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TAYLOR'S COLLEGE

Wisdom • Integrity • Excellence

CAMBRIDGE 'A' LEVEL PROGRAMME

AS TRIAL EXAMINATION MARCH/APRIL 2006

(June 2005 Intake)

Monday **3 April 2006** **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 **3** printed pages.

[Turn over

1. Find the set of values of k for which $k+2x-3x^2$ is negative for all real values of x. [2]

2. The position vectors of A and B, relative to the origin O, are $\underset{\sim}{i}+2\underset{\sim}{j}+3\underset{\sim}{k}$ and $3\underset{\sim}{i}+4\underset{\sim}{j}+5\underset{\sim}{k}$ respectively, the point C is given by

$\overrightarrow{OC} = 2\overrightarrow{OA}$ Find

a) the length of OC [2]

b) $\cos \angle AOB$, in surd form. [3]

3. Find the volume formed when the region in the first quadrant bounded by $y=x$, $y=\dfrac{1}{x}$, $x=2$ and $y=0$ is rotated through 360° about the x-axis. [5]

4. a) A sector OAB of a circle of radius r and 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]

b) Find the area of the segment cut of by the chord AB if the radius of the circle is 10 cm. [3]

5. a) By completing the square, find the greatest value of $\cos^2\theta - \cos\theta + 6$ and the value of θ when this occurs. [4]

b) Solve the equation $\sin 4x = \dfrac{1}{2}$, giving all solutions such that $0 \le x \le 180$ [2]

6. A region is bounded by the curve $y=\dfrac{1}{x^2}$ and the lines y = x, x = 0 and y = 4.

a) Show this region clearly on a sketch [2]

b) Find the area of this region [5]

7. Given that $y = x^2 + \frac{8}{(1-x)}$ $(x \in R,\ x \neq 1)$,

   a) Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ [2]

   b) Verify that there is a turning point on the graph of y when $x = -1$ and find whether it is a maximum or a minimum point. [2]

   c) Show that there are no other turning points. [6]

8. A rectangle ABCD has points A(3,2) and B(1,6)

   a) Find the equation of BC [4]

   Given that the equation of AC is $y = x - 1$, find

   b) the coordinates of C [3]

   c) the perimeter of the rectangle ABCD [3]

9. The functions f and g are defined by

   $f(x) = 3x + 2$ $\qquad x \in R$

   $g(x) = \dfrac{6}{2x+3}$ $\qquad x \in R, \quad x \neq -1.5$

a) Find the value of x for which $fg(x) = 3$ [3]

b) Sketch in a single diagram the graphs of $y = f(x)$ and $y = f^{-1}(x)$ making clear the relationship between the two graphs. [3]

c) Express each of $f^{-1}(x)$ and $g^{-1}(x)$ in terms of x and solve the equation $f^{-1}(x) = g^{-1}(x)$ [5]

10. The sum of the first 100 terms of an arithmetic progression is 10000; the first, second and fifth terms of this progression are 3 consecutive terms of a geometric progression,

    a) Find the first term, a and the non-zero common difference, d of the arithmetic progression. [8]

    b) Find the least value of n for which the sum to n terms of the geometric series $1 + 0.99 + (0.99)^2 + (0.99)^3 + \ldots\ldots$ is greater than half the sum to infinity. [5]