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

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

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

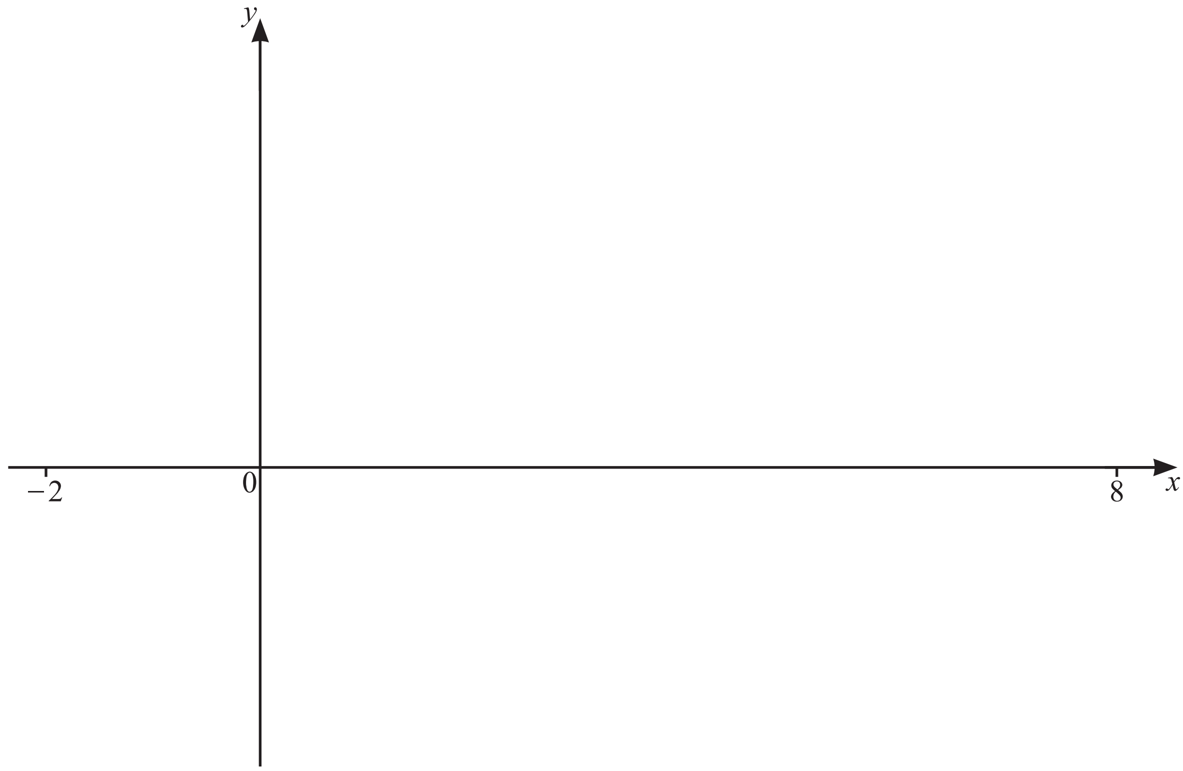
Formulae for ΔABC

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

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

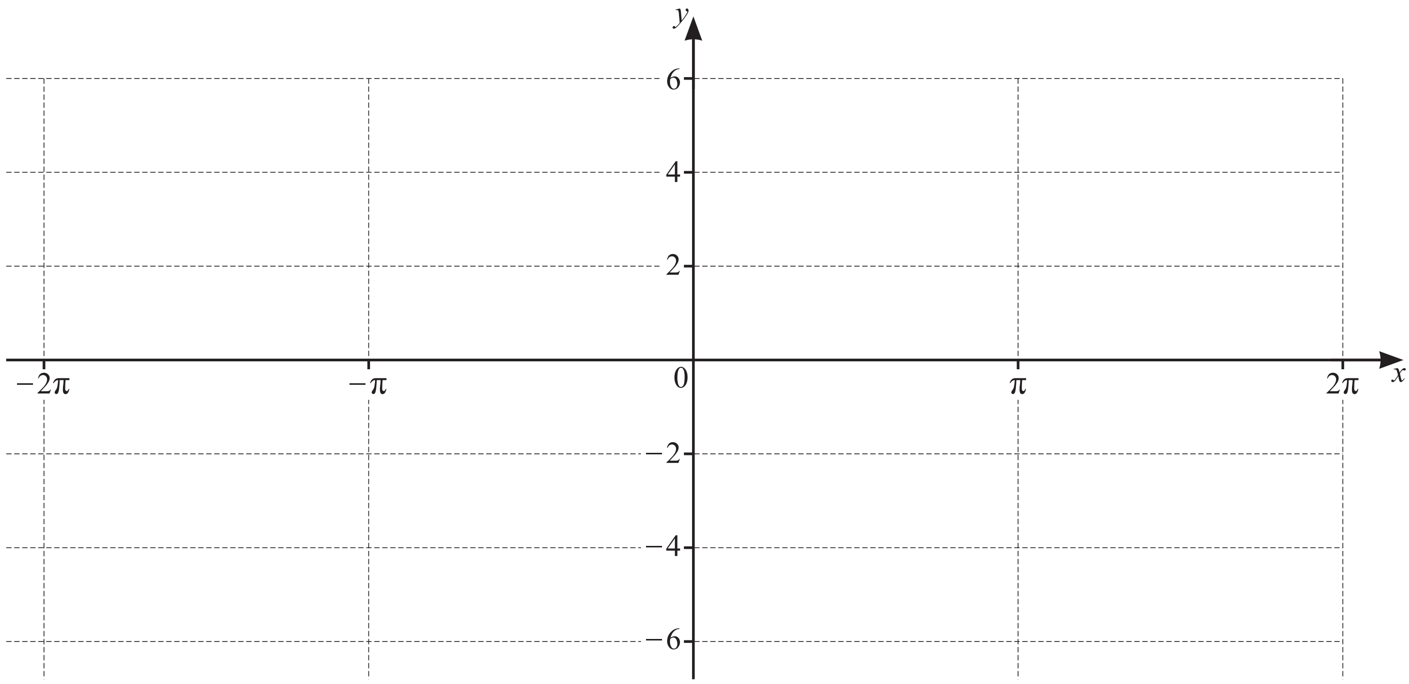
$$\Delta = \frac{1}{2}bc\sin A$$

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]

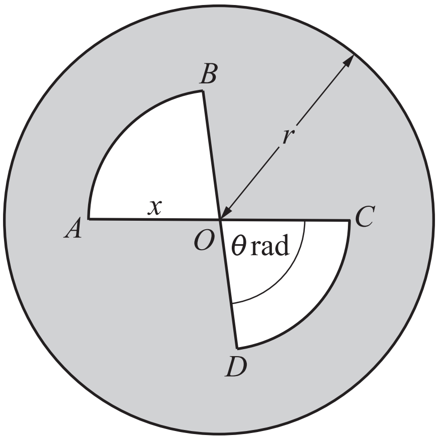
5 An arithmetic progression is such that the fourth term is 25 and the ninth term is 50.

(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 θ, the perimeter of the shaded region. [3]

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

It is given that x can vary and that r and θ are constant.

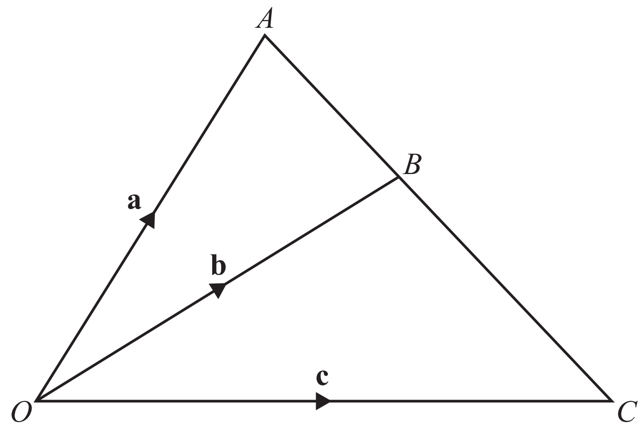
(c) Write down the least possible area of the shaded region in terms of r and θ. [2]

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]

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]

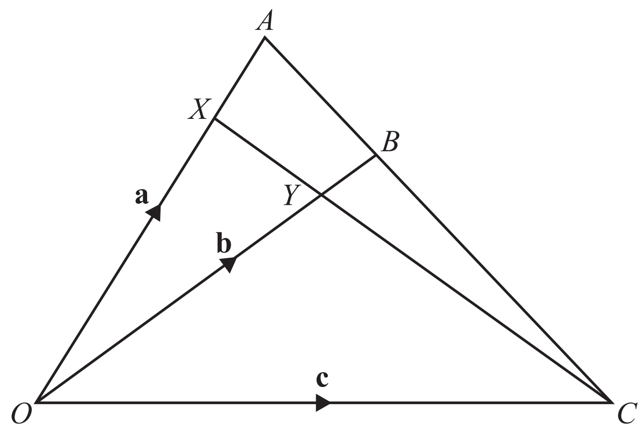
10 Given that $65 \times {}^{n}C_5 = 2(n-1) \times {}^{n+1}C_6$, find the value of n. [3]

11



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