

Cambridge IGCSE™

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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.

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*

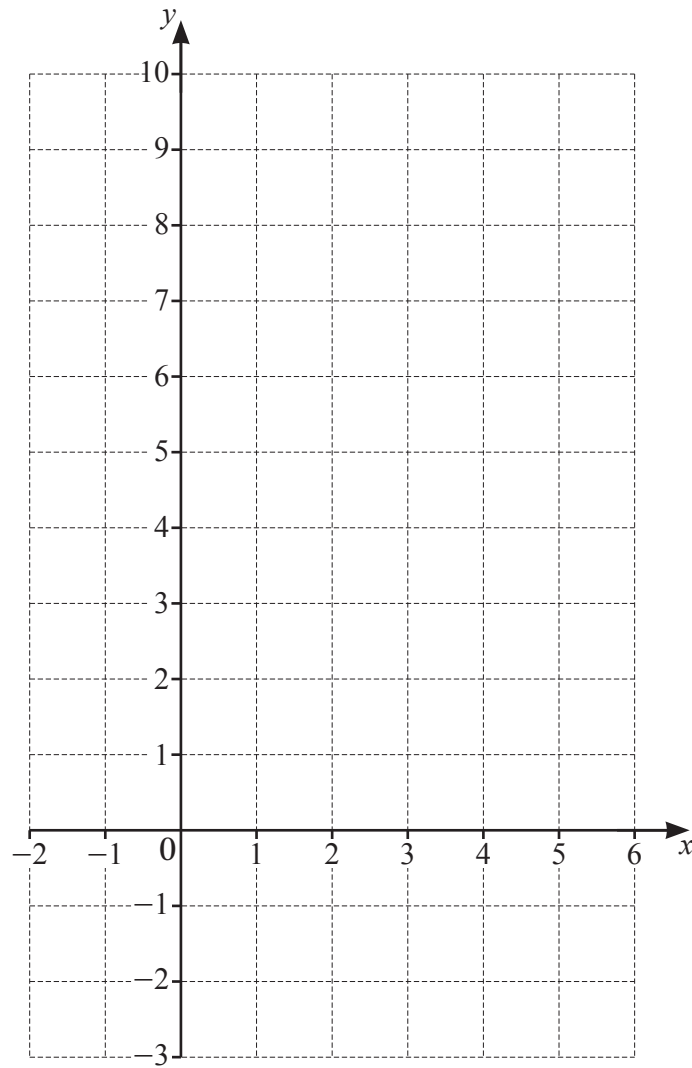
$$\begin{aligned}\sin^2 A + \cos^2 A &= 1 \\ \sec^2 A &= 1 + \tan^2 A \\ \operatorname{cosec}^2 A &= 1 + \cot^2 A\end{aligned}$$

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 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 $-2 \leq x \leq 6$.

[4]

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

[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 $(1 + 2\sqrt{2})^4 - (1 - 2\sqrt{2})^4 = k\sqrt{2}$, where k is an integer to be found. [4]

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

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

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

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

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

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

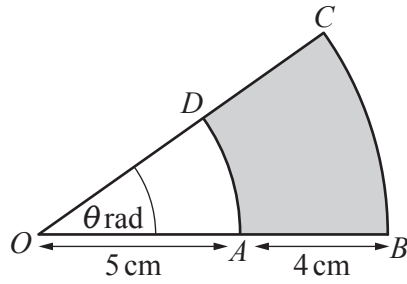
6 DO NOT USE A CALCULATOR IN THIS QUESTION.

- (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 $p(x) = x^3 + ax^2 + bx + c$, where a , b and c are constants, has remainder -5 when divided by $x-1$. The curve $y = p(x)$ 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]

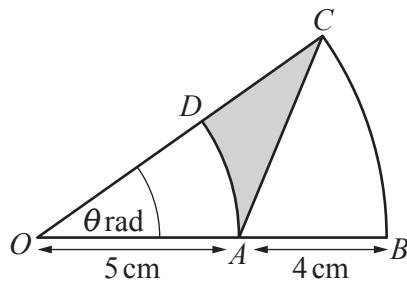


In the diagram, AD and BC are arcs of circles with common centre O .
 ODC and OAB are straight lines with $OA = 5$ cm and $AB = 4$ cm. Angle $BOC = \theta$ radians.
 The area of the shaded region $ABCD$ is 4π cm².

(a) Find θ .

[3]

(b)

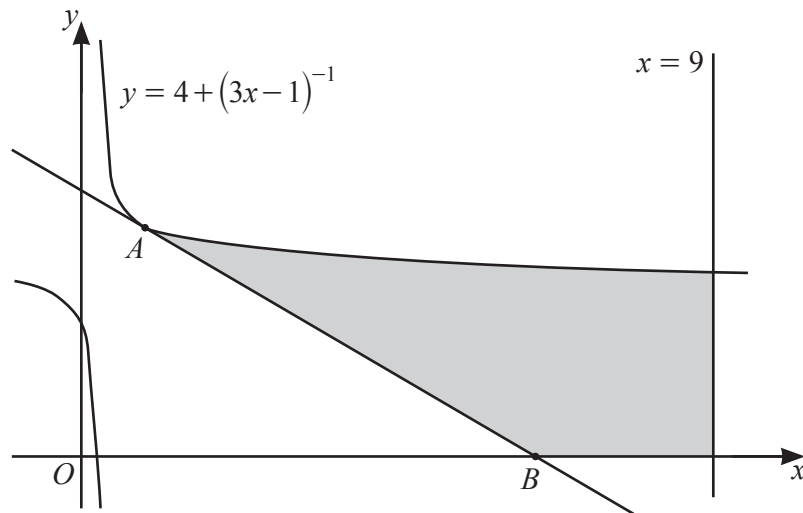


The straight line AC is added to the diagram and the region ACD is now shaded.
 Find the perimeter of the shaded region ACD .

[5]

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

9

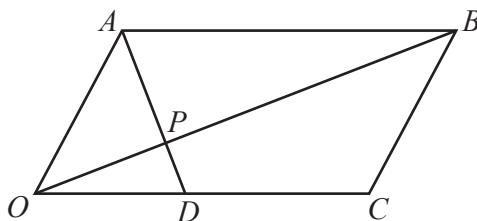


The diagram shows a sketch of part of the curve $y = 4 + (3x - 1)^{-1}$ and the line $x = 9$. The point A has x -coordinate 1. The tangent to the curve at A meets the x -axis at the point B . Find the area of the shaded region.

[10]

Question 10 is printed on the next page.

10



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 $\mathbf{a}$, $\mathbf{c}$ 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]

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