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## MATHEMATICS

**9709/23**

Paper 2 Pure Mathematics 2 (P2)

May/June 2017

**1 hour 15 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 50.

This document consists of **11** printed pages and **1** blank page.

- 1 Solve the equation  $|x + a| = |2x - 5a|$ , giving  $x$  in terms of the positive constant  $a$ . [3]

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- 2 Use logarithms to solve the equation  $3^{x+4} = 5^{2x}$ , giving your answer correct to 3 significant figures. [4]

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- 3 (i) By sketching a suitable pair of graphs, show that the equation

$$x^3 = 11 - 2x$$

has exactly one real root.

[2]

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- (ii) Use the iterative formula

$$x_{n+1} = \sqrt[3]{11 - 2x_n}$$

to find the root correct to 4 significant figures. Give the result of each iteration to 6 significant figures. [3]

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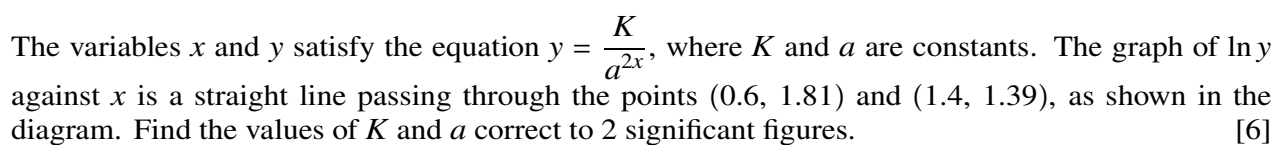
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- This image shows a full page of white paper with horizontal dotted lines, typical of primary school writing paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

[illegible]

- 6** (i) Use the factor theorem to show that  $(x + 2)$  is a factor of the expression

$$6x^3 + 13x^2 - 33x - 70$$

and hence factorise the expression completely.

[5]

[illegible]



**7 (a)** Find  $\int (2 \cos \theta - 3)(\cos \theta + 1) \, d\theta$ .

[4]

This image shows a full page of a handwriting practice worksheet. It consists of multiple sets of three horizontal dotted lines, providing a guide for letter height and placement. The lines are evenly spaced across the entire page, leaving ample room for writing practice. There is no text or other markings on the page.

- (b) (i) Find  $\int \left( \frac{4}{2x+1} + \frac{1}{2x} \right) dx$ . [2]

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- (ii) Hence find  $\int_1^4 \left( \frac{4}{2x+1} + \frac{1}{2x} \right) dx$ , giving your answer in the form  $\ln k$ . [3]

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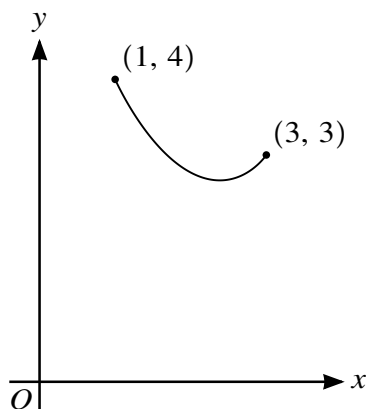
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$x = 2 - \cos 2t, \quad y = 2 \sin^3 t + 3 \cos^3 t + 1$   
for  $0 \leq t \leq \frac{1}{2}\pi$ . The end-points of the curve are (1, 4) and (3, 3).

(i) Show that  $\frac{dy}{dx} = \frac{3}{2} \sin t - \frac{9}{4} \cos t$ . [5]

[illegible]

- (ii) Find the coordinates of the minimum point, giving each coordinate correct to 3 significant figures. [3]

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- (iii) Find the exact gradient of the normal to the curve at the point for which  $x = 2$ . [3]

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