Cambridge International Examinations
Cambridge Pre-U Certificate

MATHEMATICS (PRINCIPAL) **9794/01**

Paper 1 Pure Mathematics 1 **For Examination from 2016**

SPECIMEN PAPER

2 hours

0123456789

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 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 80.

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

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

1 A circle has equation $(x-4)^2+(y+7)^2=64$.

(i) Write down the coordinates of the centre and the radius of the circle. [2]

Two points, A and B, lie on the circle and have coordinates (4, 1) and (12, –7) respectively.

(ii) Find the coordinates of the midpoint of the chord AB. [2]

2 The equation of a curve is $y=x^3-2x^2-4x+3$.

(i) Find $\frac{\mathrm{d}y}{\mathrm{d}x}$. [2]

(ii) Hence find the coordinates of the stationary points on the curve. [4]

3 Let $\mathrm{f}(x)=x^2$ and $\mathrm{g}(x)=7x-2$ for all real values of x.

(i) Give a reason why f has no inverse function. [1]

(ii) Write down an expression for $\mathrm{gf}(x)$. [2]

(iii) Find $\mathrm{g}^{-1}(x)$. [2]

(iv) Explain the relationship between the graph of $y=\mathrm{g}(x)$ and $y=\mathrm{g}^{-1}(x)$. [2]

4 **(i)** Show that $x=2$ is a root of the equation $2x^3-x^2-15x+18=0$. [1]

(ii) Hence solve the equation $2x^3-x^2-15x+18=0$. [5]

5 The coefficient of x^3 in the expansion of $(2+ax)^5$ is 10 times the coefficient of x^2 in $\left(1+\frac{ax}{3}\right)^4$. Find a. [4]

6 Solve the simultaneous equations

$$x+y=1, \quad x^2-2xy+y^2=9.$$ [6]

7 **(i)** Express $\frac{8x-1}{(2x-1)(x+1)}$ in the form $\frac{A}{2x-1}+\frac{B}{x+1}$ where A and B are constants. [4]

(ii) Hence show that $\int_2^5 \frac{8x-1}{(2x-1)(x+1)}\,\mathrm{d}x=\ln 24$. [5]

8 Given that the equation $x^3+2x-7=0$ has a root between x = 1 and x = 2, use the Newton-Raphson formula with x_0 = 1 to find this root correct to 3 decimal places. [4]

9 The complex number $3 - 4\mathrm{i}$ is denoted by z. Giving your answers in the form $x + \mathrm{i}y$, and showing clearly how you obtain them, find

(i) $2z + z^*$, [2]

(ii) $\dfrac{5}{z}$. [2]

(iii) Show z and z^* on an Argand diagram. [2]

10 **(i)** Prove that $\cot\theta + \dfrac{\sin\theta}{1+\cos\theta} = \operatorname{cosec}\theta$. [4]

(ii) Hence solve the equation $\cot\left(\theta + \dfrac{\pi}{4}\right) + \dfrac{\sin\left(\theta + \dfrac{\pi}{4}\right)}{1+\cos\left(\theta + \dfrac{\pi}{4}\right)} = \dfrac{5}{2}$ for $0 \leqslant \theta \leqslant 2\pi$. [4]

11 An arithmetic progression has first term a and common difference d. The first, ninth and fourteenth terms are, respectively, the first three terms of a geometric progression with common ratio r, where $r \neq 1$.

(i) Find d in terms of a and show that $r = \frac{5}{8}$. [7]

(ii) Find the sum to infinity of the geometric progression in terms of a. [2]

12 **(i)** Use integration by parts to show that $\int \ln x \,\mathrm{d}x = x\ln x - x + c$. [2]

(ii) Find

(a) $\int (\ln x)^2 \,\mathrm{d}x$, [4]

(b) $\int \dfrac{\ln(\ln x)}{x} \,\mathrm{d}x$. [5]

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