TAYLOR'S UNIVERSITY COLLEGE

Wisdom · Integrity · Excellence

CAMBRIDGE A LEVEL PROGRAMME

SEMESTER ONE EXAMINATION DECEMBER 2008

(June 2008 Intake)

Monday **1 December 2008** **1.00 pm – 2.30 pm**

MATHEMATICS 9709/1

PAPER 1 Pure Mathematics 1 (P1) 1 hour 30 minutes

Additional materials: Answer Paper
List of formulae (MF9)

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.
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 60.
Questions carrying smaller numbers of marks are printed earlier in the paper, and questions carrying larger numbers of marks later in the paper.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

This document consists of **4** printed pages.

1. A sector OAB of a circle, of radius r and a centre O, has $\angle AOB = \theta$ radians. Given that the area of the sector OAB is twice the square of the length of the arc AB, find θ. [3]

2. The coefficient of x^5 in the expansion of $(1+5x)^8$ is equal to the coefficient of x^4 in the expansion of $(a + 5x)^7$. Find the value of a. [4]

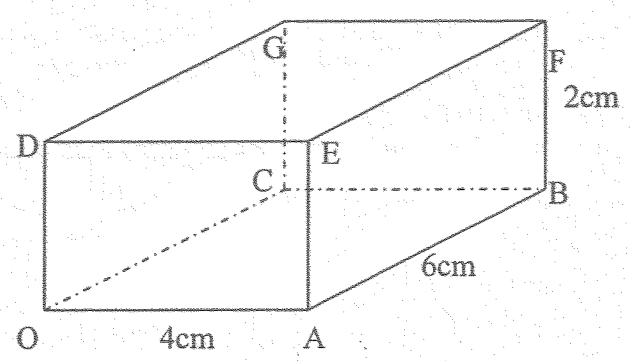
3. The first three terms of a geometric progression are $k - 3$, $2k - 4$ and $4k - 3$, in that order. Find the value of k and the common ratio of the progression. [4]

4. The straight line l_1 with the equation $2x + y = 8$ intersects the y-axis at point P. The straight line l_2 is perpendicular to l_1 and passes through the point (2,4). Given l_2 intersects the x-axis at point Q.
   (i) Find the equation of l_2. [3]
   (ii) Find the length of PQ. [1]

5. (a) Find the range of values of x such that $3x^2 - 7x + 4 \geq 0$. [3]
   (b) Find the values of m, given that $m - 8\sqrt{m} + 15 = 0$. [3]

6. (a) Prove the identity $(1 + \sin\theta + \cos\theta)^2 = 2(1 + \sin\theta)(1 + \cos\theta)$. [3]
   (b) Solve the equation $2 - \sin x = \cos^2 x + 7\sin^2 x$, for $0° \leq x \leq 180°$. [4]

7.



The diagram shows a cuboid OABCDEFG with OA = 4cm, AB = 6cm and BF = 2cm. Given the unit vectors **i**, **j** and **k** are in the directions $\overrightarrow{OA}$, $\overrightarrow{OC}$ and $\overrightarrow{OD}$ respectively. M and N are the midpoints of $\overrightarrow{AB}$ and $\overrightarrow{OD}$ respectively. Find

(i) the unit vector of $\overrightarrow{FN}$, [3]

(ii) the angle MNG, correct to 1 decimal place. [4]

8. The function f is defined by $f(x) = x^2 - 6x$ for $x \geq 3$.

(i) Explain why $f^{-1}(x)$ exist and find $f^{-1}(x)$. [4]

(ii) State the range of the inverse function $f^{-1}(x)$. [1]

(iii) Sketch the graphs for $y = f(x)$ and $y = f^{-1}(x)$ on the same axes, making clear the relationship between these two graphs. [3]

9. (i) Sketch, on the same axes, the graphs of $y = x^2 + 1$ and $y = 2x + 1$. [2]

(ii) Find the coordinates of the points of intersection. [3]

(iii) The area bounded by the two curves is rotated through 360^0 about the x-axis. Calculate the volume of the solid of revolution formed. [3]

[Turn over

10. A solid rectangular block has a base which measures $2x$ cm by x cm. The height of the block is y cm and the volume of the block is 576 cm^3.

(i) Express y in terms of x and show that the total surface area, A cm^2, of the block is given by

$$A = 4x^2 + \frac{1728}{x}$$ [4]

(ii) Given that x can vary,

(a) find the value of x for which A has a stationary value, [2]

(b) find this stationary value and determine whether it is a maximum or a minimum value. [3]