Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

0123456789

MATHEMATICS **9709/01**

Paper 1 Pure Mathematics 1 **For examination from 2020**

SPECIMEN PAPER **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 [ ].

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1 The following points

$A(0, 1)$, $B(1, 6)$, $C(1.5, 7.75)$, $D(1.9, 8.79)$ and $E(2, 9)$

lie on the curve $y = \mathrm{f}(x)$. The table below shows the gradients of the chords AE and BE.

Chord	AE	BE	CE	DE
Gradient of chord	4	3		

(a) Complete the table to show the gradients of CE and DE. [2]

(b) State what the values in the table indicate about the value of $\mathrm{f}'(2)$. [1]

2 Functions f and g are defined by

$$f : x \mapsto 3x + 2, \quad x \in \mathbb{R},$$

$$g : x \mapsto 4x - 12, \quad x \in \mathbb{R}.$$

Solve the equation $f^{-1}(x) = gf(x)$. [4]

3 An arithmetic progression has first term 7. The nth term is 84 and the $(3n)$th term is 245.

Find the value of n. [4]

4 A curve has equation $y = \mathrm{f}(x)$. It is given that $\mathrm{f}'(x) = \dfrac{1}{\sqrt{x+6}} + \dfrac{6}{x^2}$ and that $\mathrm{f}(3) = 1$.

Find $\mathrm{f}(x)$. [5]

5 **(a)** The curve $y = x^2 + 3x + 4$ is translated by $\begin{pmatrix} 2 \\ 0 \end{pmatrix}$.

Find and simplify the equation of the translated curve. [2]

(b) The graph of $y = \mathrm{f}(x)$ is transformed to the graph of $y = 3\mathrm{f}(-x)$.

Describe fully the two single transformations which have been combined to give the resulting transformation. [3]

6 **(a)** Find the coefficients of x^2 and x^3 in the expansion of $(2 - x)^6$. [3]

(b) Hence find the coefficient of x^3 in the expansion of $(3x + 1)(2 - x)^6$. [2]

7 **(a)** Show that the equation $1 + \sin x \tan x = 5\cos x$ can be expressed as

$$6\cos^2 x - \cos x - 1 = 0.$$ [3]

(b) Hence solve the equation $1 + \sin x \tan x = 5 \cos x$ for $0 \leqslant x \leqslant 180$. [3]

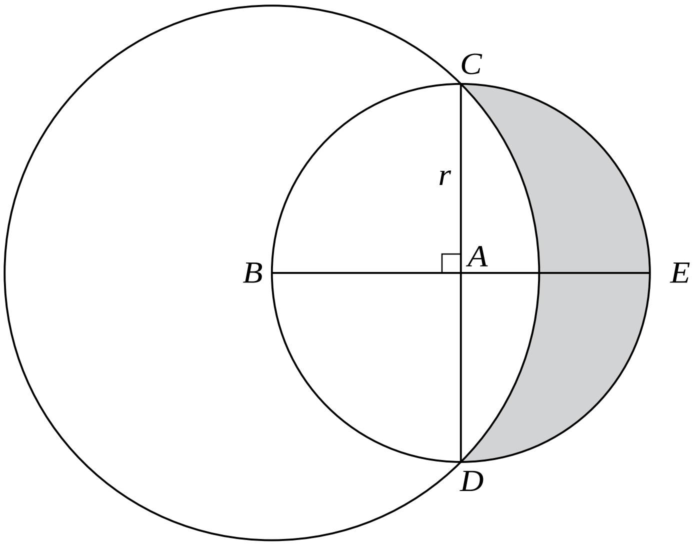
8 A curve has equation $y = \dfrac{12}{3-2x}$.

(a) Find $\dfrac{dy}{dx}$. [2]

A point moves along this curve. As the point passes through A, the x-coordinate is increasing at a rate of 0.15 units per second and the y-coordinate is increasing at a rate of 0.4 units per second.

(b) Find the possible x-coordinates of A. [4]

9



The diagram shows a circle with centre A and radius r. Diameters CAD and BAE are perpendicular to each other. A larger circle has centre B and passes through C and D.

(a) Show that the radius of the larger circle is $r\sqrt{2}$. [1]

(b) Find the area of the shaded region in terms of r. [6]

10 The circle $x^2 + y^2 + 4x - 2y - 20 = 0$ has centre C and passes through the points A and B.

(a) State the coordinates of C. [1]

It is given that the midpoint, D, of AB has coordinates $(1\frac{1}{2}, 1\frac{1}{2})$.

(b) Find the equation of AB, giving your answer in the form $y = mx + c$. [4]

(c) Find, by calculation, the x-coordinates of A and B. [3]

11 The function f is defined, for $x \in \mathbb{R}$, by f : $x \mapsto x^2 + ax + b$, where a and b are constants.

(a) It is given that $a = 6$ and $b = -8$.

Find the range of f. [3]

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(b) It is given instead that $a = 5$ and that the roots of the equation $f(x) = 0$ are k and $-2k$, where k is a constant.

Find the values of b and k. [3]

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(c) Show that if the equation $(x + a) = a$ has no real roots then $a^2 < 4(b - a)$. [3]

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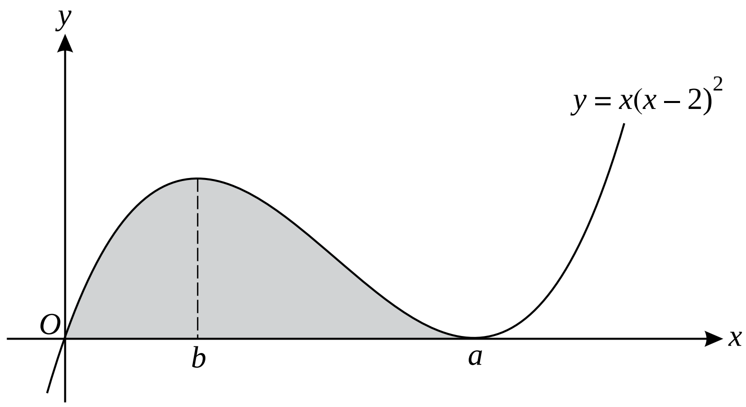

The diagram shows the curve with equation $y = x(x-2)^2$. The minimum point on the curve has coordinates $(a, 0)$ and the x-coordinate of the maximum point is b, where a and b are constants.

(a) State the value of a. [1]

(b) Calculate the value of b. [4]

(c) Find the area of the shaded region. [4]

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(d) The gradient, $\frac{dy}{dx}$, of the curve has a minimum value m.

Calculate the value of m. [4]

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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.