**Cambridge Assessment International Education**
Cambridge Pre-U Certificate

**MATHEMATICS (PRINCIPAL)** **9794/02**

Paper 2 Pure Mathematics 2 **May/June 2019**

**2 hours**

*7860084372*

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 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.

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

This document consists of **4** printed pages.

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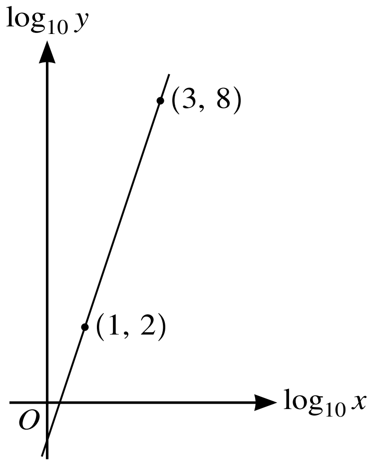
1 A polynomial is defined by $f(x) = x^3 + ax^2 - 3ax - 12$, where $a$ is a constant.

**(a)** Given that $(x + 2)$ is a factor of $f(x)$, find $a$. [3]

**(b)** Find the remainder when $f(x)$ is divided by $(x - 3)$. [2]

2 Solve the equation $2\cos x = \tan x(1 + 4\sin x)$ for $0° \leqslant x \leqslant 360°$. [6]

3




The diagram shows the graph of $\log_{10} y$ against $\log_{10} x$. This graph is a straight line which passes through the points (1, 2) and (3, 8).

**(a)** Find an equation for this straight line. [3]

**(b)** Hence determine the relationship between $x$ and $y$, giving your answer in a form not involving logarithms. [3]

4 Solve the inequality $x^4 - 5x^2 - 36 > 0$. [6]

5 The area of a circle is increasing at the rate of $3\,\text{cm}^2\,\text{s}^{-1}$. Find the rate of change of the radius when the circumference is 15 cm. [4]

6 The points $A$ and $B$ have coordinates $(-2, 1)$ and $(6, 7)$ respectively.

**(a)** Find the equation of the circle that has $AB$ as a diameter. [3]

**(b)** Show that this circle does not meet the line $2x + y + 4 = 0$. [5]

**(c)** Find the equation of the tangent to the circle at the point (5, 8). Give your answer in the form $ax + by + c = 0$, where $a$, $b$ and $c$ are integers. [4]

**7** The line $l_1$ has equation $\mathbf{r} = \begin{pmatrix} a \\ -3 \\ 7 \end{pmatrix} + \lambda \begin{pmatrix} 3 \\ 4 \\ 0 \end{pmatrix}$, where $a$ is a constant.

**(a)** Given that this line passes through the point (2, 9, 7), find the value of $a$. [2]

**(b)** Given also that the line $l_1$ is perpendicular to the line $l_2$, where $l_2$ is given by $\mathbf{r} = \begin{pmatrix} 2 \\ 9 \\ 7 \end{pmatrix} + \mu \begin{pmatrix} 2 \\ b \\ -b \end{pmatrix}$, find the value of the constant $b$. [2]

**(c)** There are two points on the line $l_1$ that are a distance of 10 units from the point of intersection of the two lines. Find the position vectors of these two points. [4]

**8** The equation $x^3 - x - 2 = 0$ has a single root $\alpha$, which can be found using an iterative process.

**(a)** Use a sign change method to find the pair of consecutive integers between which $\alpha$ lies. [2]

**(b)** In order to find the value of $\alpha$, the iterative formula

$$x_{n+1} = \sqrt{p + \frac{q}{x_n}},$$

with a suitable starting value, is to be used. Determine the values of the constants $p$ and $q$ and hence find $\alpha$ correct to 4 significant figures. Show the result of each iteration. [4]

**(c)** By considering the gradient of an appropriate function, explain why an iterative process using the formula $x_{n+1} = \dfrac{x_n + 2}{x_n^2}$ will not converge to $\alpha$. [4]

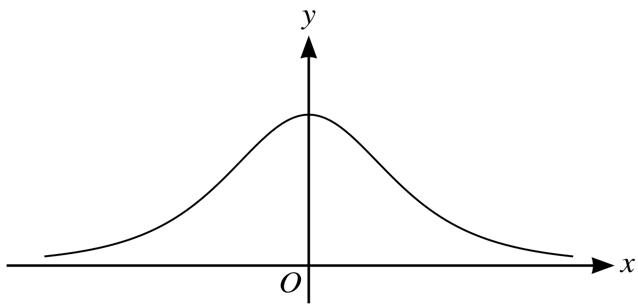
**9** A curve has equation $x^2 - 3xy + y^3 = 8$.

**(a)** Find the gradient of the curve at the point where it crosses the $y$-axis. [5]

**(b)** Find the value of $\dfrac{d^2y}{dx^2}$ at the point where the curve crosses the $y$-axis. [5]

**Question 10 is printed on the next page.**

10




**(a)** The diagram shows part of the curve $y = \frac{1}{(k^2 + x^2)^2}$, where $k$ is a constant greater than 0. The curve has a stationary point at $x = 0$, and this is a local maximum. Show that there are no other stationary points. [3]

**(b)** Use the substitution $x = k \tan u$ to show that

$$\int_0^k \frac{1}{(k^2 + x^2)^2} \, dx = \frac{2 + \pi}{8k^3}.$$ [8]

**(c)** Hence find the area enclosed by the curve $y = \frac{1}{(k^2 + x^2)^2}$, the tangent to the curve at $x = 0$ and the line $x = k$. [2]