

Cambridge International AS & A Level

CANDIDATE
NAME

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CENTRE
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MATHEMATICS

9709/11

Paper 1 Pure Mathematics 1

October/November 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.

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- 1 (a) Expand $(1 + 3x)^6$ in ascending powers of x up to, and including, the term in x^2 . [2]

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- (b) Hence find the coefficient of x^2 in the expansion of $(1 - 7x + x^2)(1 + 3x)^6$. [2]

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

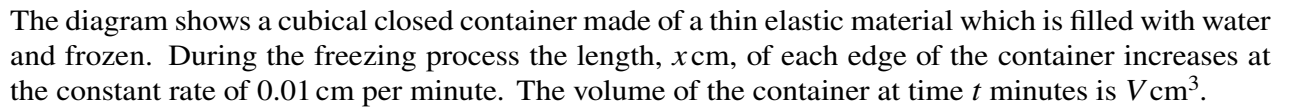
Showing all necessary working, determine which of the following statements is correct.

- A** The line and curve intersect only for a particular set of values of c .

- B** The line and curve intersect for all values of c .

- C** The line and curve do not intersect for any values of c . [4]

This image shows a single page of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.



[3]

This image shows a full page of white paper with horizontal dashed lines, typical of primary-ruled notebook paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

- 4** The transformation R denotes a reflection in the x -axis and the transformation T denotes a translation of $\begin{pmatrix} 3 \\ -1 \end{pmatrix}$.

- (a)** Find the equation, $y = g(x)$, of the curve with equation $y = x^2$ after it has been transformed by the sequence of transformations R followed by T. [2]

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- (b)** Find the equation, $y = h(x)$, of the curve with equation $y = x^2$ after it has been transformed by the sequence of transformations T followed by R. [2]

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- (c)** State fully the transformation that maps the curve $y = g(x)$ onto the curve $y = h(x)$. [2]

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- 5 (a) Show that the equation

$$4 \sin x + \frac{5}{\tan x} + \frac{2}{\sin x} = 0$$

may be expressed in the form $a \cos^2 x + b \cos x + c = 0$, where a , b and c are integers to be found. [3]

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- (b) Hence solve the equation $4 \sin x + \frac{5}{\tan x} + \frac{2}{\sin x} = 0$ for $0^\circ \leq x \leq 360^\circ$. [3]

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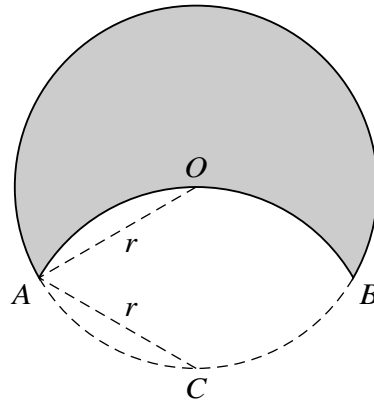
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The diagram shows a motif formed by the major arc AB of a circle with radius r and centre O , and the minor arc AOB of a circle, also with radius r but with centre C . The point C lies on the circle with centre O .

- (a) Given that angle $ACB = k\pi$ radians, state the value of the fraction k . [1]

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- (b) State the perimeter of the shaded motif in terms of π and r . [1]

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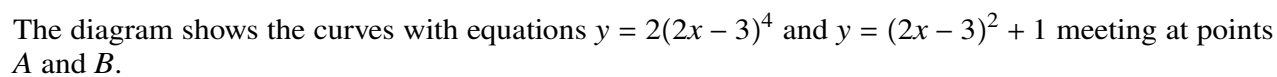
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- 7 The sum of the first two terms of a geometric progression is 15 and the sum to infinity is $\frac{125}{7}$. The common ratio of the progression is negative.

Find the third term of the progression.

[7]

[illegible]



- [illegible]

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

[5]

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- 9 (a) Express $4x^2 - 12x + 13$ in the form $(2x + a)^2 + b$, where a and b are constants. [2]

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The function f is defined by $f(x) = 4x^2 - 12x + 13$ for $p < x < q$, where p and q are constants. The function g is defined by $g(x) = 3x + 1$ for $x < 8$.

- (b) Given that it is possible to form the composite function gf , find the least possible value of p and the greatest possible value of q . [3]

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(c) Find an expression for $gf(x)$.

[1]

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The function h is defined by $h(x) = 4x^2 - 12x + 13$ for $x < 0$.

(d) Find an expression for $h^{-1}(x)$.

[3]

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10 A curve has a stationary point at $(2, -10)$ and is such that $\frac{d^2y}{dx^2} = 6x$.

(a) Find $\frac{dy}{dx}$. [3]

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(b) Find the equation of the curve. [3]

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- (c) Find the coordinates of the other stationary point and determine its nature. [3]

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- (d) Find the equation of the tangent to the curve at the point where the curve crosses the y -axis. [2]

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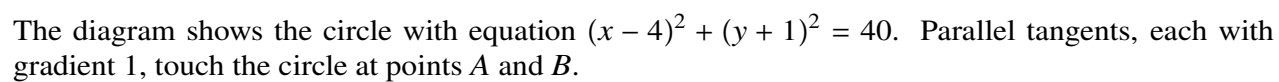
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(b) Find the coordinates of A , giving each coordinate in surd form.

[4]

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(c) Find the equation of the tangent at A , giving the answer in the form $y = mx + c$, where c is in surd form.

[2]

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[illegible]

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