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TAYLOR'S
COLLEGE

Wisdom • Integrity • Excellence

CAMBRIDGE 'A' LEVEL PROGRAMME

AS TRIAL EXAMINATION AUGUST/SEPTEMBER 2005

(January 2005 & March 2005 Intake)

Thursday **25 August 2005** **8.30 am – 10.15 am**

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.

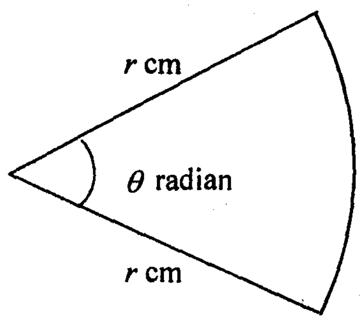
This document consists of **4** printed pages.

[Turn over

1. Find the value of the coefficient of $\frac{1}{x}$ in the expansion of $\left(2x-\frac{3}{x}\right)^5$. [4]

2. A curve is such that $\frac{dy}{dx} = 3x^2 + 6x + k$, where k is a constant. The gradient of the curve at (1,5) is 4. Find the equation of the curve. [5]

3.



A sector has radius r cm and angle θ radians as shown in the diagram. The perimeter of the sector is always 40 cm.

(i) Express r and A, the area of the sector, in terms of θ. [4]

(ii) If $\theta = \frac{\pi}{4}$, find the area of the sector, in terms of π. [1]

4. x^2, $(8x+1)$ and $(7x+2)$, where $x \neq 0$, are the second, fourth and sixth terms respectively of an arithmetic series.

(i) Find the value of x. [3]

(ii) Find the common difference and the first term of the series. [3]

5. Three points have coordinates $A(1,7)$, $B(7,5)$ and $C(0,-2)$. Find

(i) the mid-point of AB; [1]

(ii) the equation of the perpendicular bisector of AB, and [3]

(iii) the area of the triangle ABC. [2]

6. Given that $f(x) = \dfrac{4}{x-4} - \dfrac{1}{x-1}$.

(i) Write down the expressions for $f'(x)$ and $f''(x)$. You need not simplify your answers. [2]

(ii) Find the coordinates of the two stationary points on the graph of f and identify each as a maximum or minimum. [4]

7. The function $f : x \mapsto 4 - x^2$ is defined for all real values of x.

(i) State the range of f. [2]

(ii) Determine the exact values of x for which $ff(x) = 0$. [5]

8. (i) On the same axes, sketch $y = \sin 2x$ and $y = \cos 3x$ for $0 \leq x \leq \pi$. Hence find the number of solutions to the equation $\sin 2x = \cos 3x$ in the same interval. [3]

(ii) Find all the values of x, $0° \leq x \leq 360°$, which satisfy the equation

$$3 \sin x = 2 + \frac{1}{\sin x}.$$ [4]

9. Relative to the origin O, the position vectors of the points A and B are given by

$$\overrightarrow{OA} = \mathbf{i} + \mathbf{j} \text{ and } \overrightarrow{OB} = \mathbf{i} - 8\mathbf{j} - 6\mathbf{k}$$

(i) The point C is such that $2\overrightarrow{AC} = \overrightarrow{CB}$. Find the unit vector in the direction of $\overrightarrow{OC}$.

[4]

(ii) The point D is such that $\overrightarrow{OD} = 2\mathbf{i} + \mathbf{j} + \lambda\mathbf{k}$. The angle between $\overrightarrow{OA}$ and $\overrightarrow{OD}$ is $\frac{\pi}{4}$. Find the possible values of λ. [4]

[Turn over

10.

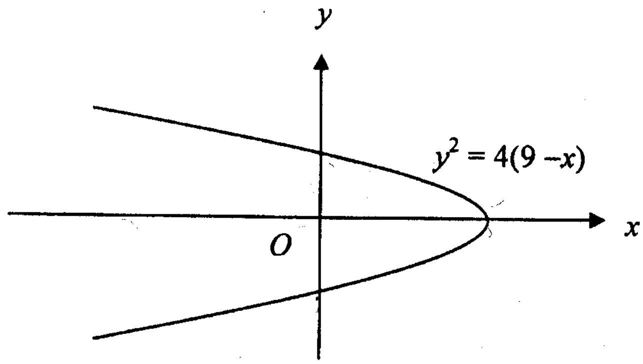


Diagram shows a region bounded by the parabola $y^2 = 4(9 - x)$ and the y-axis.

Find

(i) the points of intersections between the parabola and the two axes; [3]

(ii) the enclosed area, and [3]

(iii) the volume generated by rotating the enclosed region about the x-axis. [3]

11. (i) Express $2x^2 - 8x + 5$ in the form of $a(x + b)^2 + c$, [3]

(ii) For the curve $y = 2x^2 - 8x + 5$, find the set of values of x for which $y \geq 15$. [3]

Given that $\mathrm{f} : x \mapsto 2x^2 - 8x + 5$ for the domain $x \geq k$.

(iii) Find the least value of k for which f is one-one. [1]

(iv) State the domain and range of f^{-1}. [2]

(v) Sketch, on a single diagram, the graphs of $y = \mathrm{f}(x)$ and $y = \mathrm{f}^{-1}(x)$, making clear the relationship between these two graphs. [3]