Cambridge International AS Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary Level

MATHEMATICS **9709/23**

Paper 2 Pure Mathematics 2 **(P2)** **May/June 2015**

1 hour 15 minutes

* 2 2 5 8 6 8 5 2 3 9 *

Additional Materials: Answer Booklet/Paper
Graph Paper
List of Formulae (MF9)

READ THESE INSTRUCTIONS FIRST

If you have been given an Answer Booklet, follow the instructions on the front cover of the Booklet.
Write your Centre number, candidate number and name on all the work you hand in.
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.
Questions carrying smaller numbers of marks are printed earlier in the paper, and questions carrying larger numbers of marks later in the paper.

This document consists of **3** printed pages and **1** blank page.

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1 **(i)** Use logarithms to solve the equation $2^x = 20^5$, giving the answer correct to 3 significant figures. [2]

(ii) Hence determine the number of integers n satisfying

$$20^{-5} < 2^n < 20^5. \quad [2]$$

2 **(i)** Given that $(x + 2)$ is a factor of

$$4x^3 + ax^2 - (a + 1)x - 18,$$

find the value of the constant a. [3]

(ii) When a has this value, factorise $4x^3 + ax^2 - (a + 1)x - 18$ completely. [3]

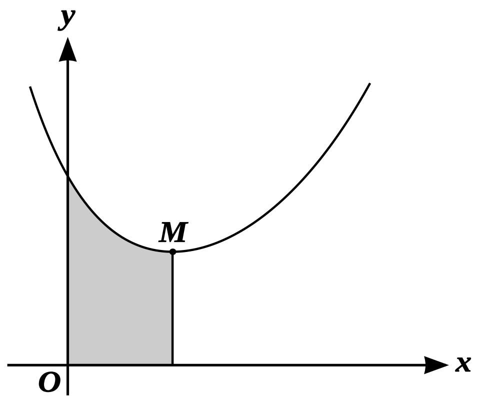
3 It is given that θ is an acute angle measured in degrees such that

$$2\sec^2\theta + 3\tan\theta = 22.$$

(i) Find the value of $\tan\theta$. [3]

(ii) Use an appropriate formula to find the exact value of $\tan(\theta + 135°)$. [3]

4



The diagram shows the curve $y = e^x + 4e^{-2x}$ and its minimum point M.

(i) Show that the x-coordinate of M is $\ln 2$. [3]

(ii) The region shaded in the diagram is enclosed by the curve and the lines $x = 0$, $x = \ln 2$ and $y = 0$. Use integration to show that the area of the shaded region is $\frac{5}{2}$. [4]

5 **(i)** By sketching a suitable pair of graphs, show that the equation

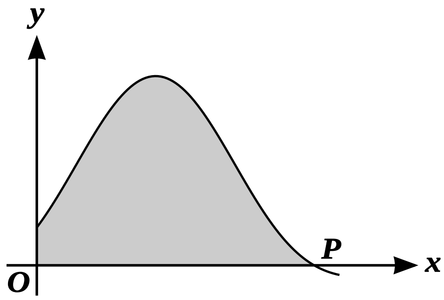
$$|3x| = 16 - x^4$$

has two real roots. [3]

(ii) Use the iterative formula $x_{n+1} = \sqrt[4]{(16 - 3x_n)}$ to find one of the real roots correct to 3 decimal places. Give the result of each iteration to 5 decimal places. [3]

(iii) Hence find the coordinates of each of the points of intersection of the graphs $y = |3x|$ and $y = 16 - x^4$, giving your answers correct to 3 decimal places. [2]

6



The diagram shows part of the curve with equation

$$y = 4\sin^2 x + 8\sin x + 3$$

and its point of intersection P with the x-axis.

(i) Find the exact x-coordinate of P. [3]

(ii) Show that the equation of the curve can be written

$$y = 5 + 8\sin x - 2\cos 2x,$$

and use integration to find the exact area of the shaded region enclosed by the curve and the axes. [6]

7 **(a)** Find the gradient of the curve

$$3\ln x + 4\ln y + 6xy = 6$$

at the point $(1, 1)$. [4]

(b) The parametric equations of a curve are

$$x = \frac{10}{t} - t, \qquad y = \sqrt{(2t - 1)}.$$

Find the gradient of the curve at the point $(-3, 3)$. [6]

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