

Cambridge International AS & A Level

CANDIDATE
NAME

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CENTRE
NUMBER

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MATHEMATICS

9709/11

Paper 1 Pure Mathematics 1

October/November 2020

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. Blank pages are indicated.

- 1** Find the set of values of m for which the line with equation $y = mx - 3$ and the curve with equation $y = 2x^2 + 5$ do not meet. [3]

This image shows a full page of white paper with horizontal dotted lines, typical of primary school writing 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.

- 2** The equation of a curve is such that $\frac{dy}{dx} = \frac{1}{(x-3)^2} + x$. It is given that the curve passes through the point (2, 7).

Find the equation of the curve.

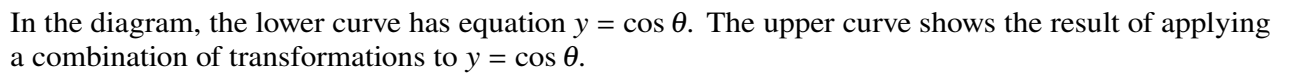
[4]

This image shows a single sheet 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** Air is being pumped into a balloon in the shape of a sphere so that its volume is increasing at a constant rate of $50 \text{ cm}^3 \text{ s}^{-1}$.

Find the rate at which the radius of the balloon is increasing when the radius is 10 cm. [3]

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[3]

This image shows a full page of white paper with horizontal dashed lines, typical of primary school writing 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.

- 5** In the expansion of $\left(2x^2 + \frac{a}{x}\right)^6$, the coefficients of x^6 and x^3 are equal.

(a) Find the value of the non-zero constant a .

[4]

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

(b) Find the coefficient of x^6 in the expansion of $(1 - x^3) \left(2x^2 + \frac{a}{x}\right)^6$.

[1]

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- 6** The equation of a curve is $y = 2 + \sqrt{25 - x^2}$.

Find the coordinates of the point on the curve at which the gradient is $\frac{4}{3}$. [5]

[illegible]

7 (a) Show that $\frac{\sin \theta}{1 - \sin \theta} - \frac{\sin \theta}{1 + \sin \theta} \equiv 2 \tan^2 \theta$. [3]

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.

(b) Hence solve the equation $\frac{\sin \theta}{1 - \sin \theta} - \frac{\sin \theta}{1 + \sin \theta} = 8$, for $0^\circ < \theta < 180^\circ$. [3]

- 8** A geometric progression has first term a , common ratio r and sum to infinity S . A second geometric progression has first term a , common ratio R and sum to infinity $2S$.

(a) Show that $r = 2R - 1$.

[3]

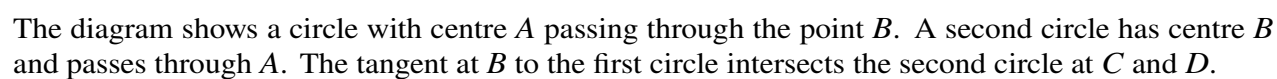
[illegible]

It is now given that the 3rd term of the first progression is equal to the 2nd term of the second progression.

(b) Express S in terms of a .

[4]

[illegible]



(a) Find the equation of the tangent CBD . [2]

[illegible]

- (b) Find an equation of the circle with centre B . [3]

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- (c) Find, by calculation, the x -coordinates of C and D . [3]

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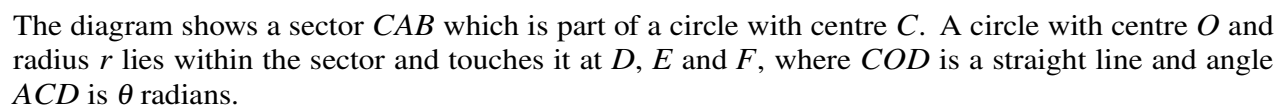
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It is now given that $r = 4$ and $\theta = \frac{1}{6}\pi$.

- (b) Find the perimeter of sector CAB in terms of π . [3]

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- (c) Find the area of the shaded region in terms of π and $\sqrt{3}$. [4]

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11 The functions f and g are defined by

$$\begin{aligned} f(x) &= x^2 + 3 \quad \text{for } x > 0, \\ g(x) &= 2x + 1 \quad \text{for } x > -\frac{1}{2}. \end{aligned}$$

(a) Find an expression for $fg(x)$. [1]

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(b) Find an expression for $(fg)^{-1}(x)$ and state the domain of $(fg)^{-1}$. [4]

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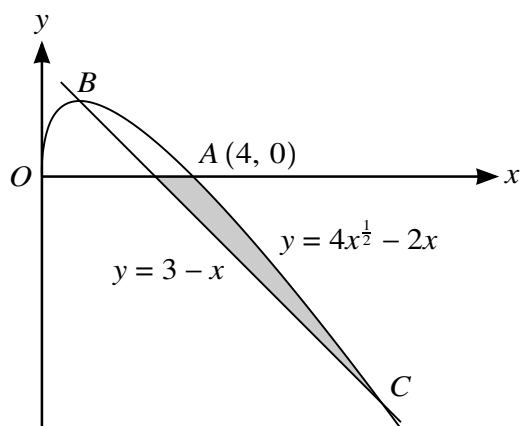
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(c) Solve the equation $fg(x) - 3 = gf(x)$.

[4]

[illegible]

12



The diagram shows a curve with equation $y = 4x^{\frac{1}{2}} - 2x$ for $x \geq 0$, and a straight line with equation $y = 3 - x$. The curve crosses the x -axis at $A(4, 0)$ and crosses the straight line at B and C .

- (a) Find, by calculation, the x -coordinates of B and C . [4]

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- (b) Show that B is a stationary point on the curve. [2]

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(c) Find the area of the shaded region.

[6]

[illegible]

[illegible]

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