



## Cambridge International AS & A Level

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**MATHEMATICS**

**9709/11**

Paper 1 Pure Mathematics 1

**May/June 2021**

**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.







- 3 (a) Find the first three terms in the expansion of  $(3 - 2x)^5$  in ascending powers of  $x$ . [3]

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- (b) Hence find the coefficient of  $x^2$  in the expansion of  $(4 + x)^2(3 - 2x)^5$ . [3]

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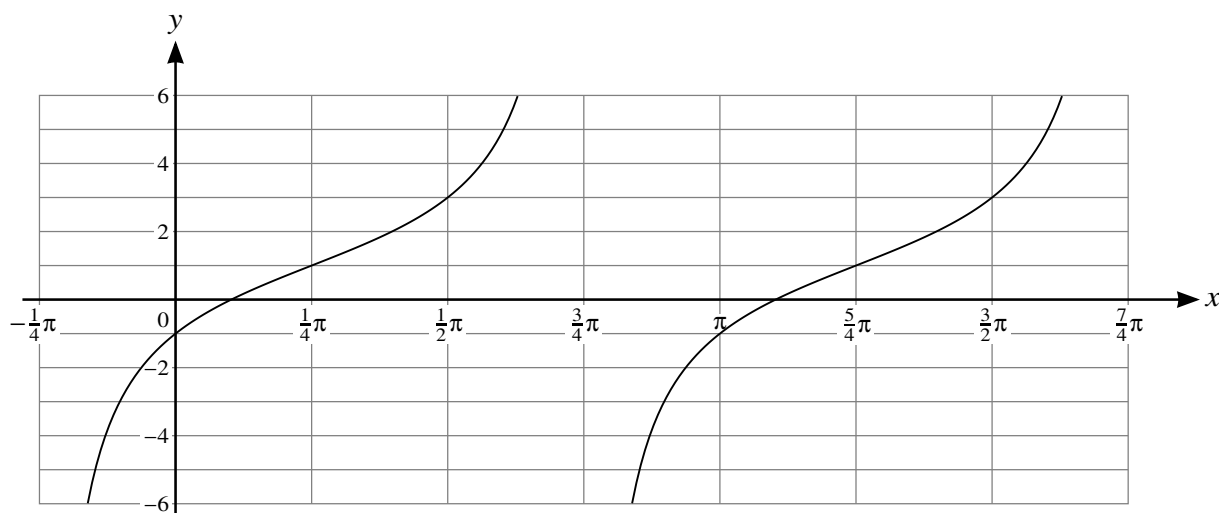
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The diagram shows part of the graph of  $y = a \tan(x - b) + c$ .

Given that  $0 < b < \pi$ , state the values of the constants  $a$ ,  $b$  and  $c$ .

[3]

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5 The fifth, sixth and seventh terms of a geometric progression are  $8k$ ,  $-12$  and  $2k$  respectively.

Given that  $k$  is negative, find the sum to infinity of the progression. [4]

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- 6 The equation of a curve is  $y = (2k - 3)x^2 - kx - (k - 2)$ , where  $k$  is a constant. The line  $y = 3x - 4$  is a tangent to the curve.

Find the value of  $k$ .

[5]

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(b) Hence solve the equation  $\frac{1 - 2 \sin^2 \theta}{1 - \sin^2 \theta} = 2 \tan^4 \theta$  for  $0^\circ \leq \theta \leq 180^\circ$ . [3]

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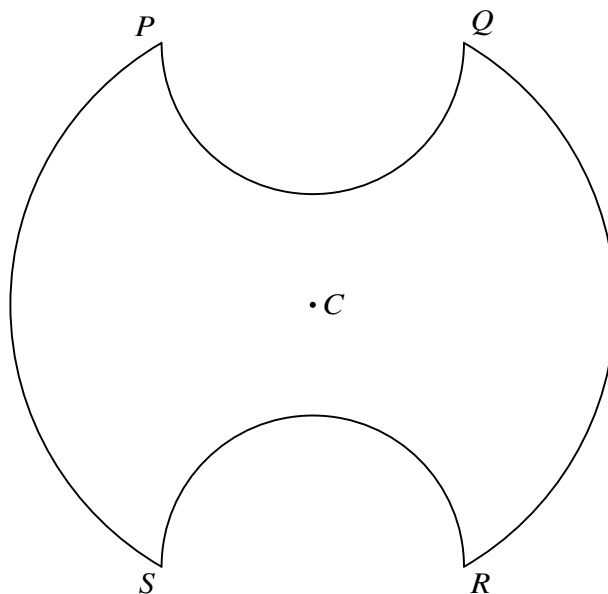
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The diagram shows a symmetrical metal plate. The plate is made by removing two identical pieces from a circular disc with centre  $C$ . The boundary of the plate consists of two arcs  $PS$  and  $QR$  of the original circle and two semicircles with  $PQ$  and  $RS$  as diameters. The radius of the circle with centre  $C$  is 4 cm, and  $PQ = RS = 4$  cm also.

- (a) Show that angle  $PCS = \frac{2}{3}\pi$  radians. [2]

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- (b) Find the exact perimeter of the plate. [3]

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9 Functions  $f$  and  $g$  are defined as follows:

$$f(x) = (x - 2)^2 - 4 \text{ for } x \geq 2,$$

$$g(x) = ax + 2 \text{ for } x \in \mathbb{R},$$

where  $a$  is a constant.

(a) State the range of  $f$ . [1]

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(b) Find  $f^{-1}(x)$ . [2]

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(c) Given that  $a = -\frac{5}{3}$ , solve the equation  $f(x) = g(x)$ . [3]

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10 The equation of a circle is  $x^2 + y^2 - 4x + 6y - 77 = 0$ .

- (a) Find the  $x$ -coordinates of the points  $A$  and  $B$  where the circle intersects the  $x$ -axis. [2]

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- (b) Find the point of intersection of the tangents to the circle at  $A$  and  $B$ . [6]

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11 The equation of a curve is  $y = 2\sqrt{3x + 4} - x$ .

- (a) Find the equation of the normal to the curve at the point (4, 4), giving your answer in the form  $y = mx + c$ . [5]

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

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

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(d) Find the exact area of the region bounded by the curve, the  $x$ -axis and the lines  $x = 0$  and  $x = 4$ . [4]

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