Cambridge International AS Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary Level

MATHEMATICS **9709/21**

Paper 2 Pure Mathematics 2 **(P2)** **October/November 2016**

1 hour 15 minutes

Additional Materials: List of Formulae (MF9)

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READ THESE INSTRUCTIONS FIRST

An answer booklet is provided inside this question paper. You should follow the instructions on the front cover of the answer booklet. If you need additional answer paper ask the invigilator for a continuation booklet.

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 50.

This document consists of **3** printed pages, **1** blank page and **1** insert.

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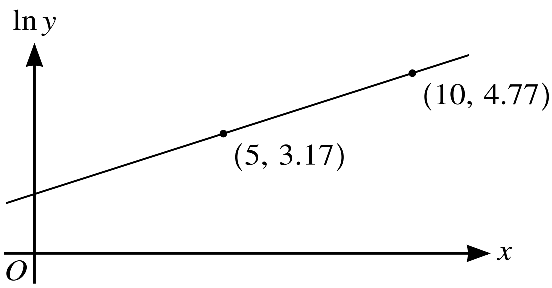
1 **(i)** It is given that x satisfies the equation $3^{2x} = 5(3^x) + 14$. Find the value of 3^x and, using logarithms, find the value of x correct to 3 significant figures. [4]

(ii) Hence state the values of x satisfying the equation $3^{2|x|} = 5(3^{|x|}) + 14$. [1]

2



The variables x and y satisfy the equation $y = Ae^{px}$, where A and p are constants. The graph of $\ln y$ against x is a straight line passing through the points (5, 3.17) and (10, 4.77), as shown in the diagram. Find the values of A and p correct to 2 decimal places. [5]

3 A curve has equation $y = 2\sin 2x - 5\cos 2x + 6$ and is defined for $0 \leqslant x \leqslant \pi$. Find the x-coordinates of the stationary points of the curve, giving your answers correct to 3 significant figures. [6]

4 It is given that the positive constant a is such that

$$\int_{-a}^{a} (4e^{2x} + 5)\,dx = 100.$$

(i) Show that $a = \frac{1}{2}\ln(50 + e^{-2a} - 5a)$. [4]

(ii) Use the iterative formula $a_{n+1} = \frac{1}{2}\ln(50 + e^{-2a_n} - 5a_n)$ to find a correct to 3 decimal places. Give the result of each iteration to 5 decimal places. [3]

5 **(i)** Show that $\dfrac{\cos 2x + 9\cos x + 5}{\cos x + 4} \equiv 2\cos x + 1$. [3]

(ii) Hence find the exact value of $\displaystyle\int_{-\pi}^{\pi} \frac{\cos 4x + 9\cos 2x + 5}{\cos 2x + 4}\,dx$. [4]

6 The equation of a curve is $3x^2 + 4xy + y^2 = 24$. Find the equation of the normal to the curve at the point (1, 3), giving your answer in the form $ax + by + c = 0$ where a, b and c are integers. [8]

7 The polynomial $p(x)$ is defined by

$$p(x) = ax^3 + 3x^2 + bx + 12,$$

where a and b are constants. It is given that $(x + 3)$ is a factor of $p(x)$. It is also given that the remainder is 18 when $p(x)$ is divided by $(x + 2)$.

(i) Find the values of a and b. [5]

(ii) When a and b have these values,

(a) show that the equation $p(x) = 0$ has exactly one real root, [4]

(b) solve the equation $p(\sec y) = 0$ for $-180° < y < 180°$. [3]

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