progression is greater than 25 000.

[3]

- 6 The first three terms, in ascending powers of  $x$ , in the expansion of  $\left(1 - \frac{2x}{9}\right)^{18} (1 + 3x)^3$  are written in the form  $1 + ax + bx^2$ , where  $a$  and  $b$  are constants. Find the exact values of  $a$  and  $b$ . [7]





The diagram shows a circle with centre  $O$  and radius  $r$ .  $OAB$  and  $OCD$  are sectors of a circle with centre  $O$  and radius  $x$ , where  $0 < x \leq r$ . Angle  $AOB = \text{angle } COD = \theta$  radians, where  $0 < \theta < \pi$ .

(a) Find, in terms of  $r$ ,  $x$  and  $\theta$ , the perimeter of the shaded region. [3]

(b) Find, in terms of  $r$ ,  $x$  and  $\theta$ , the area of the shaded region. [1]

It is given that  $x$  can vary and that  $r$  and  $\theta$  are constant.

(c) Write down the least possible area of the shaded region in terms of  $r$  and  $\theta$ . [2]

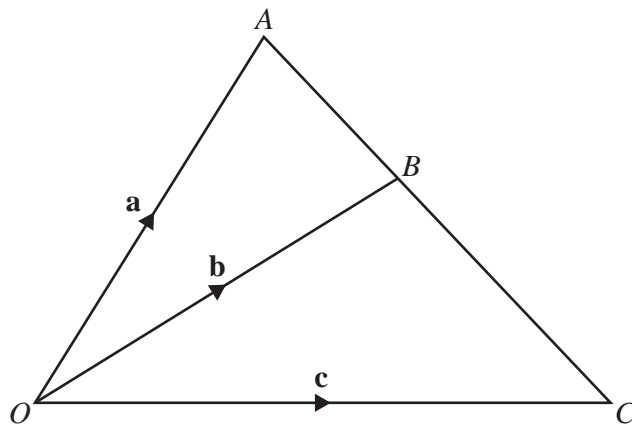
- 8 Find  $\int_0^a \left( \frac{2}{x+1} - \frac{1}{x+2} \right) dx$ , where  $a$  is a positive constant. Give your answer, as a single logarithm, in terms of  $a$ . [5]

## 11

- 9 Solve the equation  $2 \log_p y + 10 \log_y p - 9 = 0$ , where  $p$  is a positive constant, giving  $y$  in terms of  $p$ .  
[5]

- 10 Given that  $65 \times {}^n C_5 = 2(n-1) \times {}^{n+1} C_6$ , find the value of  $n$ . [3]

11

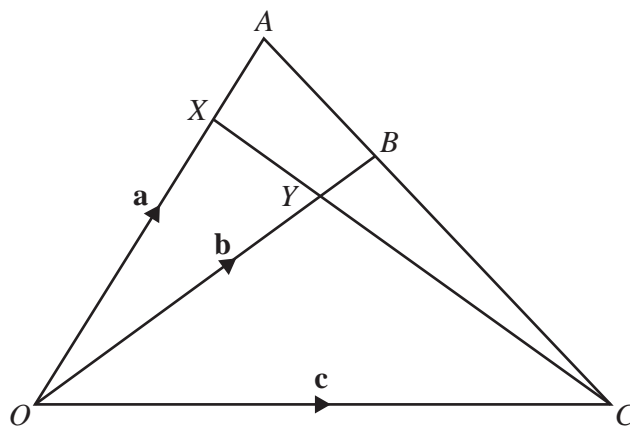


The diagram shows a triangle  $OAC$ . The point  $B$  lies on  $AC$  such that  $AB : AC = 2 : 5$ . It is given that  $\vec{OA} = \mathbf{a}$ ,  $\vec{OB} = \mathbf{b}$  and  $\vec{OC} = \mathbf{c}$ .

(a) Show that  $5\mathbf{b} - 3\mathbf{a} = 2\mathbf{c}$ .

[4]

13



The diagram now includes points  $X$  and  $Y$ , such that  $\overrightarrow{OX} = \frac{3}{4}\overrightarrow{OA}$  and  $\overrightarrow{OY} = m\overrightarrow{OB}$ , where  $m$  is a constant. It is also given that  $XY : XC = \lambda : 1$ , where  $\lambda$  is a constant.

(b) Using **part (a)**, find  $\overrightarrow{XC}$  in terms of  $\mathbf{a}$  and  $\mathbf{b}$ . [2]

(c) Hence find the values of  $m$  and  $\lambda$ . [4]

12 (a) Show that  $\frac{1}{\operatorname{cosec} \theta - 1} + \frac{1}{\operatorname{cosec} \theta + 1} = 2 \sin \theta \sec^2 \theta$ . [3]

(b) Hence solve the equation  $\frac{1}{\operatorname{cosec} 2\phi - 1} + \frac{1}{\operatorname{cosec} 2\phi + 1} = 4 \sin 2\phi$ , for  $-90^\circ \leq \phi \leq 90^\circ$ . [6]

- 13 Given that  $f''(x) = 6(3x+4)^{-\frac{1}{2}}$ ,  $f'(4) = 18$  and  $f(4) = \frac{512}{9}$ , find  $f(x)$ . [8]

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