Cambridge International Examinations
Cambridge Pre-U Certificate

MATHEMATICS (PRINCIPAL) **9794/02**

Paper 2 Pure Mathematics 2 **For Examination from 2016**

SPECIMEN PAPER

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 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 **4** printed pages.

1 **(a)** Express each of the following as a single logarithm.

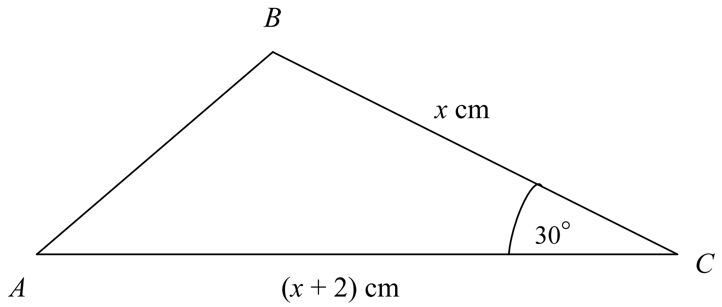
(i) $\log_a 5 + \log_a 3$ [1]

(ii) $5 \log_b 2 - 3 \log_b 4$ [3]

(b) Express $\left(9a^4\right)^{-\frac{1}{2}}$ as an algebraic fraction in its simplest form. [2]

(c) Show that $\dfrac{3\sqrt{3}-1}{2\sqrt{3}-3} = \dfrac{15+7\sqrt{3}}{3}$. [3]

2



The diagram shows a triangle ABC in which angle $C = 30°$, $BC = x$ cm and $AC = (x + 2)$ cm. Given that the area of triangle ABC is 12 cm^2, calculate the value of x. [5]

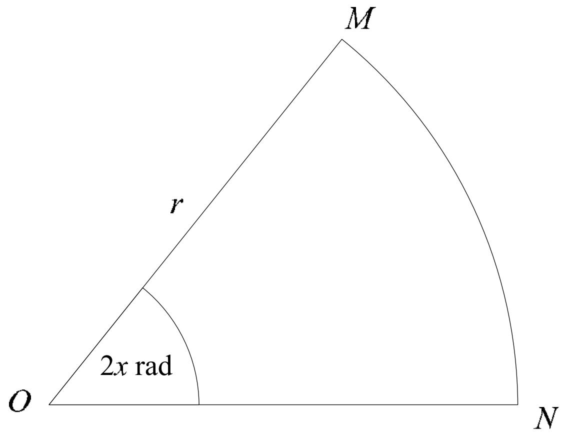
3 **(i)** The points A and B have coordinates $(-4, 4)$ and $(8, 1)$ respectively. Find the equation of the line AB. Give your answer in the form $y = mx + c$. [3]

(ii) Determine, with a reason, whether the line $y = 7 - 4x$ is perpendicular to the line AB. [2]

4 **(i)** Show that $2x^2 - 10x - 3$ may be expressed in the form $a(x + b)^2 + c$ where a, b and c are real numbers to be found. Hence write down the co-ordinates of the minimum point on the curve. [4]

(ii) Solve the equation $4x^4 - 13x^2 + 9 = 0$. [3]

5



The diagram shows a sector of a circle, *OMN*. The angle *MON* is $2x$ radians, the radius of the circle is r and *O* is the centre.

(i) Find expressions, in terms of r and x, for the area, A, and the perimeter, P, of the sector. [2]

(ii) Given that $P = 20$, show that $A = \dfrac{100x}{(1+x)^2}$. [2]

(iii) Find $\dfrac{dA}{dx}$, and hence find the value of x for which the area of the sector is a maximum. [5]

6 Diane is given an injection that combines two drugs, Antiflu and Coldcure. At time t hours after the injection, the concentration of Antiflu in Diane's bloodstream is $3e^{-0.02t}$ units and the concentration of Coldcure is $5e^{-0.07t}$ units. Each drug becomes ineffective when its concentration falls below 1 unit.

(i) Show that Coldcure becomes ineffective before Antiflu. [3]

(ii) Sketch, on the same diagram, the graphs of concentration against time for each drug. [3]

(iii) 20 hours after the first injection, Diane is given a second injection. Determine the concentration of Coldcure 10 hours later. [2]

7 Solve the differential equation $x^2 \dfrac{dy}{dx} = \sec y$ given that $y = \dfrac{\pi}{6}$ when $x = 4$ giving your answer in the form $y = f(x)$. [6]

8 The parametric equations of a curve are

$$x = e^{2t} - 5t, \quad y = e^{2t} - 3t.$$

(i) Find $\dfrac{dy}{dx}$ in terms of t. [3]

(ii) Find the equation of the tangent to the curve at the point when $t = 0$, giving your answer in the form $ay + bx + c = 0$ where a, b and c are integers. [5]

9 The points A and B have position vectors $\mathbf{a}$ and $\mathbf{b}$ relative to an origin O, where $\mathbf{a} = 5\mathbf{i} + 4\mathbf{j} - 2\mathbf{k}$ and $\mathbf{b} = -7\mathbf{i} + 3\mathbf{j} + \mathbf{k}$.

(i) Find the length of AB. [3]

(ii) Use a scalar product to find angle OAB. [4]

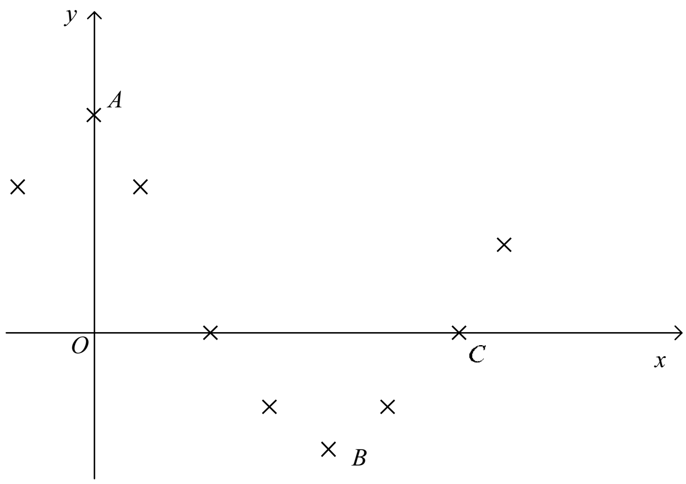
10 A curve has equation

$$y = e^{ax}\cos bx$$

where a and b are constants.

(i) Show that, at any stationary points on the curve, $\tan bx = \dfrac{a}{b}$. [4]

(ii)



Values of related quantities x and y were measured in an experiment and plotted on a graph of y against x, as shown in the diagram. Two of the points, labelled A and B, have coordinates (0, 1) and (0.2, –0.8) respectively. A third point labelled C has coordinates (0.3, 0.04). Attempts were then made to find the equation of a curve which fitted closely to these three points, and two models were proposed.

In the first model the equation is $y = e^{-x}\cos 15x$.

In the second model the equation is $y = f\cos(\lambda x) + g$, where the constants f, λ, and g are chosen to give a maximum precisely at the point $A(0, 1)$ and a minimum precisely at the point $B(0.2, -0.8)$.

By calculating suitable values evaluate the suitability of the two models. [12]