

CANDIDATE  
NAME

--

CENTRE  
NUMBER

--	--	--	--	--

CANDIDATE  
NUMBER

--	--	--	--

**MATHEMATICS**

**9709/13**

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.



**1** An arithmetic progression has first term  $-12$  and common difference  $6$ . The sum of the first  $n$  terms exceeds  $3000$ . Calculate the least possible value of  $n$ . [4]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



- 3 (i) Find the term independent of  $x$  in the expansion of  $\left(\frac{2}{x} - 3x\right)^6$ . [2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

- (ii) Find the value of  $a$  for which there is no term independent of  $x$  in the expansion of

$$(1 + ax^2)\left(\frac{2}{x} - 3x\right)^6. \quad [3]$$

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

- 4 The function  $f$  is such that  $f(x) = (2x - 1)^{\frac{3}{2}} - 6x$  for  $\frac{1}{2} < x < k$ , where  $k$  is a constant. Find the largest value of  $k$  for which  $f$  is a decreasing function. [5]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

5 (i) Show that the equation  $\frac{\cos \theta + 4}{\sin \theta + 1} + 5 \sin \theta - 5 = 0$  may be expressed as  $5 \cos^2 \theta - \cos \theta - 4 = 0$ . [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



6 The functions f and g are defined by

$$f(x) = \frac{2}{x^2 - 1} \text{ for } x < -1,$$
$$g(x) = x^2 + 1 \text{ for } x > 0.$$

(i) Find an expression for  $f^{-1}(x)$ . [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

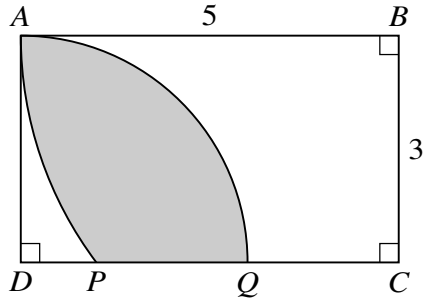
.....

.....





7



The diagram shows a rectangle  $ABCD$  in which  $AB = 5$  units and  $BC = 3$  units. Point  $P$  lies on  $DC$  and  $AP$  is an arc of a circle with centre  $B$ . Point  $Q$  lies on  $DC$  and  $AQ$  is an arc of a circle with centre  $D$ .

- (i) Show that angle  $ABP = 0.6435$  radians, correct to 4 decimal places. [1]

.....

.....

.....

.....

.....

.....

.....

.....

.....

- (ii) Calculate the areas of the sectors  $BAP$  and  $DAQ$ . [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(iii) Calculate the area of the shaded region.

[3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....





9 Relative to an origin  $O$ , the position vectors of the points  $A$ ,  $B$  and  $C$  are given by

$$\vec{OA} = \begin{pmatrix} 8 \\ -6 \\ 5 \end{pmatrix}, \quad \vec{OB} = \begin{pmatrix} -10 \\ 3 \\ -13 \end{pmatrix} \quad \text{and} \quad \vec{OC} = \begin{pmatrix} 2 \\ -3 \\ -1 \end{pmatrix}.$$

A fourth point,  $D$ , is such that the magnitudes  $|\vec{AB}|$ ,  $|\vec{BC}|$  and  $|\vec{CD}|$  are the first, second and third terms respectively of a geometric progression.

(i) Find the magnitudes  $|\vec{AB}|$ ,  $|\vec{BC}|$  and  $|\vec{CD}|$ . [5]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



10 A curve has equation  $y = f(x)$  and it is given that  $f'(x) = ax^2 + bx$ , where  $a$  and  $b$  are positive constants.

- (i) Find, in terms of  $a$  and  $b$ , the non-zero value of  $x$  for which the curve has a stationary point and determine, showing all necessary working, the nature of the stationary point. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

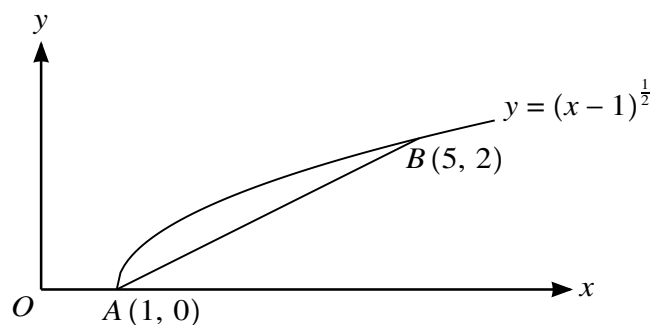
.....

.....





11



The diagram shows the curve  $y = (x - 1)^{\frac{1}{2}}$  and points  $A(1, 0)$  and  $B(5, 2)$  lying on the curve.

- (i) Find the equation of the line  $AB$ , giving your answer in the form  $y = mx + c$ . [2]

.....

.....

.....

.....

.....

.....

- (ii) Find, showing all necessary working, the equation of the tangent to the curve which is parallel to  $AB$ . [5]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(iii) Find the perpendicular distance between the line  $AB$  and the tangent parallel to  $AB$ . Give your answer correct to 2 decimal places. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

**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.