CAMBRIDGE A LEVEL PROGRAMME
SEMESTER ONE EXAMINATION JUNE 2008
(Jan 2008 Intake)

Wednesday   11 June 2008   8.30 am – 10.30 am

FURTHER MATHEMATICS   **9231/01**

PAPER 1   2 hours

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

READ THESE INSTRUCTIONS FIRST

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
The number of marks is given in brackets [ ] at the end of each question or part question.
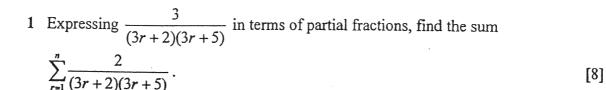The total marks for this paper is **75**.
At the end of the examination, fasten all your work securely together.

This document consists of **3** printed pages.

1 Expressing $\dfrac{3}{(3r+2)(3r+5)}$ in terms of partial fractions, find the sum

$$\sum_{r=1}^{n} \frac{2}{(3r+2)(3r+5)}.$$ [8]

2 If the equation $4x^4 - 5x^3 + 6x^2 + x - 9 = 0$ has roots $\alpha, \beta, \gamma, \delta$ find the equation having roots $2\alpha^2 + 1, 2\beta^2 + 1, 2\gamma^2 + 1, 2\delta^2 + 1$. [9]

3 It is given that for $n = 1,2,3,\ldots$,

$$a_n = 2 \cdot 5^{2n-1} + 2^{n-1} \cdot 3^{n+1}.$$

Find the values of a_1, a_2, a_3, hence make a conjecture about a number which divides a_n. Prove it by mathematical induction. [10]

4 Find all the solutions of the system of linear equations

$$x + y + z = 0$$
$$x + ky + z = 0$$
$$x + y + k^2 z = 0.$$ [16]

5 a) Find the vector equation of the line of intersection of the planes $x + 2y - 4z = 3$ and $2x + 3y - 5z = 1$. [6]

 b) Find the distance of the point (1, 4, -3) from the line of intersection of the two planes. [6]

6 The curve C has equation

$$y = \frac{2x^2 - 8x + 8}{x^2 - 16}.$$

(i) Express y in the form $P + \dfrac{Q}{x+a} + \dfrac{R}{x+b}$ where P, Q, R, a and b are integers. [5]

(ii) Write down the equations of all the asymptotes of C. [3]

(iii) Show that C has two stationary points and find their coordinates. [6]

(iv) Sketch C, and give the coordinates of the points of intersection of C with the axes. [6]