TAYLOR'S UNIVERSITY COLLEGE

Wisdom • Integrity • Excellence

CAMBRIDGE A LEVEL PROGRAMME

SEMESTER ONE EXAMINATION JUNE 2009

(Jan 2009 Intake)

Monday **8 June 2009** **8.30 am – 10.30 am**

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.

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

1 The planes Π_1, Π_2 and Π_3 have equations $x-2y+2z=1$, $-x+3y-z=k$ and $2x-5y+kz=-2$ respectively, where k is a constant. Find the common line of intersection of the three planes. [5]

2 Find the sum of the cubes of the integers between 100 and 200 which are divisible by 7. [5]

3 Prove by mathematical induction that, for all positive integers n, $n\left(n^2+5\right)$ is divisible by 6. [8]

4 **(i)** Find the equation of the line of intersection of the planes $3x+9y-7z=4$ and $2x-6y+5z=1$. [3]

(ii) Find the shortest distance between the lines $\mathbf{r}=\begin{pmatrix}2\\1\\-3\end{pmatrix}+s\begin{pmatrix}9\\-4\\5\end{pmatrix}$ and $\mathbf{r}=\begin{pmatrix}4\\5\\-6\end{pmatrix}+t\begin{pmatrix}2\\-3\\1\end{pmatrix}$. [4]

(iii) Find the equation of the plane parallel to the plane $5x+2y-8z=3$ and containing the point (9, -6, 4). [2]

5 The curve C has equation $y=\dfrac{x^3}{1+3x^4}$, find $\dfrac{dy}{dx}$ in terms of x. Hence find the coordinates of the stationary points and determine their nature. Sketch the curve C. [9]

6 The equation $2x^3-4x^2+3x-9=0$ has roots α, β, γ. If $S_n=\alpha^n+\beta^n+\gamma^n$, find S_2 and the equation with roots $\alpha^3, \beta^3, \gamma^3$. [8]

Find also S_3, S_6 and S_{-3}. [6]