



# Cambridge IGCSE™

CANDIDATE  
NAME

CENTRE  
NUMBER

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NUMBER

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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

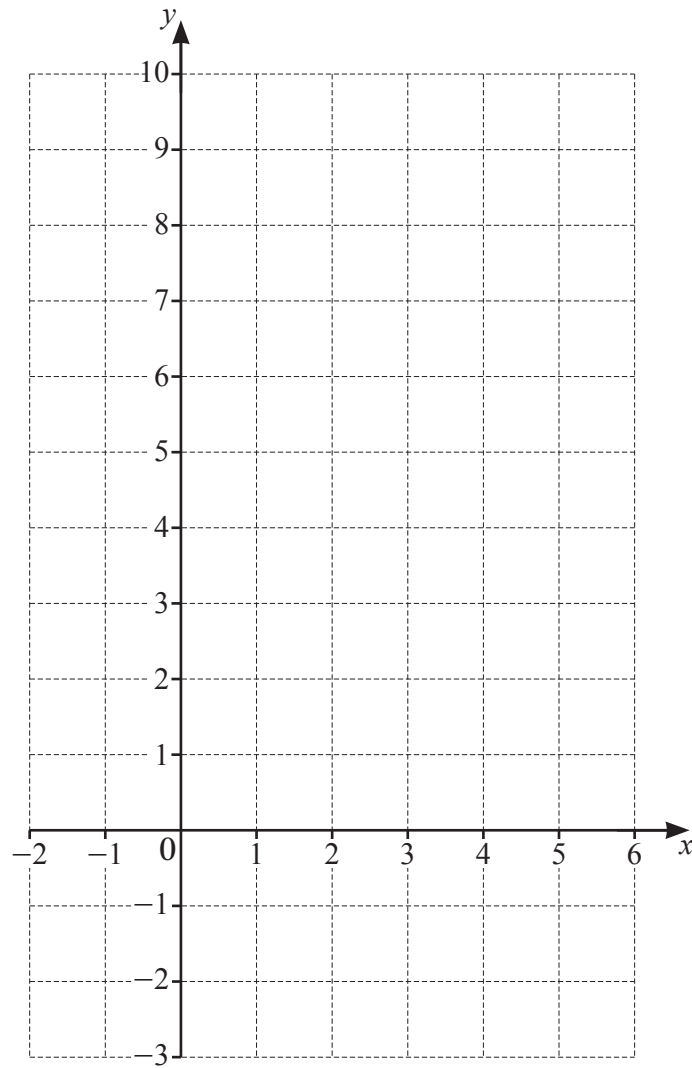
- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **12** pages.

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

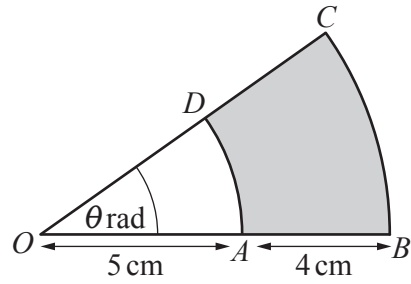
**6 DO NOT USE A CALCULATOR IN THIS QUESTION.**

(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]

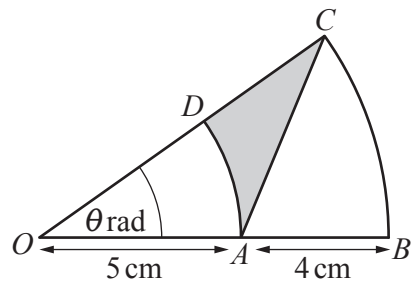
7  
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In the diagram,  $AD$  and  $BC$  are arcs of circles with common centre  $O$ .  
 $ODC$  and  $OAB$  are straight lines with  $OA = 5$  cm and  $AB = 4$  cm. Angle  $BOC = \theta$  radians.  
 The area of the shaded region  $ABCD$  is  $4\pi$  cm<sup>2</sup>.

(a) Find  $\theta$ .

[3]

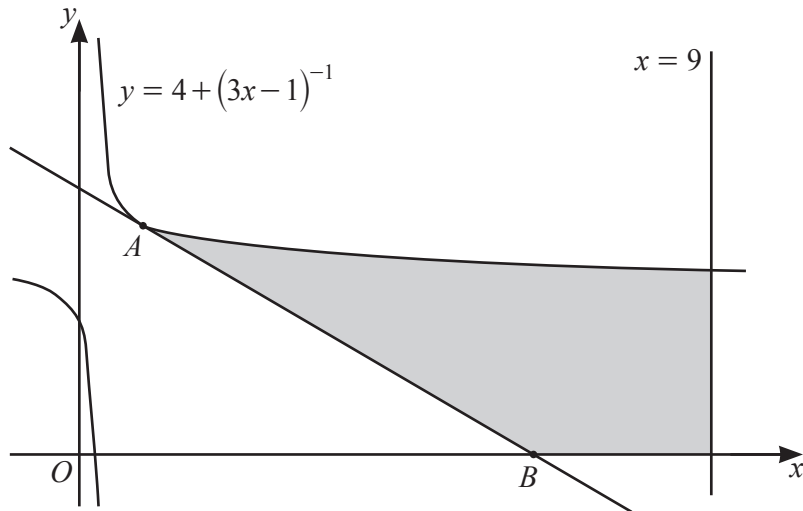
(b)



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]

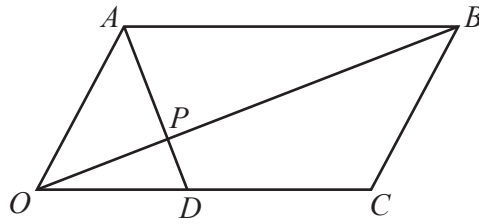
- 8 A curve is such that  $\frac{d^2y}{dx^2} = \cos\left(4x - \frac{\pi}{4}\right)$ . Given that  $\frac{dy}{dx} = \frac{3}{4}$  at the point  $\left(\frac{3\pi}{16}, \frac{\pi}{4}\right)$  on the curve, find the equation of the curve. [7]

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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]

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  $\lambda$  and  $\mu$  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]