



# Cambridge Pre-U

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**MATHEMATICS**

**9794/02**

Paper 2 Pure Mathematics 2

**May/June 2022**

**2 hours**

You must answer on the answer booklet/paper.

You will need: Answer booklet/paper  
Graph paper  
List of formulae (MF20)

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## INSTRUCTIONS

- Answer **all** questions.
- If you have been given an answer booklet, follow the instructions on the front cover of the answer booklet.
- 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 on all the work you hand in.
- Do **not** use an erasable pen or correction fluid.
- 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.
- At the end of the examination, fasten all your work together. Do **not** use staples, paper clips or glue.

## INFORMATION

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

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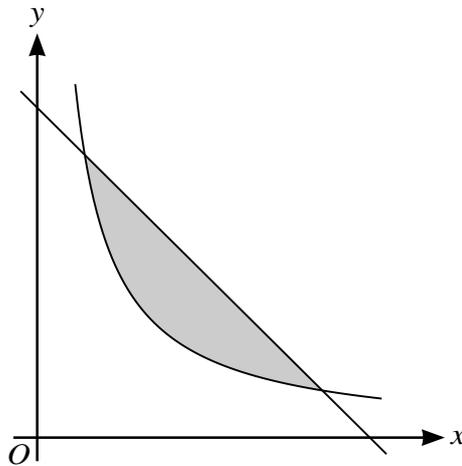
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This document has 4 pages. Any blank pages are indicated.



- 1 Solve  $|2x - 3| = |x - 1|$ . [3]
- 2 The points  $P$  and  $Q$  have coordinates  $(1, 7)$  and  $(9, 3)$  respectively.
- (a) Find the equation of the perpendicular bisector of  $PQ$ , giving your answer in the form  $y = mx + c$ . [4]
- (b) Find the area of the triangle enclosed by the  $x$ -axis, the  $y$ -axis and the perpendicular bisector of  $PQ$ . [2]
- 3 (a) Express  $(1 - x)(x - 4)$  in the form  $a - (x - b)^2$ , where  $a$  and  $b$  are constants to be found. [3]
- (b) State the coordinates of the maximum point of the curve  $y = (1 - x)(x - 4) + \frac{3}{4}$ . [2]
- 4 The points  $A$  and  $B$  have position vectors  $3\mathbf{i} - \mathbf{j} + 2\mathbf{k}$  and  $-2\mathbf{i} + \mathbf{j} + 3\mathbf{k}$  respectively, relative to the origin  $O$ . The line  $L$  passes through  $A$  and  $B$ .
- (a) Given that  $L$  is parallel to the vector  $10\mathbf{i} + a\mathbf{j} + b\mathbf{k}$ , find the values of  $a$  and  $b$ . [3]
- (b) Given also that  $L$  is perpendicular to the vector  $2\mathbf{i} + \mathbf{j} + c\mathbf{k}$ , find the value of  $c$ . [2]

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The diagram shows part of the curve  $xy = 6$  and part of the line  $y = 7 - x$ . Find the exact area of the region enclosed by the curve and the line, shaded on the diagram. [6]

- 6 Solve the equation  $7 \cos \theta - 4 \sin \theta = 3$  for  $0^\circ < \theta < 360^\circ$ . [7]
- 7 A geometric progression,  $u_1, u_2, u_3, \dots$ , has first term  $u_1 = a$  and common ratio  $r$ , where  $|r| < 1$ .  
The sum to infinity of the series  $u_1 + u_2 + u_3 + \dots$  is 8.  
The sum to infinity of the series consisting of the even-numbered terms,  $u_2 + u_4 + u_6 + \dots$ , is 2.  
Determine the value of  $a$  and the value of  $r$ . [7]

8 (a) Find the two complex numbers  $z$  which satisfy both  $\frac{z}{z^*} = \frac{3}{5} + \frac{4}{5}i$  and  $zz^* = 5$ . Give your answers in the form  $z = x + iy$ . [6]

(b) Sketch on an Argand diagram the locus of points given by  $|w - 4| = |w + 2i|$ , for complex numbers  $w$ . [2]

9 A triangle has sides  $p - q$ ,  $p$  and  $p + q$ , where  $p > q > 0$ . The largest angle of the triangle is  $\alpha$ .

(a) Use the cosine rule to show that  $\cos \alpha = \frac{p - 4q}{2(p - q)}$ . [4]

(b) Given that  $p = 7$  and  $q = 1$ , find the exact area of the triangle. [3]

(c) Given instead that  $\alpha = 150^\circ$ , find an expression for  $p$  in terms of  $q$ . [3]

10 A curve has equation  $y = \frac{1 - x^2}{1 + x^2}$ .

(a) (i) Show that  $\frac{dy}{dx} = -\frac{4x}{(1 + x^2)^2}$ . [3]

(ii) Find  $\frac{d^2y}{dx^2}$  in terms of  $x$ , simplifying your answer. [4]

(b) The curve crosses the  $x$ -axis at two points  $A$  and  $B$ . Show that the tangents to the curve at  $A$  and  $B$  intersect at a point  $C$  on the  $y$ -axis. [3]

(c) Show that  $C$  is a maximum point of the curve. [3]

11 It is given that  $k > \ln 5$  and that  $\int_{\ln 5}^k \frac{10}{e^x - 3 - 4e^{-x}} dx = \ln 25$ .

Using the substitution  $u = e^x$ , or otherwise, determine the exact value of the constant  $k$ . [10]

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