

# Cambridge International AS & A Level

CANDIDATE  
NAME

|  |
|--|
|  |
|--|

CENTRE  
NUMBER

|  |  |  |  |  |
|--|--|--|--|--|
|  |  |  |  |  |
|--|--|--|--|--|

CANDIDATE  
NUMBER

|  |  |  |  |
|--|--|--|--|
|  |  |  |  |
|--|--|--|--|

## MATHEMATICS

9709/12

Paper 1 Pure Mathematics 1

February/March 2023

**1 hour 50 minutes**

You must answer on the question paper.

You will need: List of formulae (MF19)

## 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.
- If additional space is needed, you should use the lined page at the end of this booklet; the question number or numbers must be clearly shown.
- 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 75.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **20** pages. Any blank pages are indicated.

- 1** A line has equation  $y = 3x - 2k$  and a curve has equation  $y = x^2 - kx + 2$ , where  $k$  is a constant.

Show that the line and the curve meet for all values of  $k$ .

[4]

Handwriting practice lines consisting of 20 rows of dotted lines on a white background. Each row is defined by two horizontal dotted lines. In the bottom right corner, there is a small, partially visible circular logo with the word "AHEAD" in a stylized font.

- 2** A function  $f$  is defined by  $f(x) = x^2 - 2x + 5$  for  $x \in \mathbb{R}$ . A sequence of transformations is applied in the following order to the graph of  $y = f(x)$  to give the graph of  $y = g(x)$ .

Stretch parallel to the  $x$ -axis with scale factor  $\frac{1}{2}$

### Reflection in the $y$ -axis

Stretch parallel to the  $y$ -axis with scale factor 3

Find  $g(x)$ , giving your answer in the form  $ax^2 + bx + c$ , where  $a$ ,  $b$  and  $c$  are constants. [4]

This image shows a full page of blank handwriting practice paper. It features multiple sets of horizontal lines for writing, each consisting of a solid top line, a dashed midline, and a solid bottom line. The lines are evenly spaced across the entire page. In the bottom right corner, there is a partial view of a circular logo containing the word "AHEAD".

- 3** A curve has equation  $y = \frac{1}{60}(3x + 1)^2$  and a point is moving along the curve.

Find the  $x$ -coordinate of the point on the curve at which the  $x$ - and  $y$ -coordinates are increasing at the same rate. [4]

A large area of dotted lines for writing.

IN AHEAD

- 4 The circumference round the trunk of a large tree is measured and found to be 5.00 m. After one year the circumference is measured again and found to be 5.02 m.

- (a) Given that the circumferences at yearly intervals form an arithmetic progression, find the circumference 20 years after the first measurement. [2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

- (b) Given instead that the circumferences at yearly intervals form a geometric progression, find the circumference 20 years after the first measurement. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

- 5** Points  $A(7, 12)$  and  $B$  lie on a circle with centre  $(-2, 5)$ . The line  $AB$  has equation  $y = -2x + 26$ .

Find the coordinates of  $B$ .

[6]

A series of horizontal dotted lines for writing practice.

A circular logo located at the bottom right corner of the page. The word "AHEAD" is written in a bold, sans-serif font, following the curve of the top half of the circle. The background of the circle appears to have a textured or patterned design.

**6** In the expansion of  $\left(\frac{x}{a} + \frac{a}{x^2}\right)^7$ , it is given that

$$\frac{\text{the coefficient of } x^4}{\text{the coefficient of } x} = 3.$$

Find the possible values of the constant  $a$ .

[6]

[illegible]

- 7 (a)** By first obtaining a quadratic equation in  $\cos \theta$ , solve the equation

$$\tan \theta \sin \theta = 1$$

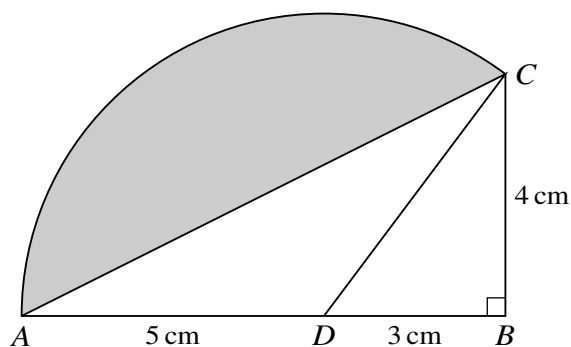
for  $0^\circ < \theta < 360^\circ$ .

[5]

[illegible]



Handwriting practice lines (dotted lines on a solid background).



The diagram shows triangle  $ABC$  in which angle  $B$  is a right angle. The length of  $AB$  is 8 cm and the length of  $BC$  is 4 cm. The point  $D$  on  $AB$  is such that  $AD = 5$  cm. The sector  $DAC$  is part of a circle with centre  $D$ .

- (a) Find the perimeter of the shaded region. [5]

[illegible]

Blank lined paper with horizontal ruling lines and a dashed midline for handwriting practice. A small circular logo with the text "AHEAD" is visible in the bottom right corner.

- 9** The function  $f$  is defined by  $f(x) = -3x^2 + 2$  for  $x \leq -1$ .

(a) State the range of  $f$ .

[1]

.....

.....

.....

(b) Find an expression for  $f^{-1}(x)$ .

[3]

[illegible]

The function  $g$  is defined by  $g(x) = -x^2 - 1$  for  $x \leq -1$ .

- (c)** Solve the equation  $fg(x) - gf(x) + 8 = 0$ . [5]

AHEAD

- 10** At the point  $(4, -1)$  on a curve, the gradient of the curve is  $-\frac{3}{2}$ . It is given that  $\frac{dy}{dx} = x^{-\frac{1}{2}} + k$ , where  $k$  is a constant.

**(a)** Show that  $k = -2$ .

[1]

.....

.....

.....

.....

**(b)** Find the equation of the curve.

[4]

AHEAD

- (c) Find the coordinates of the stationary point. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

- (d) Determine the nature of the stationary point. [2]

.....

.....

.....

.....

.....

.....

.....

.....

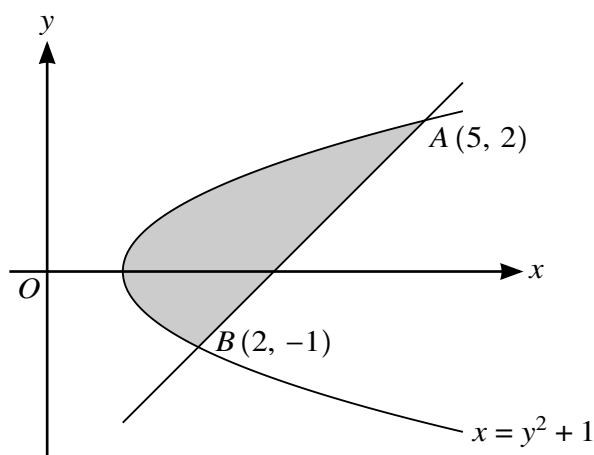
.....

.....

.....

.....

11



The diagram shows the curve with equation  $x = y^2 + 1$ . The points  $A(5, 2)$  and  $B(2, -1)$  lie on the curve.

- (a) Find an equation of the line  $AB$ .

[2]

.....

.....

.....

.....

.....

- (b) Find the volume of revolution when the region between the curve and the line  $AB$  is rotated through  $360^\circ$  about the  $y$ -axis.

[9]

.....

.....

.....

.....

.....

.....

.....

.....

.....





This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. In the bottom right corner, there is a small, partially visible circular logo. The logo has a blue border and contains the word "AHEAD" in white capital letters. A red circle is also visible at the very edge of the logo.





**BLANK PAGE**

---

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at [www.cambridgeinternational.org](http://www.cambridgeinternational.org) after the live examination series.

Cambridge Assessment International Education is part of Cambridge Assessment. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which is a department of the University of Cambridge.

