Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER | CANDIDATE NUMBER

9965890960

ADDITIONAL MATHEMATICS **0606/23**

Paper 2 **May/June 2024**

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 **12** pages.

DC (KN/SG) 332423/3

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

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

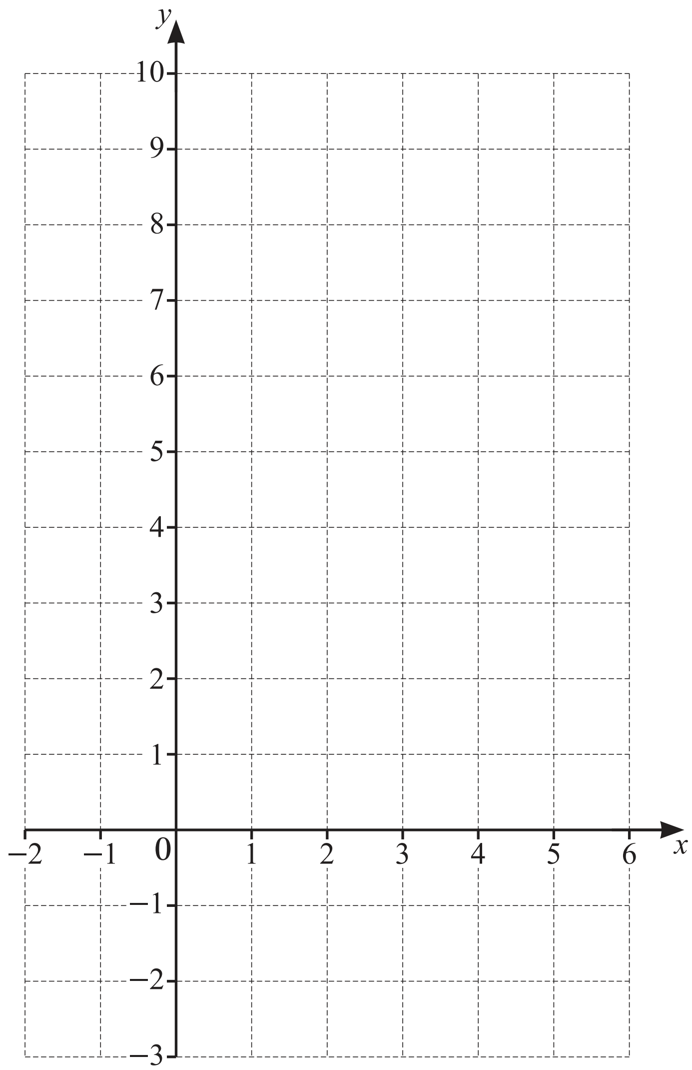
$$a^2 = b^2 + c^2 - 2bc\cos A$$

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

1 The point A has coordinates (1, 4) and the point B has coordinates (5, 6). The perpendicular bisector of AB intersects the x-axis at the point C and the y-axis at the point D. Given that O is the origin, find the area of triangle OCD. [5]

2 Given that the equation $kx^2 + (2k-1)x + k + 1 = 0$ has no real roots, find the set of possible values of k. [4]

3 **(a)**



Draw the graphs of $y = |2x - 5|$ and $y = |4 - x|$ for $-2 \leqslant x \leqslant 6$. [4]

(b) Use your graphs to solve the inequality $|4 - x| \leqslant |2x - 5|$. [2]

4 **(a)** Find and simplify the term independent of x in the expansion of $\left(x^2 - \frac{1}{2x^3}\right)^{10}$. [2]

(b) **DO NOT USE A CALCULATOR IN THIS PART OF THE QUESTION.**

(i) Use the binomial theorem to show that $\left(1+2\sqrt{2}\right)^4 - \left(1-2\sqrt{2}\right)^4 = k\sqrt{2}$, where k is an integer to be found. [4]

(ii) Hence write $\frac{\left(1+2\sqrt{2}\right)^4 - \left(1-2\sqrt{2}\right)^4}{1+\sqrt{2}}$ in the form $a+b\sqrt{2}$, where a and b are integers. [2]

5 **(a)** The function f is defined by $\mathrm{f}(x) = \dfrac{1+2\sin^2 x}{\cos^2 x}$ for $-\dfrac{\pi}{2} < x < \dfrac{\pi}{2}$.

(i) Show that $\mathrm{f}(x)$ can be written as $a\tan^2 x + b$, where a and b are integers. [2]

(ii) Hence solve the equation $\mathrm{f}(x) = 4$. [3]

(iii) Hence also find the gradient of the curve $y = \mathrm{f}(x)$ at each of the points where $y = 4$. [4]

(b) Solve the equation $50\cos^2\theta = 5\sin\theta + 47$ for $0° \leqslant \theta \leqslant 360°$. [5]

6 DO NOT USE A CALCULATOR IN THIS QUESTION.

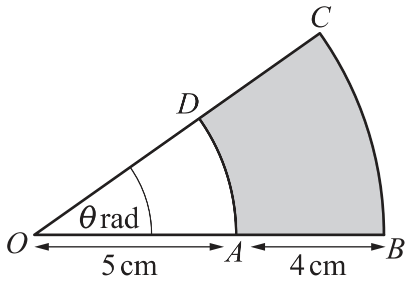
(a) Given that $x-3$ and $x+1$ are both factors of $2x^3-3x^2-8x-3$, solve the equation $2x^3-3x^2-8x-3=0$. [2]

(b) The polynomial $\mathrm{p}(x)=x^3+ax^2+bx+c$, where a, b and c are constants, has remainder -5 when divided by $x-1$. The curve $y=\mathrm{p}(x)$ has stationary points at $x=\frac{4}{3}$ and $x=2$.

(i) Find the values of a, b and c. [7]

(ii) Hence use the second derivative test to show that the stationary point at $x=2$ is a minimum. [2]

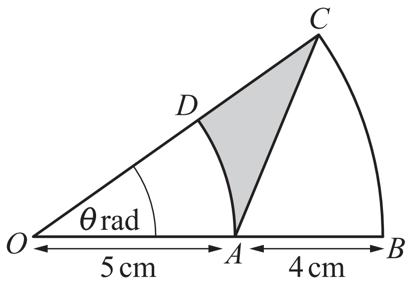
7



In the diagram, *AD* and *BC* are arcs of circles with common centre *O*.
ODC and *OAB* are straight lines with $OA = 5\,\text{cm}$ and $AB = 4\,\text{cm}$. Angle $BOC = \theta$ radians.
The area of the shaded region *ABCD* is $4\pi\,\text{cm}^2$.

(a) Find θ. [3]

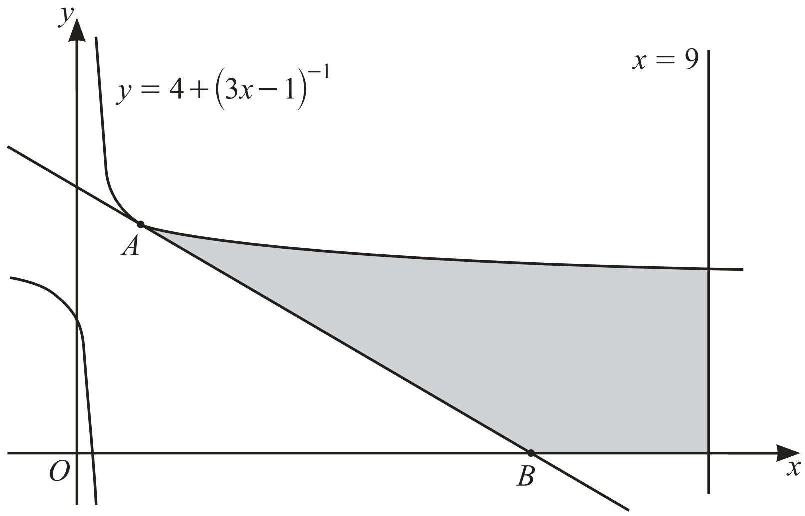
(b)



The straight line *AC* is added to the diagram and the region *ACD* is now shaded.
Find the perimeter of the shaded region *ACD*. [5]

8 A curve is such that $\dfrac{d^2y}{dx^2} = \cos\left(4x - \dfrac{\pi}{4}\right)$. Given that $\dfrac{dy}{dx} = \dfrac{3}{4}$ at the point $\left(\dfrac{3\pi}{16}, \dfrac{\pi}{4}\right)$ on the curve, find the equation of the curve. [7]

9



The diagram shows a sketch of part of the curve $y = 4 + (3x - 1)^{-1}$ and the line $x = 9$.
The point A has x-coordinate 1. The tangent to the curve at A meets the x-axis at the point B.
Find the area of the shaded region. [10]

Question 10 is printed on the next page.

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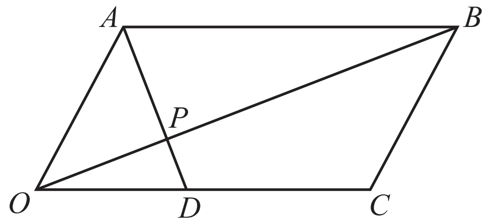

The diagram shows a parallelogram *OABC*. The point *D* divides the line *OC* in the ratio 2 : 3.

$$\overrightarrow{OA} = \mathbf{a} \quad \text{and} \quad \overrightarrow{OC} = \mathbf{c}$$

The point *P* lies on *AD* such that $\overrightarrow{OP} = \lambda\overrightarrow{OB}$ and $\overrightarrow{AP} = \mu\overrightarrow{AD}$, where λ and μ are scalars.

Find two expressions for $\overrightarrow{OP}$, each in terms of **a**, **c** and a scalar, and hence show that *P* divides both *DA* and *OB* in the ratio *m* : *n*, where *m* and *n* are integers to be found. [7]