TAYLOR'S UNIVERSITY COLLEGE

Wisdom · Integrity · Excellence

CAMBRIDGE A LEVEL PROGRAMME

A2 TRIAL EXAMINATION MARCH/APRIL 2008

(Jan and March 2007 Intake)

Friday **4 April 2008** **8.30 am – 10.15 am**

MATHEMATICS 9709/3

PAPER 3 Pure Mathematics 3 (P3) 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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1. Solve $|18-4x|<2$. [3]

2. If $1+\log_a(7x-3a)=2\log_a x+\log_a 2$, find in terms of a, the possible values of x. [4]

3. Find the gradient of the curve $3x^2-y^2+4xy+1=0$ at point (3,-2). [4]

4. Show that the equation $e^{0.8x}=\frac{1}{3-2x}$, $x\neq\frac{3}{2}$ can be written in the form $x=p\ln(3-2x)$, stating the value of p.
Use the iterative formula
$$x_{n+1}=p\ln(3-2x_n)$$
with initial value $x_1=-2.6$ and the value of p found in the earlier part to obtain the root of $e^{0.8x}=\frac{1}{3-2x}$, , to 3 decimal places. [5]

5. i) Express $3\cos\theta-6\sin\theta$ in the form $R\cos(\theta+\alpha)$, where $R>0$ and $0<\alpha<90^\circ$, stating the value of α correct to 2 decimal places. [3]

   ii) Hence find the greatest value and least value of $3\cos\theta-6\sin\theta-2$ [2]

6. i) Show that $\int_1^e x\ln x\,dx=\frac{1}{4}\left(e^2+1\right)$. [4]

   ii) Hence evaluate $\int_1^e x(\ln x)^2\,dx$ correct to 3 decimal places. [3]

7. Let $f(x)=6x^4-7x^3+ax^2+bx-12$ where a and b are constants. If $(x-1)$ is a factor of f(x) and when f(x) is divided by $(x+1)$, the remainder is -50.
   i) Find the values of a and b. [4]
   ii) With these values of a and b, factorise f(x) completely. [4]

8. The line l has equation $r = \begin{pmatrix} 0 \\ 1 \\ 1 \end{pmatrix} + s\begin{pmatrix} 1 \\ -2 \\ 1 \end{pmatrix}$. The plane p has equation $x + 2y + 3z = 5$.

i) Show that the line l lies in the plane p. [2]

ii) A second plane is perpendicular to the plane p, parallel to the line l and contains the point with position vector $2\boldsymbol{i} + \boldsymbol{j} + 4\boldsymbol{k}$. Find the equation of this plane, giving your answer in the form $ax + by + cz = d$. [6]

9. i) The complex number w has modulus $\sqrt{2}$ and argument $-\frac{3}{4}\pi$, and the complex number z has modulus 2 and argument $-\frac{1}{3}\pi$. Find the modulus and principal argument of wz, in exact form. [3]

ii) On a single Argand diagram, sketch the following loci.

a) $|z - 2i| = 4$ [1]

b) $\arg(z + 2) = \frac{1}{4}\pi$ [1]

Hence or otherwise, find the exact value of z satisfying both equations in parts a) and b). [5]

10. Let $f(x) = \dfrac{3 - 5x + 3x^2}{(1 - 2x)(1 + x^2)}$.

i) Express $f(x)$ in partial fractions. [3]

ii) Show that, when x is sufficiently small for x^4 and higher powers to be neglected, $f(x) = 3 + x + 2x^2 + 9x^3$. [5]

iii) State the range of values of x for the expansion to be valid. [2]

[Turn over

11. In an irrigation system, water is stored in a rectangular tank with a square horizontal base of edge 200 cm and with a vertical height of 400 cm. A tap in the base is opened and water flows out. After t seconds, when the depth of water in the tank is x cm, the rate of flow is $100\sqrt{x}\ cm^3 s^{-1}$.

i) Show that $400\dfrac{dx}{dt} + \sqrt{x} = 0$. [3]

The tank is initially full.

ii) Find an expression for t in terms of x. [4]

iii) When the tap is opened, find to the nearest half hour how long the tank takes to empty. [2]

iv) Find the depth of water in the tank after the tap has been open for 2 hours. [2]