

CANDIDATE  
NAME

--

CENTRE  
NUMBER

--	--	--	--	--

CANDIDATE  
NUMBER

--	--	--	--

**MATHEMATICS**

**9709/11**

Paper 1 Pure Mathematics 1 (P1)

**October/November 2017**

**1 hour 45 minutes**

Candidates answer on the Question Paper.

Additional Materials: List of Formulae (MF9)

**READ THESE INSTRUCTIONS FIRST**

Write your Centre number, candidate number and name in the spaces at the top of this page.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.

Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.

The use of an electronic calculator is expected, where appropriate.

You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

The total number of marks for this paper is 75.

This document consists of **19** printed pages and **1** blank page.













.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

**(iii)** Find the maximum volume of a cone that can be made by these machines. [1]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....





A series of 27 horizontal dotted lines spanning the width of the page, intended for handwritten responses.

6 The points  $A(1, 1)$  and  $B(5, 9)$  lie on the curve  $6y = 5x^2 - 18x + 19$ .

(i) Show that the equation of the perpendicular bisector of  $AB$  is  $2y = 13 - x$ . [4]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

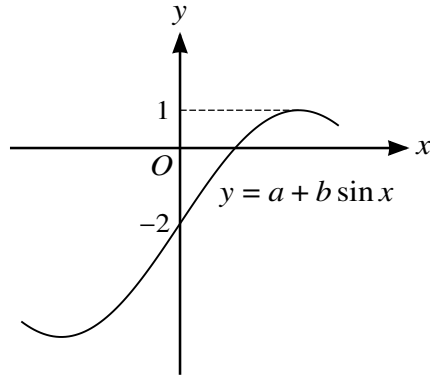
.....

.....

.....



7 (a)



The diagram shows part of the graph of  $y = a + b \sin x$ . Find the values of the constants  $a$  and  $b$ . [2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(b) (i) Show that the equation

$$(\sin \theta + 2 \cos \theta)(1 + \sin \theta - \cos \theta) = \sin \theta(1 + \cos \theta)$$

may be expressed as  $3 \cos^2 \theta - 2 \cos \theta - 1 = 0$ . [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(ii) Hence solve the equation

$$(\sin \theta + 2 \cos \theta)(1 + \sin \theta - \cos \theta) = \sin \theta(1 + \cos \theta)$$

for  $-180^\circ \leq \theta \leq 180^\circ$ . [4]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

- 8 (a) Relative to an origin  $O$ , the position vectors of two points  $P$  and  $Q$  are  $\mathbf{p}$  and  $\mathbf{q}$  respectively. The point  $R$  is such that  $PQR$  is a straight line with  $Q$  the mid-point of  $PR$ . Find the position vector of  $R$  in terms of  $\mathbf{p}$  and  $\mathbf{q}$ , simplifying your answer. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



9 Functions  $f$  and  $g$  are defined for  $x > 3$  by

$$f : x \mapsto \frac{1}{x^2 - 9},$$

$$g : x \mapsto 2x - 3.$$

(i) Find and simplify an expression for  $gg(x)$ . [2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(ii) Find an expression for  $f^{-1}(x)$  and state the domain of  $f^{-1}$ . [4]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



.....

.....

.....

.....

.....

.....

.....

.....

(iii) Solve the equation  $fg(x) = \frac{1}{7}$ .

[4]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

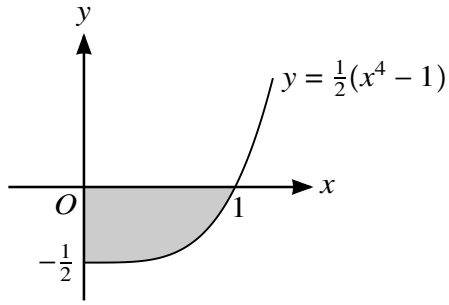
.....

.....

.....

.....

10



The diagram shows part of the curve  $y = \frac{1}{2}(x^4 - 1)$ , defined for  $x \geq 0$ .

- (i) Find, showing all necessary working, the area of the shaded region. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

- (ii) Find, showing all necessary working, the volume obtained when the shaded region is rotated through  $360^\circ$  about the  $x$ -axis. [4]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(iii) Find, showing all necessary working, the volume obtained when the shaded region is rotated through  $360^\circ$  about the  $y$ -axis. [5]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

**BLANK PAGE**

---

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.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at [www.cie.org.uk](http://www.cie.org.uk) after the live examination series.

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