CAMBRIDGE A LEVEL PROGRAMME
SEMESTER ONE EXAMINATION NOV/DEC 2009
(June 2009 Intake)

Thursday	**3 December 2009**	**1.00 pm – 3.00 pm**

FURTHER MATHEMATICS   9231/01

PAPER 1   **2 hours**

Additional materials: Answer Booklet/Paper
List of formulae (MF 10)

READ THESE INSTRUCTIONS FIRST

If you have been given an Answer Booklet, follow the instructions on the front cover of the Booklet.
Write your name and class on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
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 a calculator is expected, where appropriate.
Results obtained solely from a graphic calculator, without supporting working or reasoning, will not receive credit.
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 marks for this paper is **50**.

This document consists of **2** printed pages.

[Turn over

1   Prove that $80^{2n-1} + 37^{2n}$ is divisible by 9 for every positive integer n.   [5]

2   Find the sum $(n+1)2n + (n+2)(2n-1) + (n+3)(2n-2) + \cdots + (2n-1)(n+2) + 2n(n+1)$.   [6]

3   If the equation $3x^4 - 9x^3 + 4x^2 - 6x + 8 = 0$ has roots $\alpha, \beta, \gamma, \delta$, find the equation having

   roots $\alpha^2 - 1, \beta^2 - 1, \gamma^2 - 1, \delta^2 - 1$.   [7]

4   **(i)** Find the intersection point of the planes $x + 4y - 9z = -59$, $3x - 7y + 2z = 81$ and

      $5x + 8y - 6z = -70$.   [6]

   (ii) Find the perpendicular distance from the origin O to the plane containing the points A, B

      and C whose position vectors are $a^2\mathbf{i}$, $b^2\mathbf{j}$ and $c^2\mathbf{k}$ respectively.   [8]

5   The curve C has equation $y = \dfrac{7x - 51}{6(2x-9)(3x-7)}$.

    (i) Find the equations of the asymptotes of C.   [3]

    (ii) Find the coordinates of the points of intersection of C with the x and y axes.   [2]

    (iii) Sketch C, indicating the coordinates of the critical points and also their type.   [13]