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

MATHEMATICS **9794/01**

Paper 1 Pure Mathematics 1 **May/June 2013**

2 hours

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

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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 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 80.

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

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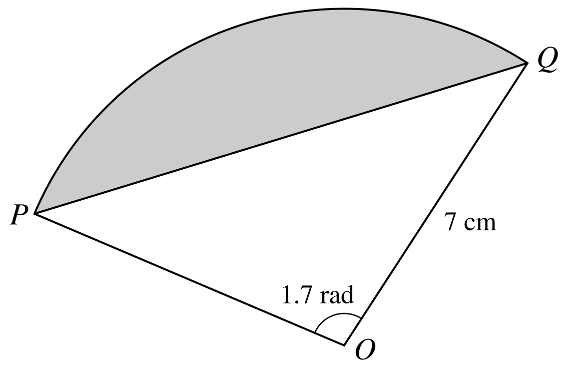
1 A is the point $(2,\ 1)$ and B is the point $(10,\ 7)$. Find the coordinates of the mid-point of AB and the length of AB. [3]

2 Find the coefficient of x^3 in the expansion of $(1-2x)^5$. [4]

3 A sector, POQ, of a circle centre O has radius 7 cm and angle 1.7 radians (see diagram).



(i) Find the length of the line PQ. [3]

(ii) Hence find the perimeter of the shaded area. [2]

4 Solve the equation $2^{5x} = 15$, giving the value of x correct to 3 significant figures. [4]

5 **(i)** Find $\int (3x^2 - 4x + 8)\,\mathrm{d}x$. [3]

(ii) Hence find $\int_1^3 (3x^2 - 4x + 8)\,\mathrm{d}x$. [2]

6 **(i)** Sketch the graph of $y = \cos 2x$ for $0 \leqslant x \leqslant 2\pi$. [2]

(ii) Describe the transformation which maps the graph of $y = \cos x$ onto the graph of $y = \cos 2x$. [3]

7 The complex number z is given by $-20 + 21\mathrm{i}$. Showing all your working,

(i) find the value of $|z|$, [2]

(ii) calculate the value of $\arg z$ correct to 3 significant figures, [2]

(iii) express $\dfrac{1}{z}$ in the form $x + \mathrm{i}y$, where x and y are real numbers. [2]

8 **(i)** Let $\mathrm{f}(x) = x^3 - x - 1$. Use a sign change method to show that the equation $x^3 - x - 1 = 0$ has a root between $x = 1$ and $x = 2$. [2]

(ii) By taking $x = 1$ as a first approximation to this root, use the Newton-Raphson formula to find this root correct to 3 decimal places. [4]

9 **(i)** Show that $\sin\theta + \sqrt{3}\cos\theta$ can be expressed in the form $R\sin(\theta + \alpha)$ where $R > 0$ and $0 < \alpha < \frac{1}{2}\pi$. State the values of R and α. [4]

(ii) Hence find the value of θ, where $0 < \theta < \pi$, such that $\sin\theta + \sqrt{3}\cos\theta = 0.8$. [4]

10 Two intersecting straight lines have equations

$$\frac{x-5}{4} = \frac{y-11}{3} = \frac{z-7}{-5} \qquad \text{and} \qquad \frac{x-9}{-2} = \frac{y-4}{1} = \frac{z+4}{4}.$$

Find the coordinates of their point of intersection. [6]

11 A curve has parametric equations given by

$$x = 2\sin\theta, \quad y = \cos 2\theta.$$

(i) Show that $\frac{\mathrm{d}y}{\mathrm{d}x} = -2\sin\theta$. [4]

(ii) Hence find the equation of the tangent to the curve at $\theta = \frac{1}{2}\pi$. [3]

(iii) Find the cartesian equation of the curve. [3]

12 **(i)** Prove the identity $\frac{1}{(x+h)^2} - \frac{1}{x^2} \equiv \frac{-2hx - h^2}{x^2(x+h)^2}$. [3]

(ii) Given that $\mathrm{f}(x) = x^{-2}$, use differentiation from first principles to find an expression for $\mathrm{f}'(x)$. [3]

13 By first factorising completely $x^3 + x^2 - 5x + 3$, find $\int \frac{2x^2 + x + 1}{x^3 + x^2 - 5x + 3}\,\mathrm{d}x$. [12]

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