TAYLOR'S
UNIVERSITY
COLLEGE
Wisdom · Integrity · Excellence

CAMBRIDGE A LEVEL PROGRAMME

SEMESTER ONE EXAMINATION JUNE 2008

(January 2008 Intake)

Monday 9 June 2008 1.15 pm – 2.45 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.

© Taylor's University College Subang Jaya 2008

[Turn over

1. Find the range of values for t such that the equation $(t+1)x^2+(t+2)x+3=0$ has two real roots, where $t \neq -1$. [3]

2. Find the terms in x^2 and x^5 in the expansion of $\left(1-\frac{x}{2}\right)^{12}$. [2]

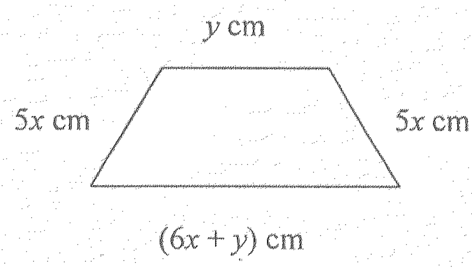
   Hence find the coefficient of x^5 in the expansion of $\left(3+2x^3\right)\left(1-\frac{x}{2}\right)^{12}$. [3]

3. The points P, Q and R have coordinates (4,6), (8,-2) and (6,2) respectively.
   (i) Find the equation of the straight line l which is perpendicular to the line PQ and which passes through the mid-point of PR. [3]
   (ii) The line l cuts PQ at S. Find the coordinates of point S [2]

4. Sketch graphs of $x^2 = y-2$ and $2y-x-2=0$ on the same axis. [2]

   The region bounded by the graphs of $x^2 = y-2$, $2y-x-2=0$, $x=0$ and $x=1$ is revolved about the x-axis. Find the volume of the resulting solid formed. (Leave your answer in terms of π). [3]

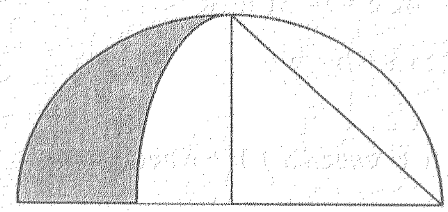
5.



A piece of wire of length 104 cm, is bent to form a trapezium as shown in the diagram. Express y in terms of x and show that the area, A cm^2, enclosed by the wire is given by $A = 208x - 20x^2$. [4]

Find the value of x and of y for which A is a maximum. [3]

6.



The diagram above shows a semi-circle ABC with center O and radius 4 cm such that angle BOC = 90^0. Given that CD is an arc of a circle with center B, calculate

(i) the length of the arc CD, in terms of π and $\sqrt{2}$, [3]

(ii) the area of the shaded region, in terms of $\sqrt{2}$. [4]

7. (a) By completing the square, find the greatest value of $\sin^2 x - \sin x + 6$ and the value of x when this occurs, for which $0^0 \leq x \leq 360^0$. [3]

(b) Solve the equation of $5\cos x - 1 = 2\sin^2 x$, for $0^0 \leq x \leq 360^0$. [4]

8. The function f and g are defined by

$$f : x \mapsto 1 + \sqrt{x+1}, x \geq -1$$

$$g : x \mapsto \frac{1}{x-2}, x \neq 2$$

(i) Find an expression for $f^{-1}(x)$ and state its domain. [3]

(ii) Sketch the graphs of $f(x)$ and $f^{-1}(x)$ in the same diagram, clearly labeled including the coordinates of the point of intersection and making clear the relationship between these two graphs. [3]

(iii) Solve the equation $gf(x) = 2$. [3]

[Turn over

9. (a) The position vectors **a**, **b**, **c** of 3 points A, B, C respectively are given by

$$\mathbf{a} = \mathbf{i} + \mathbf{j} + \mathbf{k}\,,\ \mathbf{b} = \mathbf{i} + 2\mathbf{j} + 3\mathbf{k},\ \mathbf{c} = \mathbf{i} - 3\mathbf{j} + 2\mathbf{k}$$

(i) find a unit vector parallel to $\mathbf{a} + \mathbf{b} + \mathbf{c}$ [2]

(ii) find the cosine of the angle between $\mathbf{a} + \mathbf{b} + \mathbf{c}$ and $\mathbf{a}$. [2]

(b) Given that $\overrightarrow{OA} = \begin{pmatrix} 1 \\ 4 \end{pmatrix}$ and $\overrightarrow{OB} = \begin{pmatrix} 7 \\ 1 \end{pmatrix}$ respectively. Point P $(t, t+1)$ is on AB, find

(i) $\overrightarrow{AP}$ and $\overrightarrow{BP}$ in terms of t, [4]

(ii) the value of t and the ratio $AP : PB$ [4]