

Cambridge International AS & A Level

CANDIDATE
NAME

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MATHEMATICS

9709/12

Paper 1 Pure Mathematics 1

May/June 2022

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.

- 1** The coefficient of x^4 in the expansion of $(3+x)^5$ is equal to the coefficient of x^2 in the expansion of $\left(2x + \frac{a}{x}\right)^6$.

Find the value of the positive constant a .

[4]

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- 2** The second and third terms of a geometric progression are 10 and 8 respectively.

Find the sum to infinity.

[4]

[illegible]

- 3** The equation of a curve is such that $\frac{dy}{dx} = 3(4x - 7)^{\frac{1}{2}} - 4x^{-\frac{1}{2}}$. It is given that the curve passes through the point $(4, \frac{5}{2})$.

Find the equation of the curve.

[4]

[illegible]

4 The first, second and third terms of an arithmetic progression are k , $6k$ and $k + 6$ respectively.

(a) Find the value of the constant k .

[2]

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(b) Find the sum of the first 30 terms of the progression.

[3]

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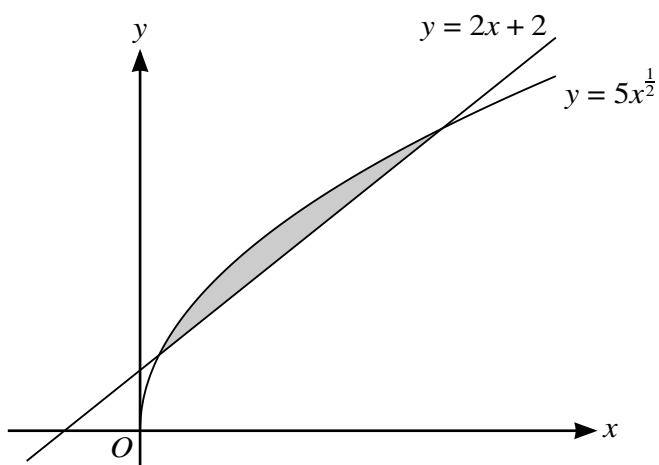
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- (a) Given that the curve and the line intersect at the points with x -coordinates 0 and $\frac{3}{4}$, find the values of k and a . [4]

[illegible]

- (b)** Given instead that $a = -\frac{7}{2}$, find the values of k for which the line is a tangent to the curve. [5]

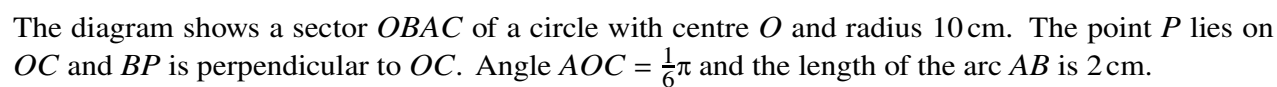
[illegible]



The diagram shows the curve with equation $y = 5x^{\frac{1}{2}}$ and the line with equation $y = 2x + 2$.

Find the exact area of the shaded region which is bounded by the line and the curve. [5]

[illegible]



- [illegible]

- (b) Hence find the area of the shaded region BPC giving your answer correct to 3 significant figures. [4]

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- 8** The equation of a circle is $x^2 + y^2 + ax + by - 12 = 0$. The points $A(1, 1)$ and $B(2, -6)$ lie on the circle.

(a) Find the values of a and b and hence find the coordinates of the centre of the circle. [4]

[illegible]

- (b)** Find the equation of the tangent to the circle at the point A , giving your answer in the form $px + qy = k$, where p , q and k are integers. [4]

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- 9 The equation of a curve is $y = 3x + 1 - 4(3x + 1)^{\frac{1}{2}}$ for $x > -\frac{1}{3}$.

(a) Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$. [3]

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- (b)** Find the coordinates of the stationary point of the curve and determine its nature. [4]

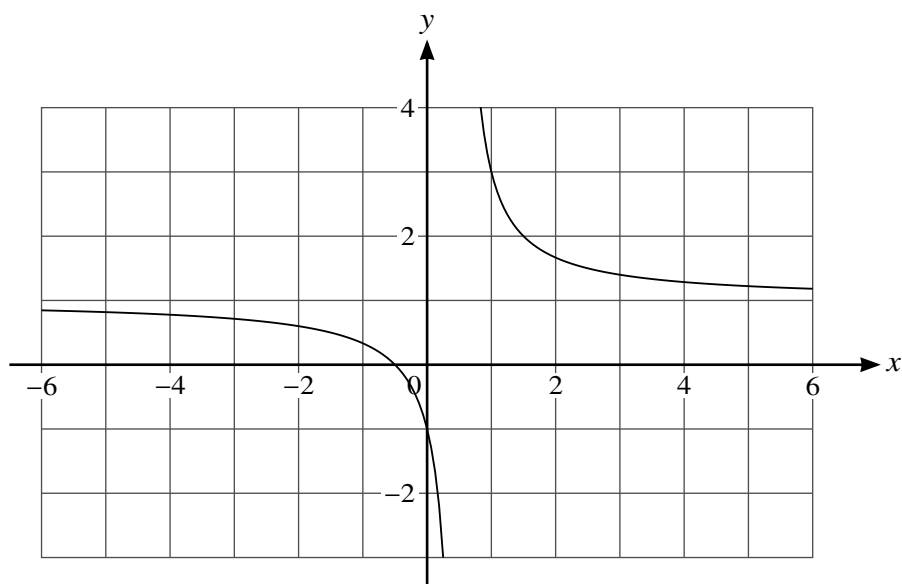
[illegible]

10 Functions f and g are defined as follows:

$$f(x) = \frac{2x+1}{2x-1} \quad \text{for } x \neq \frac{1}{2},$$

$$g(x) = x^2 + 4 \quad \text{for } x \in \mathbb{R}.$$

(a)



The diagram shows part of the graph of $y = f(x)$.

State the domain of f^{-1} .

[1]

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(b) Find an expression for $f^{-1}(x)$.

[3]

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(c) Find $gf^{-1}(3)$.

[2]

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- (d) Explain why $g^{-1}(x)$ cannot be found.

[1]

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- (e) Show that $1 + \frac{2}{2x-1}$ can be expressed as $\frac{2x+1}{2x-1}$. Hence find the area of the triangle enclosed by the tangent to the curve $y = f(x)$ at the point where $x = 1$ and the x - and y -axes. [6]

[illegible]

- 11** The function f is given by $f(x) = 4\cos^4 x + \cos^2 x - k$ for $0 \leq x \leq 2\pi$, where k is a constant.

(a) Given that $k = 3$, find the exact solutions of the equation $f(x) = 0$.

[5]

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)** Use the quadratic formula to show that, when $k > 5$, the equation $f(x) = 0$ has no solutions. [5]

This image shows a full page of a handwriting practice worksheet. It consists of multiple sets of three horizontal dotted lines, providing a guide for letter height and placement. The lines are evenly spaced across the entire page, leaving ample room for writing practice. There is no text or other markings on the page.

[illegible]

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