



# Cambridge International AS & A Level

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NAME



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**MATHEMATICS**

**9709/13**

Paper 1 Pure Mathematics 1

**October/November 2024**

**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.

- Find the 30th term of the progression.

[3]

[illegible]



**2** Find the exact solution of the equation

$$\cos \frac{1}{6} \pi + \tan 2x + \frac{\sqrt{3}}{2} = 0 \text{ for } -\frac{1}{4} \pi < x < \frac{1}{4} \pi. \quad [2]$$

[illegible]



- 3 (a) Find the coefficients of  $x^3$  and  $x^4$  in the expansion of  $(3 - ax)^5$ , where  $a$  is a constant. Give your answers in terms of  $a$ . [3]

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- (b) Given that the coefficient of  $x^4$  in the expansion of  $(ax + 7)(3 - ax)^5$  is 240, find the positive value of  $a$ . [3]

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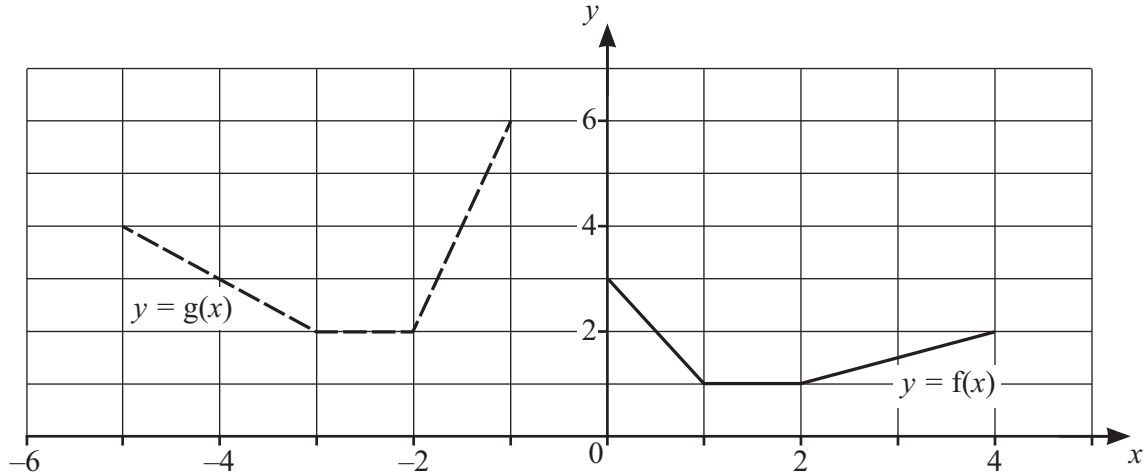
**4** Solve the equation  $4\sin^4\theta + 12\sin^2\theta - 7 = 0$  for  $0^\circ \leq \theta \leq 360^\circ$ .

[4]

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In the diagram, the graph with equation  $y = f(x)$  is shown with solid lines and the graph with equation  $y = g(x)$  is shown with broken lines.

- (a) Describe fully a sequence of three transformations which transforms the graph of  $y = f(x)$  to the graph of  $y = g(x)$ . [6]

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- (b) Find an expression for  $g(x)$  in the form  $af(bx + c)$ , where  $a$ ,  $b$  and  $c$  are integers. [2]

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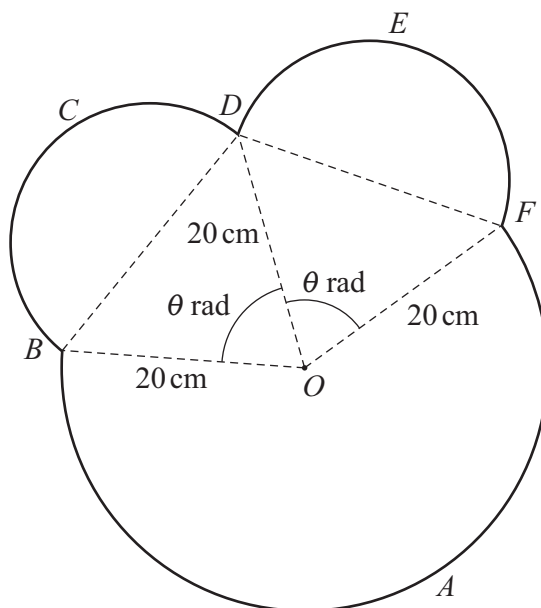




[5]

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The diagram shows a metal plate  $ABCDEF$  consisting of five parts. The parts  $BCD$  and  $DEF$  are semicircles. The part  $BAFO$  is a sector of a circle with centre  $O$  and radius 20 cm, and  $D$  lies on this circle. The parts  $OBD$  and  $ODF$  are triangles. Angles  $BOD$  and  $DOF$  are both  $\theta$  radians.

- (a) Given that  $\theta = 1.2$ , find the area of the metal plate. Give your answer correct to 3 significant figures. [5]

[illegible]





[5]

- [illegible]

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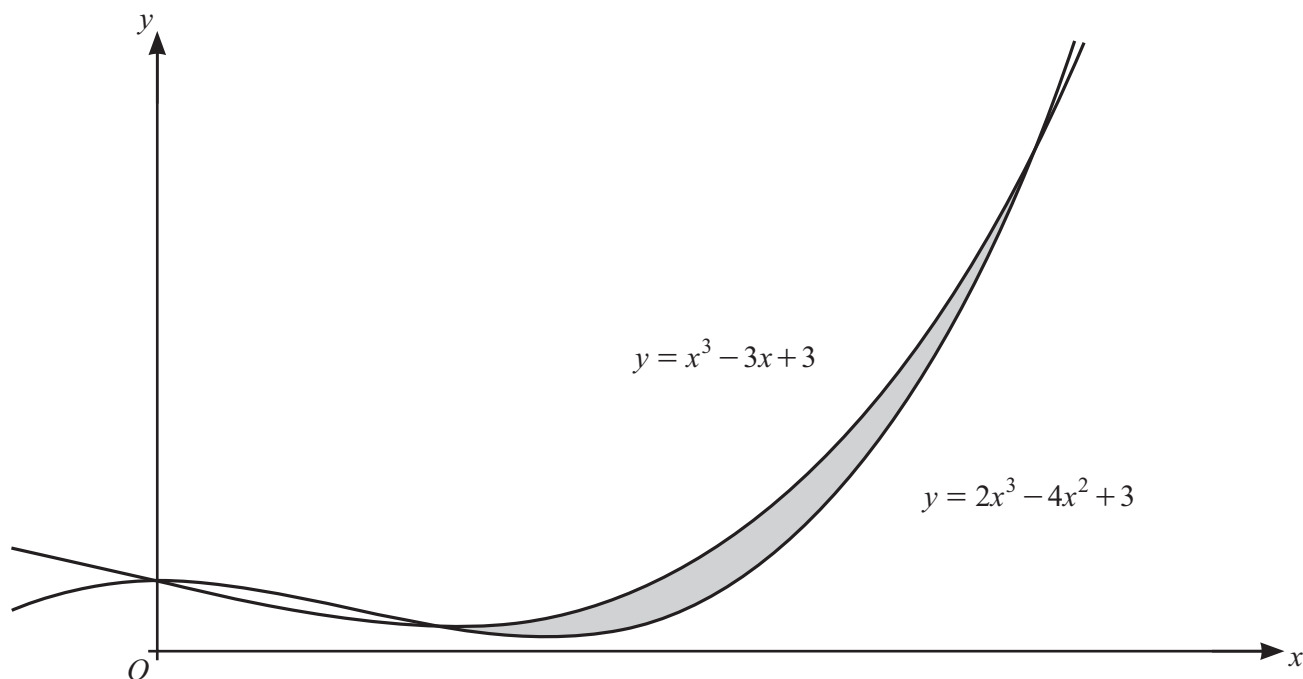
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[illegible]





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The diagram shows the curves with equations  $y = x^3 - 3x + 3$  and  $y = 2x^3 - 4x^2 + 3$ .

- (a) Find the  $x$ -coordinates of the points of intersection of the curves. [3]

[illegible]



**(b)** Find the area of the shaded region.

[4]

[illegible]

- (a)** Show that the centre of the circle lies on the line  $y = \frac{1}{2}x - 4$ . [4]

This image shows a full page of white paper with horizontal dotted lines. The lines are evenly spaced and run across the width of the page, providing a guide for handwriting practice. There are no margins, text, or other markings on the page.



(a) Find  $\frac{dy}{dx}$  and  $\frac{d^2y}{dx^2}$  in terms of  $k$ . [2]

**(b)** It is given that  $k = 2$ .

Find the coordinates of the stationary point and determine its nature. [4]





- (c) Points  $A$  and  $B$  on the curve have  $x$ -coordinates 0.25 and 1 respectively. For a different value of  $k$ , the tangents to the curve at the points  $A$  and  $B$  meet at a point with  $x$ -coordinate 0.6.

Find this value of  $k$ .

[6]

[illegible]



Additional page

If you use the following lined page to complete the answer(s) to any question(s), the question number(s) must be clearly shown.

Lined area for writing answers, consisting of multiple horizontal dotted lines.

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