



Cambridge International AS & A Level

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MATHEMATICS

9709/11

Paper 1 Pure Mathematics 1

May/June 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.



3

2 The coefficient of $\frac{1}{x}$ in the expansion of $\left(kx + \frac{1}{x}\right)^5 + \left(1 - \frac{2}{x}\right)^8$ is 74.

Find the value of the positive constant k . [5]

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3 Each year the selling price of a diamond necklace increases by 5% of the price the year before. The selling price of the necklace in the year 2000 was \$36 000.

(a) Write down an expression for the selling price of the necklace n years later and hence find the selling price in 2008. [3]

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(b) The company that makes the necklace only sells one each year. Find the total amount of money obtained in the ten-year period starting in the year 2000. [2]

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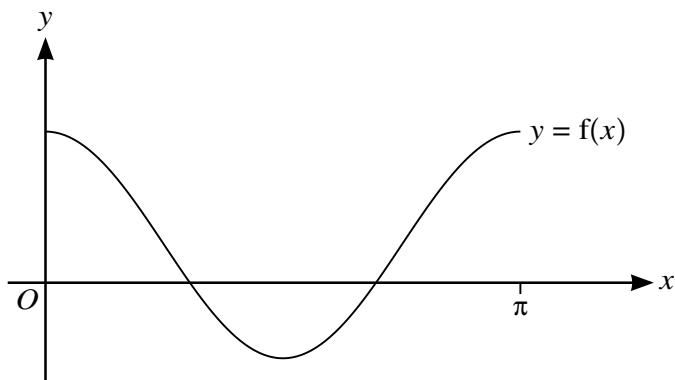
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The diagram shows the graph of $y = f(x)$, where $f(x) = \frac{3}{2} \cos 2x + \frac{1}{2}$ for $0 \leq x \leq \pi$.

- (a) State the range of f . [2]

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A function g is such that $g(x) = f(x) + k$, where k is a positive constant. The x -axis is a tangent to the curve $y = g(x)$.

- (b) State the value of k and hence describe fully the transformation that maps the curve $y = f(x)$ on to $y = g(x)$. [2]

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- (c) State the equation of the curve which is the reflection of $y = f(x)$ in the x -axis. Give your answer in the form $y = a \cos 2x + b$, where a and b are constants. [1]

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5 The equation of a line is $y = mx + c$, where m and c are constants, and the equation of a curve is $xy = 16$.

(a) Given that the line is a tangent to the curve, express m in terms of c . [3]

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(b) Given instead that $m = -4$, find the set of values of c for which the line intersects the curve at two distinct points. [3]

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6 Functions f and g are defined for $x \in \mathbb{R}$ by

$$f : x \mapsto \frac{1}{2}x - a,$$

$$g : x \mapsto 3x + b,$$

where a and b are constants.

(a) Given that $gg(2) = 10$ and $f^{-1}(2) = 14$, find the values of a and b . [4]

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(b) Using these values of a and b , find an expression for $gf(x)$ in the form $cx + d$, where c and d are constants. [2]

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- 7 (a) Prove the identity $\frac{1 + \sin \theta}{\cos \theta} + \frac{\cos \theta}{1 + \sin \theta} \equiv \frac{2}{\cos \theta}$. [3]

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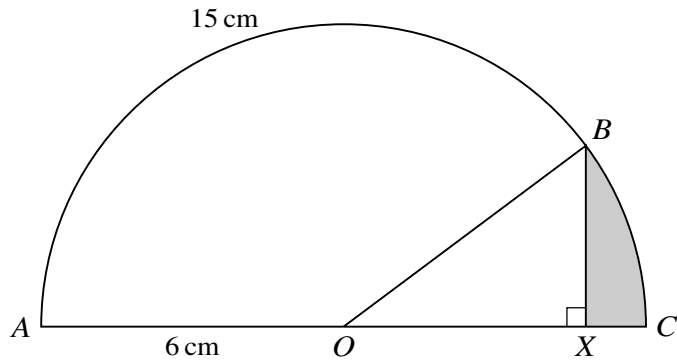
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(b) Hence solve the equation $\frac{1 + \sin \theta}{\cos \theta} + \frac{\cos \theta}{1 + \sin \theta} = \frac{3}{\sin \theta}$, for $0 \leq \theta \leq 2\pi$. [3]

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In the diagram, ABC is a semicircle with diameter AC , centre O and radius 6 cm . The length of the arc AB is 15 cm . The point X lies on AC and BX is perpendicular to AX .

Find the perimeter of the shaded region BXC . [6]

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9 The equation of a curve is $y = (3 - 2x)^3 + 24x$.

(a) Find expressions for $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$. [4]

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(b) Find the coordinates of each of the stationary points on the curve. [3]

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

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10 The coordinates of the points A and B are $(-1, -2)$ and $(7, 4)$ respectively.

(a) Find the equation of the circle, C , for which AB is a diameter.

[4]

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- (b) Find the equation of the tangent, T , to circle C at the point B . [4]

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- (c) Find the equation of the circle which is the reflection of circle C in the line T . [3]

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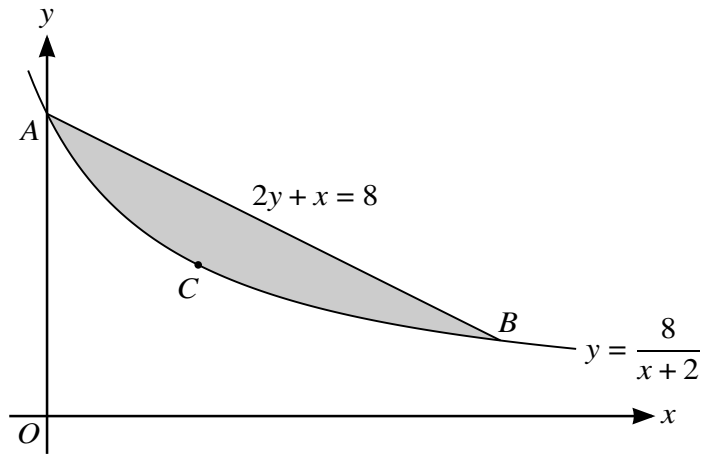
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The diagram shows part of the curve $y = \frac{8}{x+2}$ and the line $2y + x = 8$, intersecting at points A and B . The point C lies on the curve and the tangent to the curve at C is parallel to AB .

(a) Find, by calculation, the coordinates of A , B and C . [6]

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- (b) Find the volume generated when the shaded region, bounded by the curve and the line, is rotated through 360° about the x -axis. [6]

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Additional Page

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