

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]

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[4]

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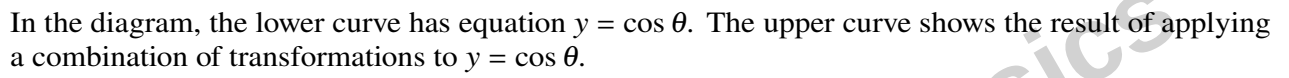
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- 3** Air is being pumped into a balloon in the shape of a sphere so that its volume is increasing at a constant rate of $50 \text{ cm}^3 \text{ s}^{-1}$.

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

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[3]

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- 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]

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- (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]

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

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- 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 $2S$.

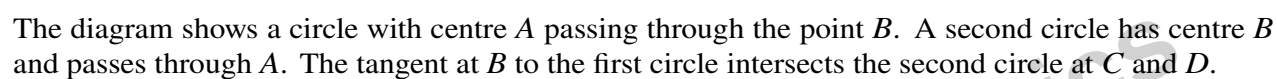
(a) Show that $r = 2R - 1$.

[3]

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[4]

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(a) Find the equation of the tangent CBD .

[2]

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- (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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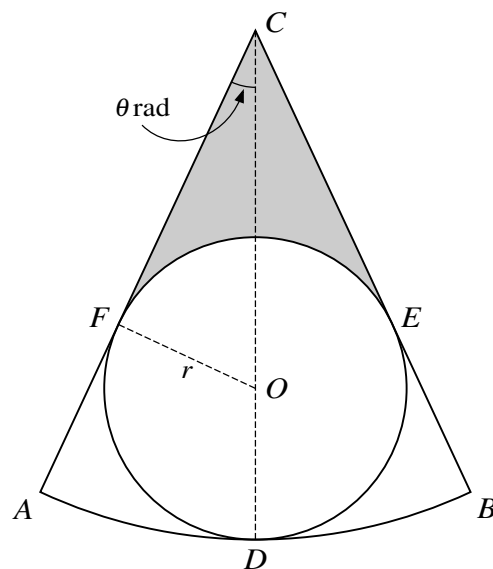
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The diagram shows a sector CAB which is part of a circle with centre C . A circle with centre O and radius r lies within the sector and touches it at D , E and F , where COD is a straight line and angle ACD is θ radians.

- (a) Find CD in terms of r and $\sin \theta$.

[3]

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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]

[illegible]

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

[4]

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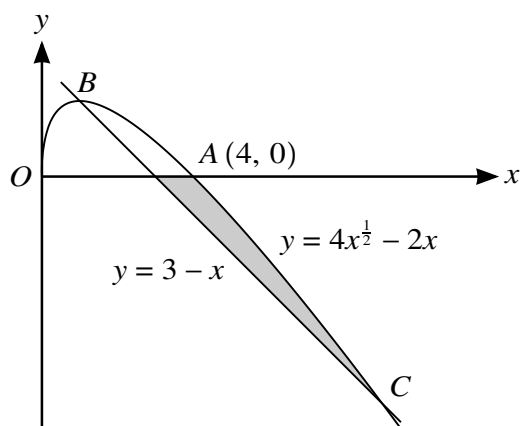
(c) Solve the equation $fg(x) - 3 = gf(x)$.

[4]

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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]

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