Cambridge International Examinations
Cambridge Pre-U Certificate

MATHEMATICS (PRINCIPAL) **9794/01**

Paper 1 Pure Mathematics 1 **May/June 2017**

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 an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, 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.

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

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

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1 The equation of a circle is given by $(x-3)^2 + (y-2)^2 = r^2$.

(i) Write down the coordinates of the centre of the circle. [1]

(ii) The circle passes through the point (0, 2). Find the length of the diameter. [2]

2 Express each of the following as a single logarithm.

(i) $\log 3 + \log 4 - \log 2$ [2]

(ii) $2\log x - 3\log y + 2\log z$ [3]

3 A triangle ABC has sides AB, BC and CA of lengths 7 cm, 6 cm and 8 cm respectively.

(i) Show that $\cos ABC = \frac{1}{4}$. [3]

(ii) Find the area of triangle ABC. [3]

4 Solve the equation $\sin 2x = \sqrt{3}\cos x$ for $0° < x < 360°$. [4]

5 Solve $|x - \sqrt{3}| < |x + 2\sqrt{3}|$ giving the answer in exact form. [5]

6 **(i)** Expand $(1+x)^{\frac{1}{2}}$, for $|x| < 1$, in ascending powers of x up to and including the term in x^3, simplifying the coefficients. [4]

(ii) In the expansion of $(2+kx)(1+x)^{\frac{1}{2}}$ the coefficient of x^3 is 1. Find the value of k. [3]

7 **(i)** Describe the transformation which maps the graph of $y = \ln x$ onto the graph of $y = \ln(1+x)$. [2]

(ii) By sketching the curves $y = \ln(1+x)$ and $y = 4 - x$ on a single diagram, show that the equation

$$\ln(1+x) = 4 - x$$

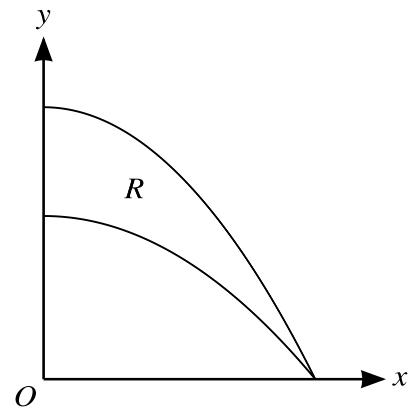
has exactly one root. [3]

(iii) Use the Newton-Raphson method with $x_0 = 2$ to find the root of the equation $\ln(1+x) = 4 - x$ correct to 3 decimal places. Show the result of each iteration. [4]

8 The curve C has equation $y^3 + 6y^2 - 2y = 3x^2 + 2x$. Show that the equation of the normal to C at the point (1, 1) can be written in the form $8y + 13x - 21 = 0$. [7]

9 Solve the equation $z^3 + 6z - 20 = 0$. Find the modulus and argument of each root and illustrate the roots on an Argand diagram. [9]

10



The diagram shows the region R in the first quadrant bounded by the curves $y = \frac{1}{3}(9 - x^2)$ and $y = \frac{1}{5}(9 - x^2)$. R is rotated through 360° about the y-axis. Calculate the volume of the solid formed. [7]

11 The points A and B have position vectors $2\mathbf{i} + \mathbf{j} - 3\mathbf{k}$ and $3\mathbf{i} - 2\mathbf{j} - \mathbf{k}$ respectively, relative to the origin O. The point P lies on OA extended so that $\overrightarrow{OP} = 3\overrightarrow{OA}$ and the point Q lies on OB extended so that $\overrightarrow{OQ} = 2\overrightarrow{OB}$.

(i) Find the coordinates of the point of intersection of the lines AQ and BP. [7]

(ii) Find the acute angle between the lines AQ and BP. [3]

12 Boyle's Law states that when a gas is kept at a constant temperature, its pressure P pascals is inversely proportional to its volume $V\,\text{m}^3$.

When the volume of a certain gas is $80\,\text{m}^3$, its pressure is 5 pascals and the rate at which the volume is increasing is $10\,\text{m}^3\,\text{s}^{-1}$. Find the rate at which the pressure is decreasing at this volume. [8]

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