

CANDIDATE
NAME

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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]

This image shows a full page of primary-ruled paper. It features approximately 20 horizontal dotted lines spaced evenly down the page, providing a guide for handwriting practice. The paper is otherwise blank, with no margins, text, or other markings.

- 2** Find the set of values of a for which the curve $y = -\frac{2}{x}$ and the straight line $y = ax + 3a$ meet at two distinct points. [4]

This image shows a full page of white paper with horizontal dashed lines, typical of primary-ruled notebook paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

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

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

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

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- 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]

This image shows a single page of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

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]

This image shows a full page of primary-ruled paper. It features approximately 20 horizontal dotted lines spaced evenly down the page, providing a guide for handwriting practice. The paper is otherwise blank, with no margins, text, or other markings.

(ii) Hence solve the equation $\frac{\cos \theta + 4}{\sin \theta + 1} + 5 \sin \theta - 5 = 0$ for $0^\circ \leq \theta \leq 360^\circ$. [4]

[illegible]

6 The functions f and g are defined by

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

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

[3]

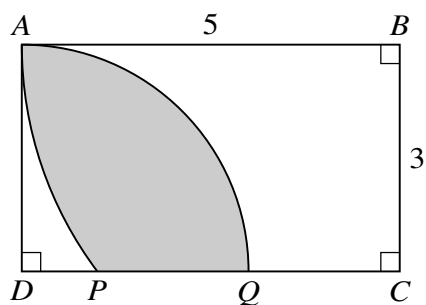
This image shows a full page of a handwriting practice worksheet. It consists of multiple sets of three horizontal dotted lines spaced evenly down the page, providing a guide for letter height and placement. The background is plain white, and there are no other markings or text present.

(ii) Solve the equation $gf(x) = 5$.

[4]

[illegible]

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]

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

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(iii) Calculate the area of the shaded region.

[3]

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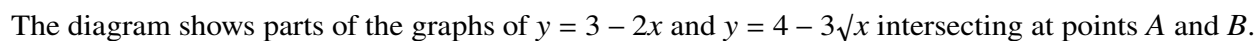
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- [illegible]

- (ii)** Find, showing all necessary working, the area of the shaded region.

[5]

[illegible]

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

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

This image shows a full page of white paper with horizontal dotted lines. The lines are evenly spaced and run across the width of the page, providing a guide for handwriting practice. There are no margins, text, or other markings on the page.

- (ii) Given that D is a point lying on the line through B and C , find the two possible position vectors of the point D . [4]

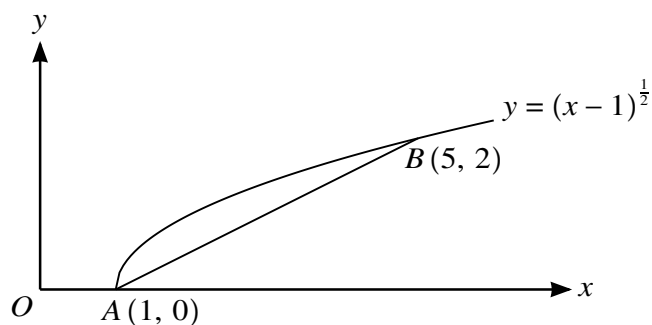
This image shows a full page of white paper with horizontal dashed lines, typical of primary school handwriting practice paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

- 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]

This image shows a full page of a document template designed for handwriting practice or general writing. It consists of approximately 20 evenly spaced horizontal dotted lines across the entire width of the page. The background is plain white, and there are no margins, headers, footers, or other markings present.

- (ii)** It is now given that the curve has a stationary point at $(-2, -3)$ and that the gradient of the curve at $x = 1$ is 9. Find $f(x)$. [6]

This image shows a full page of white paper with horizontal dotted lines. The lines are evenly spaced and run across the width of the page, providing a guide for handwriting practice. There are no margins, text, or other markings on the page.



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]

This image shows a full page of white paper with ten horizontal dashed lines, typical of primary school handwriting practice paper. The lines are evenly spaced and extend across the entire width of the page. There is no text or other markings on the paper.

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

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