UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
Cambridge International Level 3 Pre-U Certificate
Principal Subject

**MATHEMATICS** **9794/02**
Paper 2 Pure Mathematics 2 **For Examination from 2012**

ADDITIONAL PRACTICE PAPER **2 hours**

Additional Materials: Answer Booklet/Paper
Graph Paper
List of Formulae (MF20)

**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 a soft pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

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 a 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 80.

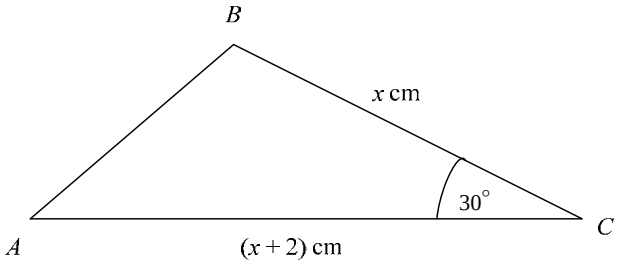
**1** **(a)** Express each of the following as a single logarithm.

**(i)** $\log_a 5 + \log_a 3$ [1]

**(ii)** $5\log_b 2 - 3\log_b 4$ [3]

**(b)** Express $\left(9a^4\right)^{-\frac{1}{2}}$ as an algebraic fraction in its simplest form. [2]

**2**




The diagram shows a triangle $ABC$ in which angle $C = 30^\circ$, $BC = x$ cm and $AC = (x + 2)$ cm. Given that the area of triangle $ABC$ is 12 cm$^2$, calculate the value of $x$. [5]

**3** Solve the simultaneous equations

$$x + y = 1, \qquad x^2 - xy + y^2 = 7.$$ [6]

**4** Find

**(i)** $\int (2x + 3)^4 \, dx$ [3]

**(ii)** $\int \left(1 + \tan^2 2x\right) dx$ [2]

**5** When $x^4 - 4x^3 + 5x^2 + x + a$ is divided by $x^2 - x + 1$, the quotient is $x^2 + bx + 1$ and the remainder is $cx - 3$. Find the values of the constants $a$, $b$ and $c$. [5]

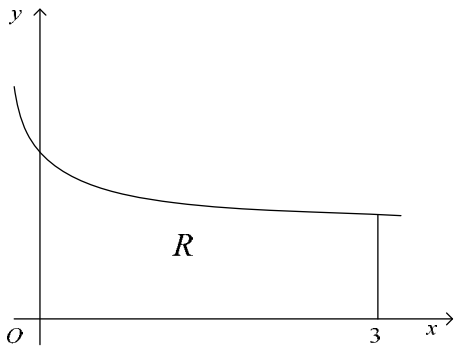
**6** The complex number 5 – 3i is denoted by $z$. Giving your answers in the form $x + iy$, and showing clearly how you obtain them, find

**(i)** $6z - z^*$, [2]

**(ii)** $(z - i)^2$, [3]

**(iii)** $\dfrac{5}{z}$. [3]

**7**




The diagram shows the region $R$ bounded by the curve $y = \dfrac{1}{\sqrt{5x+3}}$ and the lines $x = 0$, $x = 3$ and $y = 0$. Find the exact volume of the solid formed when the region $R$ is rotated completely about the $x$-axis, simplifying your answer. [5]

**8**

**(i)** Express $\dfrac{3x+2}{(x-2)^2}$ in the form $\dfrac{A}{x-2} + \dfrac{B}{(x-2)^2}$ where $A$ and $B$ are constants. [3]

**(ii)** Hence find the exact value of $\displaystyle\int_6^{10} \frac{3x+2}{(x-2)^2}\,\mathrm{d}x$, giving your answer in the form $a + b\ln c$, where $a$, $b$ and $c$ are integers. [6]

**9** The parametric equations of a curve are

$$x = \mathrm{e}^{2t} - 5t, \qquad y = \mathrm{e}^{2t} - 2t\,.$$

**(i)** Find $\dfrac{\mathrm{d}y}{\mathrm{d}x}$ in terms of $t$. [3]

**(ii)** Find the exact value of $t$ at the point on the curve where the gradient is 2. [5]

**10** Lines $L_1, L_2$ and $L_3$ have vector equations

$$L_1 = (4\mathbf{i} + \mathbf{j} + 3\mathbf{k}) + s(6\mathbf{i} + 9\mathbf{j} - 3\mathbf{k}),$$
$$L_2 = (2\mathbf{i} + 3\mathbf{j}) + t(-3\mathbf{i} - 8\mathbf{j} + 6\mathbf{k}),$$
$$L_3 = (3\mathbf{i} - \mathbf{j} + 4\mathbf{k}) + u(-2\mathbf{i} + c\mathbf{j} + \mathbf{k}).$$

In each of the following cases, find the value of $c$.

**(i)** $L_1$ and $L_3$ are parallel. [2]

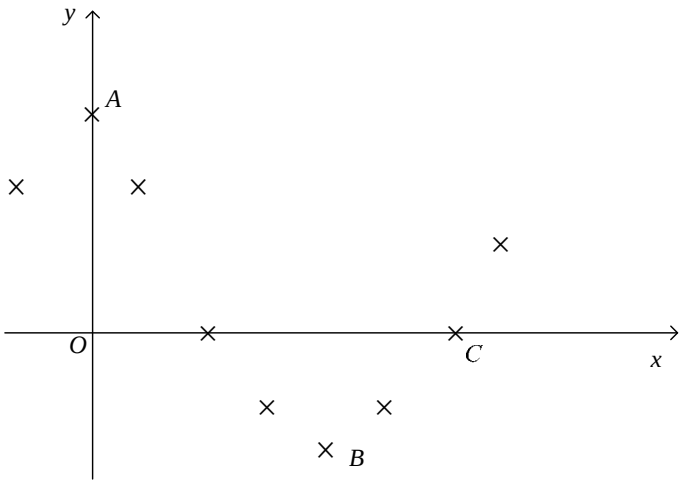
**(ii)** $L_2$ and $L_3$ intersect. [5]

**11** A curve has equation

$$y = \mathrm{e}^{ax} \cos bx$$

where $a$ and $b$ are constants.

**(i)** Show that, at any stationary points on the curve, $\tan bx = \frac{a}{b}$. [4]




Values of related quantities $x$ and $y$ were measured in an experiment and plotted on a graph of $y$ against $x$, as shown in the diagram. Two of the points, labelled $A$ and $B$, have coordinates (0, 1) and (0.2, –0.8) respectively. A third point labelled C has coordinates (0.3, 0.04). Attempts were then made to find the equation of a curve which fitted closely to these three points, and two models were proposed.

**(ii)** In the first model the equation is

$$y = \mathrm{e}^{-x} \cos 12x \,.$$

Show that this model has a maximum point close to $A$ and a minimum point close to $B$, and state the coordinates of these maximum and minimum points and also the $y$ value when $x = 0.3$. [5]

**(iii)** In an alternative model the equation is

$$y = f \cos(\lambda x) + g \,,$$

where the constants $f$, $\lambda$ and $g$ are chosen to give a maximum precisely at the point $A$ (0, 1) and a minimum precisely at the point $B$ (0.2, –0.8). Find suitable values for $f$, $\lambda$ and $g$. [5]

**(iv)** Using the alternative model, state the value of $y$ when $x = 0.3$ and hence comment on how accurate each model is in fitting the three given points. [2]