Cambridge Assessment International Education

Cambridge Pre-U

MATHEMATICS **9794/01**

Paper 1 Pure Mathematics 1 **For examination from 2020**

SPECIMEN PAPER **2 hours**

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You must answer on the answer booklet/paper.

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

INSTRUCTIONS

- Answer **all** questions.
- Follow the instructions on the front cover of the answer booklet. If you need additional answer paper, ask the invigilator for a continuation booklet.
- 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.

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. Blank pages are indicated.

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

(a) 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.

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

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

(a) Find $\frac{dy}{dx}$. [2]

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

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

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

(b) Write down an expression for $gf(x)$. [2]

(c) Find $g^{-1}(x)$. [2]

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

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

(b) 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 **(a)** 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]

(b) Hence show that $\int_2^5 \frac{8x - 1}{(2x - 1)(x + 1)}\,dx = \ln 24$. [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 $3 - 4i$ is denoted by z. Giving your answers in the form $x + iy$, and showing clearly how you obtain them, find

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

(b) $\frac{5}{z}$. [2]

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

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

(b) 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 $r \neq 1$.

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

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

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

(b) Find

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

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

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