UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
Cambridge International Level 3 Pre-U Certificate
Principal Subject

MATHEMATICS **9794/02**

Paper 2 Pure Mathematics 2 **October/November 2013**

2 hours

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 a soft pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, 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.

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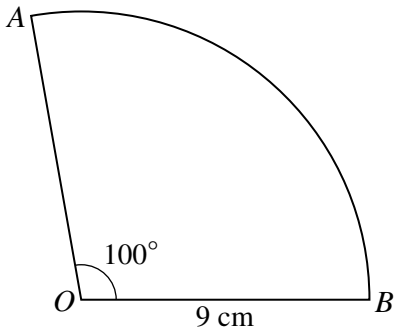
1 The diagram shows a sector OAB of a circle with centre O and radius 9 cm. The angle AOB is 100°.



(i) Express 100° in radians, giving your answer in exact form. [1]

(ii) Find the perimeter of the sector OAB. [2]

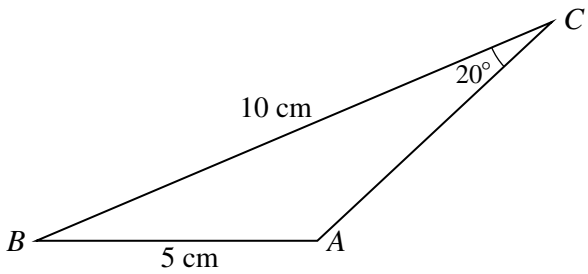
(iii) Find the area of the sector OAB. [2]

2 Solve the equation $|x + 3| = 5$. [3]

3 **(i)** Show that the equation $x^2 - \ln x - 2 = 0$ has a solution between $x = 1$ and $x = 2$. [2]

(ii) Find an approximation to that solution using the iteration $x_{n+1} = \sqrt{2 + \ln x_n}$, giving your answer correct to 2 decimal places. [3]

4 The diagram shows a triangle ABC in which $AB = 5$ cm, $BC = 10$ cm and angle $BCA = 20°$.



(i) Find angle BAC, given that it is obtuse. [3]

(ii) Find the shortest distance from A to BC. [3]

5 Solve $\sin(2\theta + 30°) = 0.1$ in the range $0° \leqslant \theta \leqslant 180°$. [4]

6 The curve $y = x^3 + ax^2 + bx + 1$ has a gradient of 11 at the point (1, 7). Find the values of a and b. [6]

7 **(a)** Differentiate $3\ln(x^2 + 1)$. [2]

(b) Find $\int \frac{x^2}{3 - 4x^3}\,\mathrm{d}x$. [3]

8 Find the exact volume of the solid of revolution generated by rotating the graph of $y = 3\mathrm{e}^x$ between $x = 0$ and $x = 2$ through 360° about the x-axis. [5]

9 Two straight lines have equations

$$\mathbf{r} = \begin{pmatrix} 16 \\ 2 \\ 3 \end{pmatrix} + \lambda \begin{pmatrix} 3 \\ 2 \\ -1 \end{pmatrix} \qquad \text{and} \qquad \mathbf{r} = \begin{pmatrix} -3 \\ 8 \\ 12 \end{pmatrix} + \mu \begin{pmatrix} 5 \\ -6 \\ -3 \end{pmatrix}.$$

Show that the two lines intersect and find the coordinates of their point of intersection. [5]

10 **(i)** Given that $10 + 4x - x^2 \equiv p - (x - q)^2$, show that $q = 2$ and find the value of p. [2]

(ii) Hence find the coordinates of all the points of intersection of the curve $y = 10 + 4x - x^2$ and the circle $(x - 2)^2 + (y - 1)^2 = 25$. [6]

11 **(i)** Expand $(1 + x)^{-1}$ up to and including the term in x^2. [2]

(ii) **(a)** Expand $\sqrt{2 + 3x^2}$ up to and including the term in x^4. [4]

(b) For what range of values of x is this expansion valid? [2]

(iii) Find the first three terms of the expansion of $\frac{\sqrt{2 + 3x^2}}{1 + x}$ in ascending powers of x and hence show that $\int_0^{0.1} \frac{\sqrt{2 + 3x^2}}{1 + x}\,\mathrm{d}x \approx 0.135$. [5]

12 A curve C is given by the parametric equations $x = 2\tan\theta$, $y = 1 + \operatorname{cosec}\theta$ for $0 < \theta < 2\pi$, $\theta \neq \frac{1}{2}\pi,\ \pi,\ \frac{3}{2}\pi$.

(i) Show that the cartesian equation for C is $\frac{4}{x^2} = y^2 - 2y$. [3]

(ii) Find an expression for $\frac{\mathrm{d}y}{\mathrm{d}x}$ and hence show that C has no stationary points. [5]

(iii) P is the point on C where $\theta = \frac{1}{4}\pi$. The tangent to C at P intersects the y-axis at Q and the x-axis at R. Find the exact area of triangle OQR. [7]

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