TAYLOR'S UNIVERSITY COLLEGE
Wisdom · Integrity · Excellence

CAMBRIDGE A LEVEL PROGRAMME

AS TRIAL EXAMINATION MARCH/APRIL 2009

(June 2008 Intake)

Monday **30 March 2009** **1.30 pm – 3.15 pm**

MATHEMATICS 9709/1

PAPER 1 Pure Mathematics 1 (P1) 1 hour 45 minutes

Additional materials: Answer Booklet/Paper
List of formulae (MF9)

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.
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 75.
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.

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[Turn over

1 Show that $2x^2 + 8x + 13$ is always positive. [3]

2 Find the coefficient of x^2 in the expansion of $\left(2x + \frac{3}{x}\right)^6$. [4]

3 **(i)** Show that $\cos^4 x - \sin^4 x = 2\cos^2 x - 1$. [3]

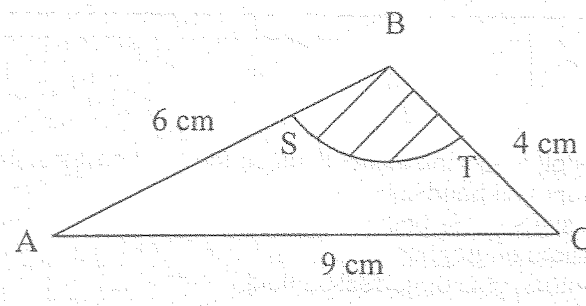
(ii) Hence solve $\cos^4 x - \sin^4 x = 0$ for which $0° \le x \le 360°$. [2]

4 The points A(1, 7), B(-1, 3) and C(k, 6), k is a positive constant, lie on the straight line L_1.

(i) Show that $k = \frac{1}{2}$. [2]

(ii) The point D lies on line L_1 and x-axis. Find the length of CD. [5]

5 The triangle ABC has AB = 6 cm, BC = 4 cm and CA = 9 cm.



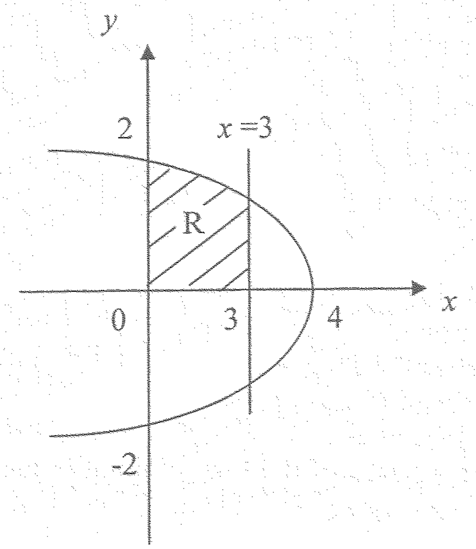
(i) Show that the angle ABC is 2.22 radians. [2]

The circular sector BST with radius r cm (where $r < 4$) is removed from the triangle. The area of the sector, shaded in the diagram, is equal to one tenth of the area of the original triangle.

(ii) Calculate the value of r. [3]

(iii) Find the perimeter of the remaining shape ASTC. [2]

6 With respect to the origin O, the position vectors of points A, B, and C are
$\overrightarrow{OA} = 9\mathbf{i} + 7\mathbf{j} - \mathbf{k}$ $\quad \overrightarrow{OB} = 3\mathbf{i} - 11\mathbf{j} + 5\mathbf{k}$ $\quad \overrightarrow{OC} = 5\mathbf{i} - 5\mathbf{j} - \mathbf{k}$
Find the cosine of the angle CAB and also the area of the triangle ABC. [7]

7 

The region R in the first quadrant is bounded by the y-axis, the x-axis, the line $x = 3$ and the curve $y^2 = 4 - x$.

(i) Calculate the area of the region R. [4]

(ii) Calculate the volume of the solid formed when R is rotated about the y-axis through one revolution. (Leave your answer in terms of π) [5]

8 **(a)** The sum of the first 100 terms of an arithmetic progression is 10 000: the first, second and fifth terms of this progression are three consecutive terms of a geometric progression. Find the first term, 'a' and the non-zero common difference, 'd', of the arithmetic progression. [5]

(b) A geometric series has first term 'a' and common ratio 'r', where $|r| < 1$. The sum to infinity of the series is 8. The sum to infinity of the series obtained by adding all the odd-numbered terms (i.e. 1st term + 3rd term + 5th term + …) is 6, find the value of r. [5]

9 Find the coordinates of the turning points of the curve, C, defined by $y = x^3 - x$.
Draw a sketch graph of C.
Hence, or otherwise, find the set of values of k for which the equation $x^3 - x - k = 0$ has three distinct real roots. [10]

[Turn over

10 The functions f and g are defined as follows:

$f : x \mapsto 2x + 3, \quad x \in \Re$

$g : x \mapsto \dfrac{1}{x+1}, \quad x \in \Re, x \neq -1$

(i) Express the inverse function, $g^{-1}(x)$, in terms of x. [2]

(ii) Show that $f(x) = g(x)$ has two real and distinct roots. [3]

(iii) The straight line $y = f(x)$ meets the curve $y = g(x)$ at points A and B. Find the coordinates of the points A and B. [3]

(iv) Find the equation of the perpendicular bisector of the line joining the points A and B. Leave your answer in the form $ax + by + c = 0$. [5]