

Cambridge IGCSE[™]

CANDIDATE NAME					
CENTRE NUMBER			CANDIDATE NUMBER		

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

$$\sin^2 A + \cos^2 A = 1$$
$$\sec^2 A = 1 + \tan^2 A$$
$$\csc^2 A = 1 + \cot^2 A$$

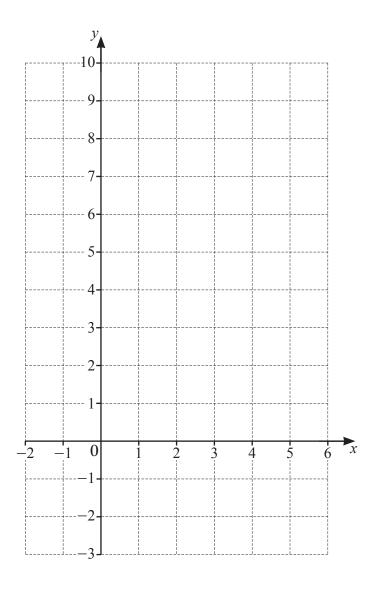
Formulae for $\triangle ABC$

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

1 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.

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 $-2 \le x \le 6$. [4]

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

(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 $f(x) = \frac{1 + 2\sin^2 x}{\cos^2 x}$ 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]

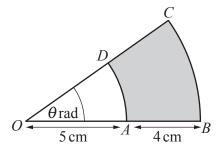
(b) Solve the equation $50\cos^2\theta = 5\sin\theta + 47$ for $0^\circ \le \theta \le 360^\circ$. [5]

6	DO NOT	LISE A	CALCUL	ATOR I	N THIS	QUESTION.
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(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]

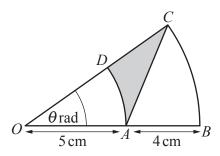
(ii) Hence use the second derivative test to show that the stationary point at x = 2 is a minimum. [2]



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)

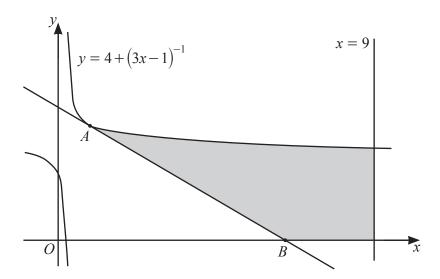


The straight line AC is added to the diagram and the region ACD is now shaded. Find the perimeter of the shaded region ACD. [5]

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A curve is such that $\frac{d^2y}{dx^2} = \cos(4x - \frac{\pi}{4})$. 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.

9

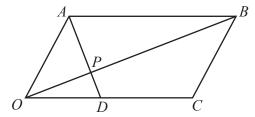


The diagram shows a sketch of part of the curve $y = 4 + (3x - 1)^{-1}$ and the line x = 9. The point *A* has *x*-coordinate 1. The tangent to the curve at *A* meets the *x*-axis at the point *B*. Find the area of the shaded region.

[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.

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

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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