Cambridge Assessment International Education

# Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

*3698312985*

## 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.

DC (LK/SG) 303197/2


**[Turn over**

## *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* $\Delta ABC$

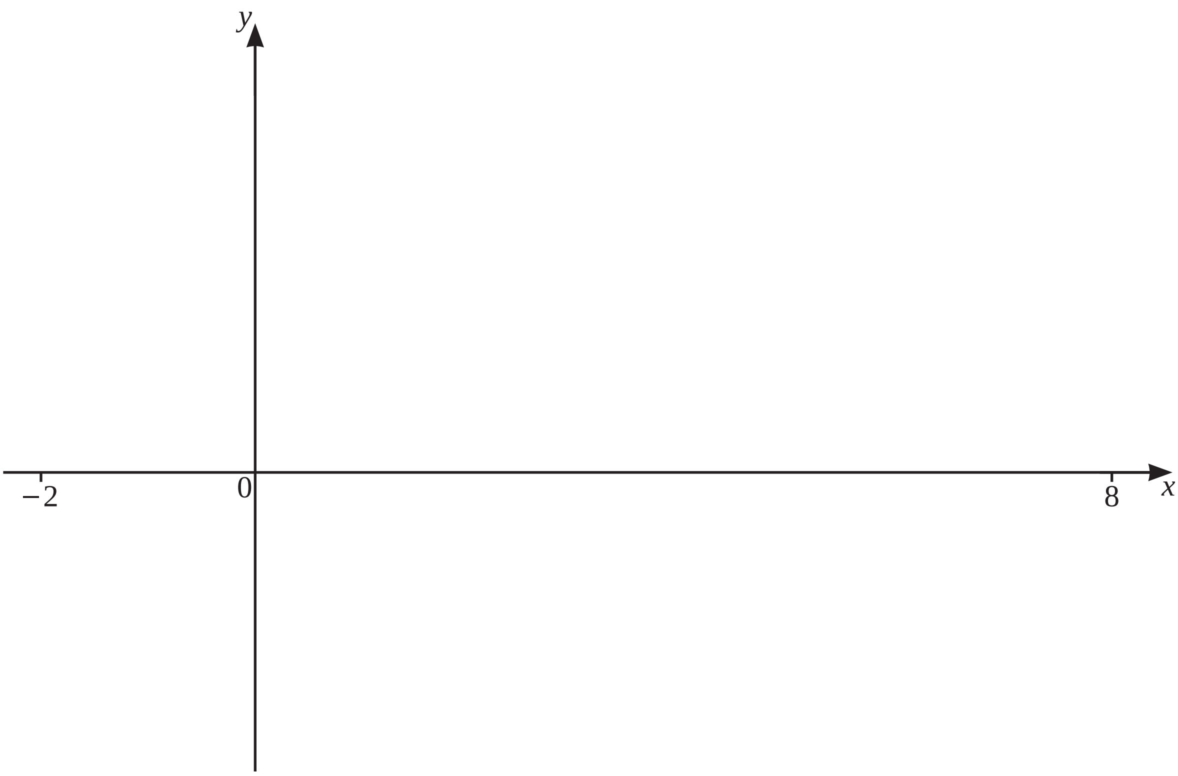
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

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

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

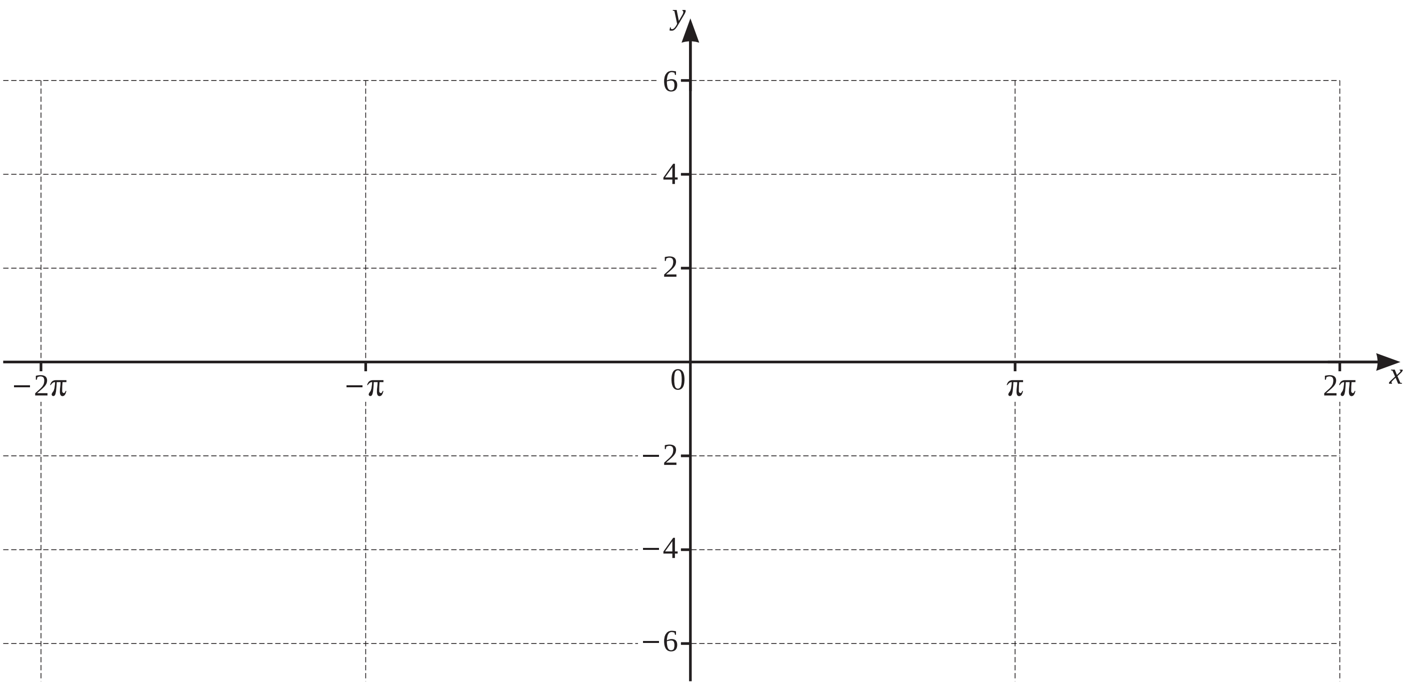
 

**1** **(a)** On the axes, sketch the graphs of $y = |2x + 1|$ and $y = |5 - 3x|$ for $-2 \leqslant x \leqslant 8$. State the coordinates of the points where these graphs meet the coordinate axes. [3]




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

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

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

Solve the equation $\left(\sqrt{5}-1\right)x^2-2x-\left(\sqrt{5}+1\right)=0$, 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.

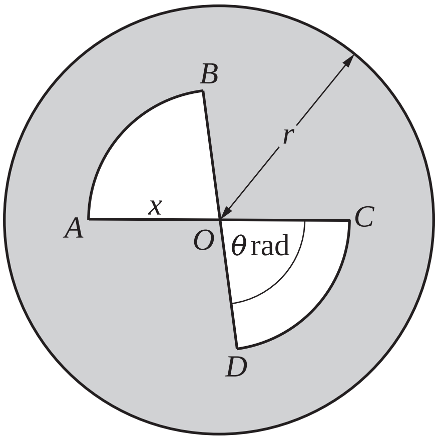
**(a)** Find the first term and the common difference. [3]

**(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]

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 $0 < x \leqslant r$. Angle $AOB$ = 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.

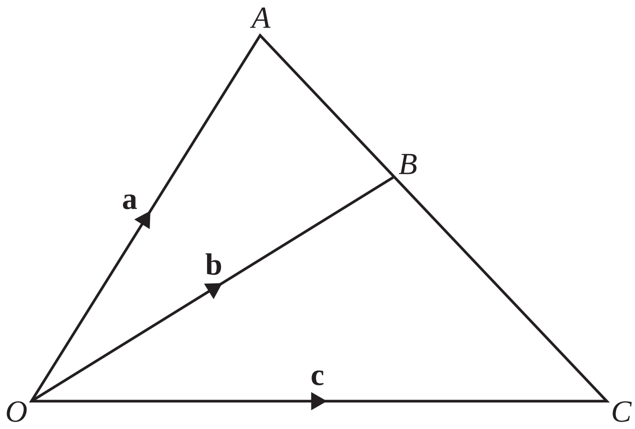
**(c)** Write down the least possible area of the shaded region in terms of $r$ and $\theta$. [2]

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

**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 $65 \times {}^nC_5 = 2(n-1) \times {}^{n+1}C_6$, find the value of $n$. [3]

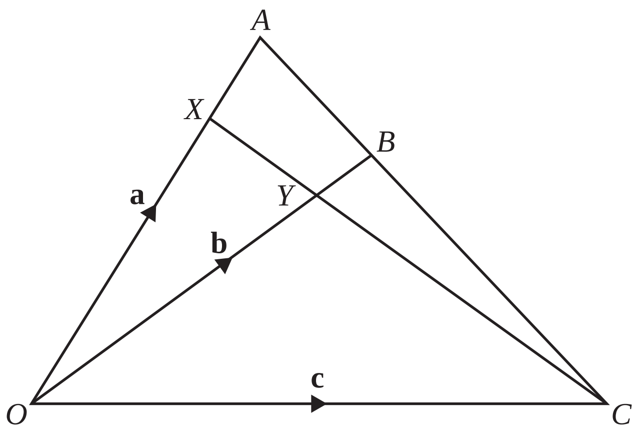
**11**




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

**(a)** Show that $5\mathbf{b} - 3\mathbf{a} = 2\mathbf{c}$. [4]




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 **a** and **b**. [2]

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

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

**(b)** Hence solve the equation $\dfrac{1}{\operatorname{cosec}2\phi - 1} + \dfrac{1}{\operatorname{cosec}2\phi + 1} = 4\sin 2\phi$, for $-90° \leqslant \phi \leqslant 90°$. [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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