



## Cambridge International AS & A Level

CANDIDATE  
NAME

CENTRE  
NUMBER

--	--	--	--	--

CANDIDATE  
NUMBER

--	--	--	--



**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 [ ].

This document has **22** pages. Blank pages are indicated.

**BLANK PAGE**

1 The following points

$A(0, 1)$ ,  $B(1, 6)$ ,  $C(5, 5)$ ,  $D(9, 2)$  and  $E(2, 2)$

lie on the curve  $y = f(x)$ . 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 x-axis intercepts indicate about the value of  $f'(2)$ . [1]

.	.	.
.	.	.
.	.	.
.	.	.
.	.	.
.	.	.
.	.	.
.	.	.
.	.	.
.	.	.





## 6

4 A continuous function  $y=f(x)$  is given such that  $f'(x)=\frac{1}{\sqrt{x+6}}+\frac{6}{x^2}$  and  $f(3)=1$ . Find  $f(x)$ . [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  $y = f(x)$  is transformed to the graph  $y = f(-x)$ .

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 solve the equation  $\sin x \tan x = 5 \cos x$  for  $0 \leq x \leq \pi$ . [3]

.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.

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

(a) Find  $\frac{dy}{dx}$ .

[2]

.	.	.
.	.	.
.	.	.
.	.	.
.	.	.
.	.	.
.	.	.
.	.	.
.	.	.
.	.	.
.	.	.
.	.	.
.	.	.
.	.	.
.	.	.

A point moves along this curve. As the point passes through A, the x-coordinate is increasing at a rate of 4 units per second and the y-coordinate is increasing at a rate of 4 units per second.

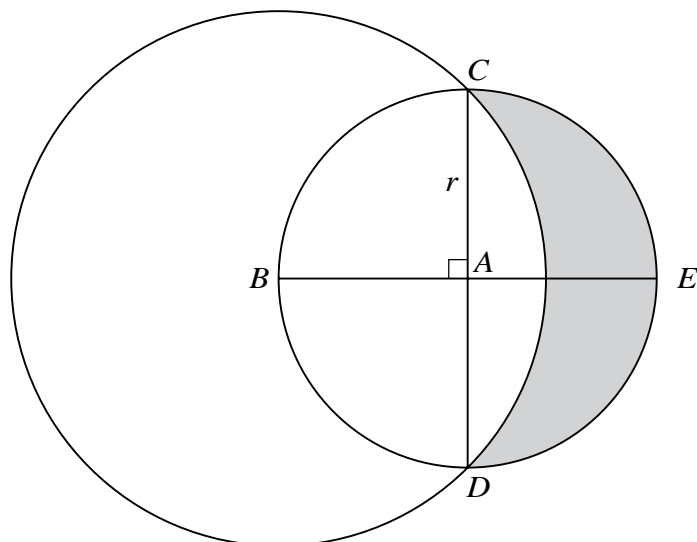
(b) Find the possible x-coordinates of A.

[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  $x^2 + y^2 + 4x - 2y - 4 = 0$  has centre  $C$  and passes through 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 calculations in  $x$ -coordinates of  $A$  and  $B$ .

[3]

- 
- 
- 
- 
- 
- 
- 
- 
- 
- 
- 
- 
- 
- 
- 
- 
- 
- 
- 
- 
-

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

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

Find the range of  $f$ .

[3]

•	•	•
•	•	•
•	•	•
•	•	•
•	•	•
•	•	•
•	•	•
•	•	•
•	•	•
•	•	•
•	•	•
•	•	•
•	•	•
•	•	•
•	•	•
•	•	•

(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]

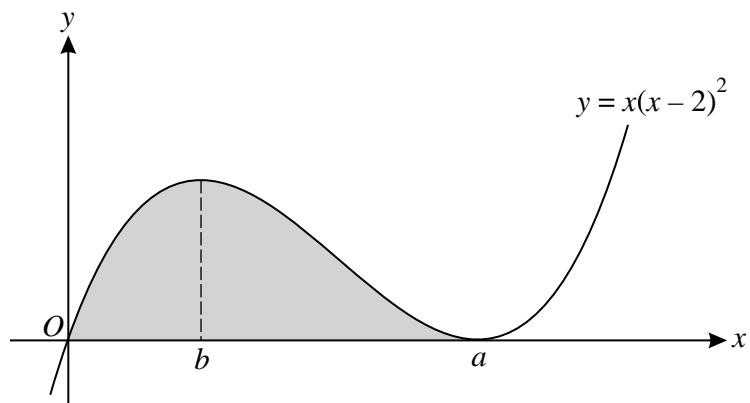
•	•	•
•	•	•
•	•	•
•	•	•
•	•	•
•	•	•
•	•	•
•	•	•
•	•	•
•	•	•

• •  
 • •  
 • •  
 • •  
 • •  
 • •  
 • •

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

• • • •  
 • • • •  
 • • • •  
 • • • •  
 • • • •  
 • • • •  
 • • • •  
 • • • •  
 • • • •  
 • • • •  
 • • • •  
 • • • •  
 • • • •  
 • • • •  
 • • • •  
 • • • •  
 • • • •  
 • • • •  
 • • • •  
 • • • •

12



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]

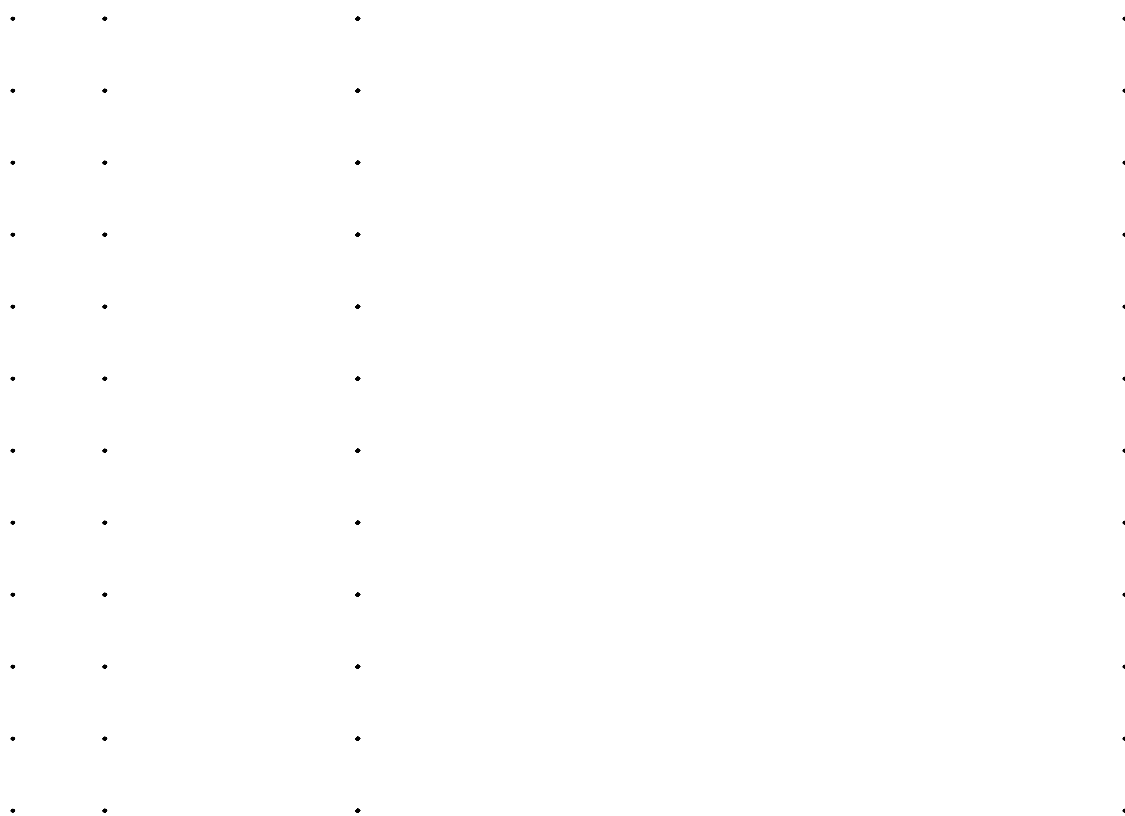
•	•
•	•
•	•
•	•

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

•	•
•	•
•	•
•	•
•	•
•	•
•	•
•	•
•	•
•	•
•	•
•	•
•	•
•	•
•	•
•	•
•	•

(c) Find the area of the shaded region

[4]



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

Calculate the value of  $m$ .

[4]



## Additional page

If you see the following line of page to complete the answer(s) to any question(s), the question number(s) must be clearly written

.	.	.
.	.	.
.	.	.
.	.	.
.	.	.
.	.	.
.	.	.
.	.	.
.	.	.
.	.	.
.	.	.
.	.	.
.	.	.
.	.	.
.	.	.
.	.	.
.	.	.
.	.	.
.	.	.
.	.	.
.	.	.
.	.	.
.	.	.
.	.	.

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

Cambridge Assessment International Education is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which itself is a department of the University of Cambridge.