



Cambridge International AS & A Level

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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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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]

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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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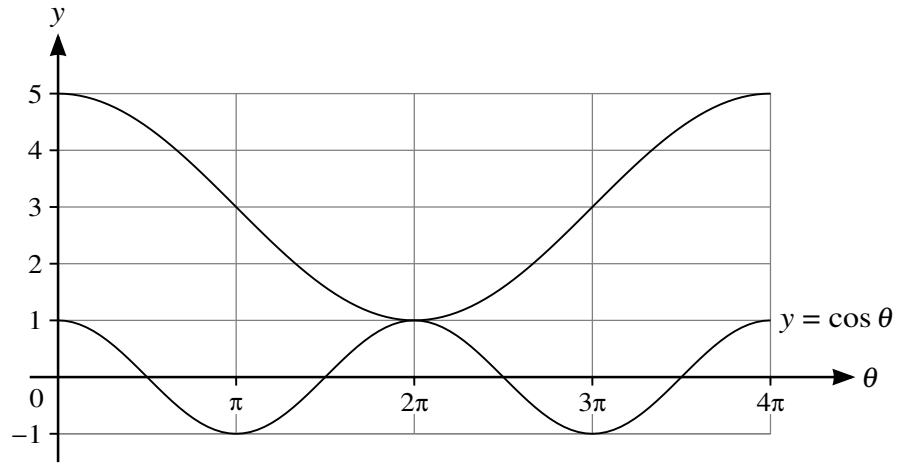
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In the diagram, the lower curve has equation $y = \cos \theta$. The upper curve shows the result of applying a combination of transformations to $y = \cos \theta$.

Find, in terms of a cosine function, the equation of the upper curve. [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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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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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]

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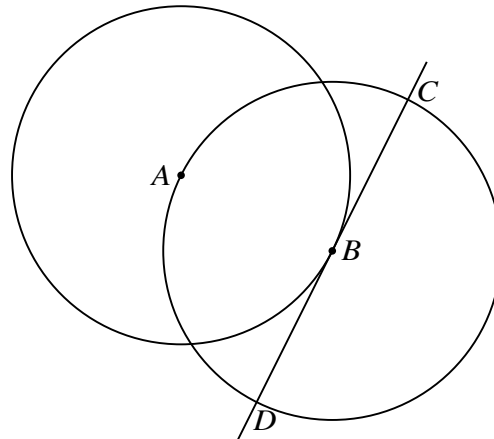
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The diagram shows a circle with centre A passing through the point B . A second circle has centre B and passes through A . The tangent at B to the first circle intersects the second circle at C and D .

The coordinates of A are $(-1, 4)$ and the coordinates of B are $(3, 2)$.

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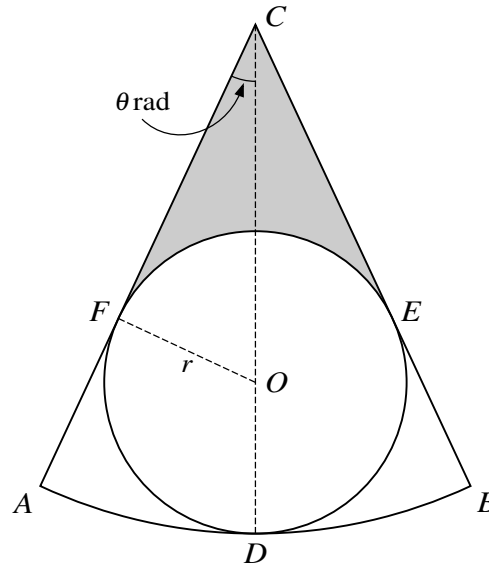
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The diagram shows a sector CAB which is part of a circle with centre C . A circle with centre O and radius r lies within the sector and touches it at D , E and F , where COD is a straight line and angle ACD is θ radians.

- (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

$$f(x) = x^2 + 3 \quad \text{for } x > 0,$$

$$g(x) = 2x + 1 \quad \text{for } x > -\frac{1}{2}.$$

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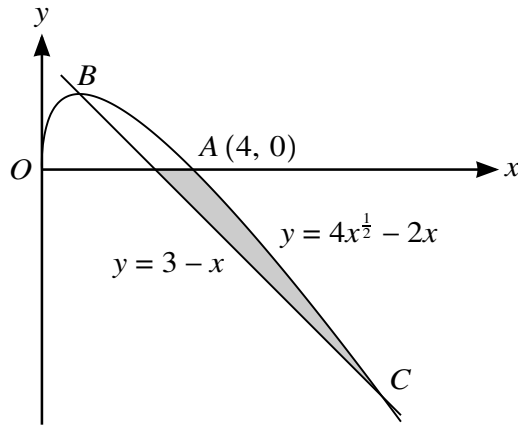
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The diagram shows a curve with equation $y = 4x^{\frac{1}{2}} - 2x$ for $x \geq 0$, and a straight line with equation $y = 3 - x$. The curve crosses the x -axis at $A(4, 0)$ and crosses the straight line at B and C .

(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]

Dotted lines for writing.

Additional Page

If you use the following lined page to complete the answer(s) to any question(s), the question number(s) must be clearly shown.

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