



Cambridge International AS & A Level

CANDIDATE
NAME

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CENTRE
NUMBER

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MATHEMATICS

9709/12

Paper 1 Pure Mathematics 1

February/March 2021

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. Any blank pages are indicated.



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- 1 (a) Find the first three terms in the expansion, in ascending powers of x , of $(1 + x)^5$. [1]

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- (b) Find the first three terms in the expansion, in ascending powers of x , of $(1 - 2x)^6$. [2]

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- (c) Hence find the coefficient of x^2 in the expansion of $(1 + x)^5(1 - 2x)^6$. [2]

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2 By using a suitable substitution, solve the equation

$$(2x-3)^2 - \frac{4}{(2x-3)^2} - 3 = 0. \quad [4]$$

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- 3** Solve the equation $\frac{\tan \theta + 2 \sin \theta}{\tan \theta - 2 \sin \theta} = 3$ for $0^\circ < \theta < 180^\circ$. [4]

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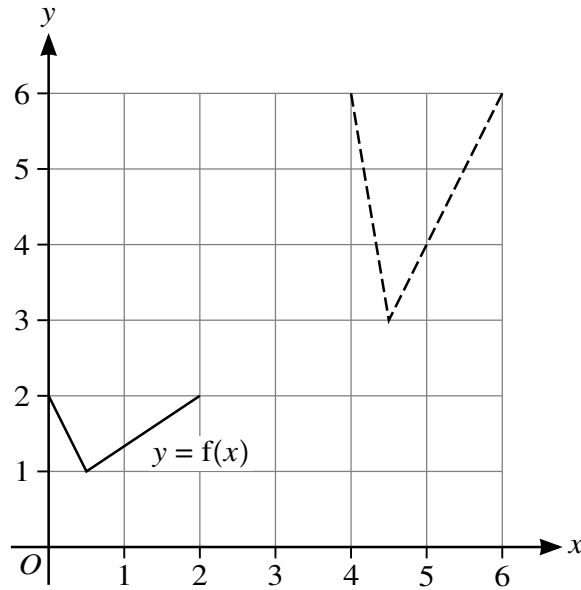
- 4** A line has equation $y = 3x + k$ and a curve has equation $y = x^2 + kx + 6$, where k is a constant.

Find the set of values of k for which the line and curve have two distinct points of intersection. [5]

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In the diagram, the graph of $y = f(x)$ is shown with solid lines. The graph shown with broken lines is a transformation of $y = f(x)$.

- (a) Describe fully the two single transformations of $y = f(x)$ that have been combined to give the resulting transformation. [4]

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- (b) State in terms of y , f and x , the equation of the graph shown with broken lines. [2]

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- 6** A curve is such that $\frac{dy}{dx} = \frac{6}{(3x-2)^3}$ and $A(1, -3)$ lies on the curve. A point is moving along the curve and at A the y -coordinate of the point is increasing at 3 units per second.

(a) Find the rate of increase at A of the x -coordinate of the point.

[3]

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7 Functions f and g are defined as follows:

$$f : x \mapsto x^2 + 2x + 3 \text{ for } x \leq -1,$$

$$g : x \mapsto 2x + 1 \text{ for } x \geq -1.$$

- (a) Express $f(x)$ in the form $(x + a)^2 + b$ and state the range of f . [3]

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- (b) Find an expression for $f^{-1}(x)$. [2]

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- (c) Solve the equation $gf(x) = 13$. [3]

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- 8** The points $A(7, 1)$, $B(7, 9)$ and $C(1, 9)$ are on the circumference of a circle.

(a) Find an equation of the circle.

[5]

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- (b) Find an equation of the tangent to the circle at B .

[2]

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9 The first term of a progression is $\cos \theta$, where $0 < \theta < \frac{1}{2}\pi$.

(a) For the case where the progression is geometric, the sum to infinity is $\frac{1}{\cos \theta}$.

(i) Show that the second term is $\cos \theta \sin^2 \theta$. [3]

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(ii) Find the sum of the first 12 terms when $\theta = \frac{1}{3}\pi$, giving your answer correct to 4 significant figures. [2]

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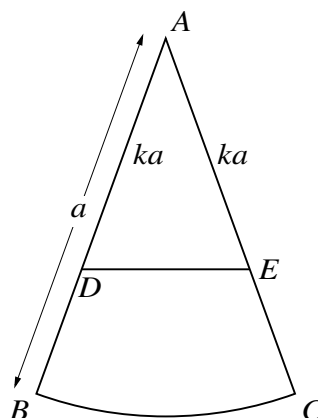
- (b)** For the case where the progression is arithmetic, the first two terms are again $\cos \theta$ and $\cos \theta \sin^2 \theta$ respectively.

Find the 85th term when $\theta = \frac{1}{3}\pi$.

[4]

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[illegible]

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- (b) For the general case in which angle $BAC = \theta$ radians, where $0 < \theta < \frac{1}{2}\pi$, it is given that $\frac{\theta}{\sin \theta} > 1$.

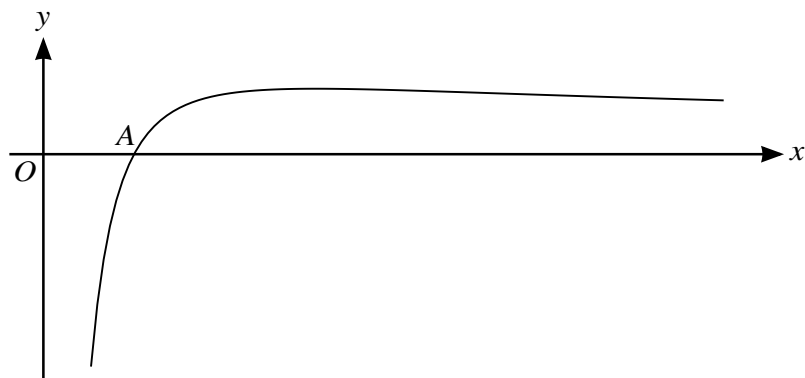
Find the set of possible values of k .

[3]

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The diagram shows the curve with equation $y = 9(x^{-\frac{1}{2}} - 4x^{-\frac{3}{2}})$. The curve crosses the x -axis at the point A .

(a) Find the x -coordinate of A .

[2]

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(b) Find the equation of the tangent to the curve at A .

[4]

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[2]

- [4]

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