Cambridge Assessment International Education

# Cambridge Pre-U

**MATHEMATICS** **9794/02**

Paper 2 Pure Mathematics 2 **May/June 2022**

**2 hours**

* 9 4 8 1 9 3 3 9 1 4 *

You must answer on the answer booklet/paper.

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

**INSTRUCTIONS**

- Answer **all** questions.
- If you have been given an answer booklet, follow the instructions on the front cover of the answer booklet.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number on all the work you hand in.
- Do **not** use an erasable pen or correction fluid.
- 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.
- At the end of the examination, fasten all your work together. Do **not** use staples, paper clips or glue.

**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. Any blank pages are indicated.

**1** Solve $|2x - 3| = |x - 1|$. [3]

**2** The points $P$ and $Q$ have coordinates $(1, 7)$ and $(9, 3)$ respectively.

**(a)** Find the equation of the perpendicular bisector of $PQ$, giving your answer in the form $y = mx + c$. [4]

**(b)** Find the area of the triangle enclosed by the $x$-axis, the $y$-axis and the perpendicular bisector of $PQ$. [2]

**3** **(a)** Express $(1 - x)(x - 4)$ in the form $a - (x - b)^2$, where $a$ and $b$ are constants to be found. [3]

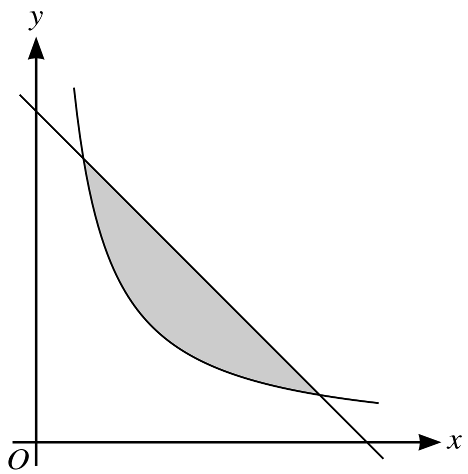
**(b)** State the coordinates of the maximum point of the curve $y = (1 - x)(x - 4) + \frac{3}{4}$. [2]

**4** The points $A$ and $B$ have position vectors $3\mathbf{i} - \mathbf{j} + 2\mathbf{k}$ and $-2\mathbf{i} + \mathbf{j} + 3\mathbf{k}$ respectively, relative to the origin $O$. The line $L$ passes through $A$ and $B$.

**(a)** Given that $L$ is parallel to the vector $10\mathbf{i} + a\mathbf{j} + b\mathbf{k}$, find the values of $a$ and $b$. [3]

**(b)** Given also that $L$ is perpendicular to the vector $2\mathbf{i} + \mathbf{j} + c\mathbf{k}$, find the value of $c$. [2]

**5**




The diagram shows part of the curve $xy = 6$ and part of the line $y = 7 - x$. Find the exact area of the region enclosed by the curve and the line, shaded on the diagram. [6]

**6** Solve the equation $7\cos\theta - 4\sin\theta = 3$ for $0° < \theta < 360°$. [7]

**7** A geometric progression, $u_1, u_2, u_3, \ldots$, has first term $u_1 = a$ and common ratio $r$, where $|r| < 1$.

The sum to infinity of the series $u_1 + u_2 + u_3 + \ldots$ is 8.

The sum to infinity of the series consisting of the even-numbered terms, $u_2 + u_4 + u_6 + \ldots$, is 2.

Determine the value of $a$ and the value of $r$. [7]

**8** **(a)** Find the two complex numbers $z$ which satisfy both $\frac{z}{z^*} = \frac{3}{5} + \frac{4}{5}\mathrm{i}$ and $zz^* = 5$. Give your answers in the form $z = x + \mathrm{i}y$. [6]

**(b)** Sketch on an Argand diagram the locus of points given by $|w - 4| = |w + 2\mathrm{i}|$, for complex numbers $w$. [2]

**9** A triangle has sides $p - q$, $p$ and $p + q$, where $p > q > 0$. The largest angle of the triangle is $\alpha$.

**(a)** Use the cosine rule to show that $\cos\alpha = \frac{p - 4q}{2(p - q)}$. [4]

**(b)** Given that $p = 7$ and $q = 1$, find the exact area of the triangle. [3]

**(c)** Given instead that $\alpha = 150°$, find an expression for $p$ in terms of $q$. [3]

**10** A curve has equation $y = \frac{1 - x^2}{1 + x^2}$.

**(a)** **(i)** Show that $\frac{\mathrm{d}y}{\mathrm{d}x} = -\frac{4x}{(1 + x^2)^2}$. [3]

**(ii)** Find $\frac{\mathrm{d}^2y}{\mathrm{d}x^2}$ in terms of $x$, simplifying your answer. [4]

**(b)** The curve crosses the $x$-axis at two points $A$ and $B$. Show that the tangents to the curve at $A$ and $B$ intersect at a point $C$ on the $y$-axis. [3]

**(c)** Show that $C$ is a maximum point of the curve. [3]

**11** It is given that $k > \ln 5$ and that $\int_{\ln 5}^{k} \frac{10}{\mathrm{e}^x - 3 - 4\mathrm{e}^{-x}}\,\mathrm{d}x = \ln 25$.

Using the substitution $u = \mathrm{e}^x$, or otherwise, determine the exact value of the constant $k$. [10]

**BLANK PAGE**