



Cambridge Pre-U

MATHEMATICS

9794/02

Paper 2 Pure Mathematics 2

May/June 2023

2 hours



You must answer on the answer booklet/paper.

You will need: Answer booklet/paper
Graph paper
List of formulae (MF20)

INSTRUCTIONS

- Answer **all** questions.
- If you have been given an answer booklet, follow the instructions on the front cover of the answer booklet.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number on all the work you hand in.
- Do **not** use an erasable pen or correction fluid.
- You should use a calculator where appropriate.
- You must show all necessary working clearly; no marks will be given for unsupported answers from a calculator.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- At the end of the examination, fasten all your work together. Do **not** use staples, paper clips or glue.

INFORMATION

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [].

This syllabus is regulated for use in England, Wales and Northern Ireland as a Cambridge International Level 3 Pre-U Certificate.

This document has 4 pages. Any blank pages are indicated.

- 1 (a) Show that $x + 1$ is a factor of $4x^3 + 8x^2 + x - 3$. [2]
(b) Hence solve the equation $4x^3 + 8x^2 + x - 3 = 0$. [4]
- 2 In an arithmetic progression, the first term is 32, the last term is 14 and the sum of the terms is 299. Find the number of terms and the common difference. [4]
- 3 Functions f and g are defined for all real values of x by $f(x) = x^2 + 2$ and $g(x) = 3x + 5$.
- (a) State the range of f and the range of g . [2]
(b) Find the value of $gf(4)$. [2]
(c) State, with a reason, which of f and g does not have an inverse. [1]
- 4 Solve the equation $\cos 2\theta = 2 \cos \theta$ for $0^\circ < \theta < 360^\circ$. [5]
- 5 A curve is given parametrically by $x = 3t - \ln(3t)$, $y = t^3 - \ln(t^3)$, where $t > 0$. Find the exact value of t at the point on the curve at which the gradient is 3. [5]
- 6 (a) Find $\int xe^{2x} dx$. [3]
(b) Determine, in exact form, $\int_{\frac{1}{12}\pi}^{\frac{1}{6}\pi} \cos^2(3x) dx$. [5]
- 7 (a) Expand $\frac{1}{\sqrt{1+2x}}$ as a series of ascending powers of x , up to and including the term in x^3 . Express each coefficient in its simplest form. [4]
(b) Hence determine the coefficient of x^2 in the expansion of $\frac{(2-3x)^2}{\sqrt{1+2x}}$. [3]
- 8 (a) Express $\frac{2x^2+1}{x(x-1)^2}$ as the sum of three partial fractions. [5]
(b) Hence show that $\int_2^4 \frac{2x^2+1}{x(x-1)^2} dx = p + \ln q$, where p and q are integers to be found. [5]

- 9 (a) Give full details of a sequence of transformations which maps the graph of $y = e^x$ onto the graph of $y = e^{2-x}$. [2]
- (b) Sketch, on the same diagram, the graphs of $y = e^{2-x}$ and $y = \ln(x+1)$, and hence show that the equation $e^{2-x} = \ln(x+1)$ has only one root. [3]
- (c) This root may be found using the iterative formula $x_{n+1} = 2 - \ln(\ln(x_n + 1))$. Using a starting value of 1.5, and showing the result of each iteration, find the value of this root correct to 3 significant figures. [3]

10 The equation of a curve C is $x^2 + 2xy + 3y^2 = 18$.

- (a) Show that the equation of the normal to C at the point $(5, -1)$ can be written as $x = 2y + 7$. [6]
- (b) Find the exact coordinates of the point where this normal meets C again. [4]

11 The fixed line L has vector equation $\mathbf{r} = \begin{pmatrix} 2 \\ -4 \\ 5 \end{pmatrix} + \lambda \begin{pmatrix} 4 \\ 1 \\ 1 \end{pmatrix}$.

For each value of the parameter t , the line $M(t)$ is given by the equation $\mathbf{r} = \begin{pmatrix} 7 \\ 1 \\ 2 \end{pmatrix} + \mu \begin{pmatrix} 3 \\ 2 \\ t \end{pmatrix}$.

- (a) Determine the value of t for which
- (i) L and $M(t)$ are perpendicular; [2]
- (ii) L and $M(t)$ intersect. [5]

(b) The point $P(30, 3, 12)$ is on L and the line $M(-1)$ has equation $\mathbf{r} = \begin{pmatrix} 7 + 3\mu \\ 1 + 2\mu \\ 2 - \mu \end{pmatrix}$.

The point Q lies on $M(-1)$.

- (i) Show that $(PQ)^2 = 14\mu^2 - 126\mu + 633$. [2]
- (ii) Given now that Q is the point on $M(-1)$ which is closest to P , find the coordinates of Q . [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 Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

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