TAYLOR'S UNIVERSITY COLLEGE

Wisdom • Integrity • Excellence

CAMBRIDGE A LEVEL PROGRAMME

SEMESTER ONE EXAMINATION JUNE 2008

(March 2008 Intake)

Wednesday **11 June 2008** **1.30 pm – 3.30 pm**

MATHEMATICS 9709/1,6

2 hours

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

READ THESE INSTRUCTIONS FIRST

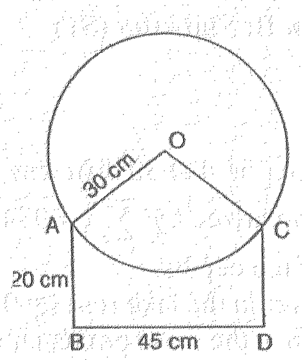
Write your name and class on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a soft pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

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 80.
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



7. A circular disc, centre O and radius 30 cm, rests on two vertical supports AB and CD, each 20 cm tall and 45 cm apart as shown in the diagram. Calculate, correct to three significant figures

   a) the angle AOC in radians, [3]

   b) the height, above BD, of the lowest point of the arc AC, [3]

   c) the area of the disc that lies above the chord AC. [3]

8. Express $x^2 + 4x$ in the form $(x+a)^2 + b$, stating the numerical values of a and b. [2]
   The functions f and g are defined as

$$f : x \to x^2 + 4x,\ \ x \geq -2$$
$$g : x \to x + 6,\ \ x \in R$$

   a) Show that the equation $gf(x) = 0$ has no real roots. [2]

   b) Find the inverse function f^{-1} and determine its domain and range. [3]

   c) 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]

9. The tangents at (0,-1) and (3,-4) on the curve $y = 2x - x^2 - 1$ meet at T.

   a) Find the equation of tangent at (0,-1). [3]

   b) Find the equation of tangent at (3,-4). [2]

   c) Find the coordinates of T. [2]

   d) Calculate the area of the region bounded by the curve and the tangents. [5]

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Section A: Pure Mathematics (P1)

1. The gradient at any point on a curve is $\frac{2}{(3-x)^2}$. The curve passes through the point (5,11). Find the equation of the curve. [4]

2. Sketch the graph of the curve $y = 3\sin x$, for $-\pi \leq x \leq \pi$. The straight line $y = kx$, where k is a constant, passes through the maximum point of the curve $y = 3\sin x$, for $-\pi \leq x \leq \pi$. Find the value of k in terms of π and state the coordinates of the other point, apart from the origin, where the line and the curve intersect. [5]

3. Find the first three terms in the expansion, in ascending powers of x, of $(2-x)^6$. Hence find the value of the constant a for which the coefficient of x in the expansion of $(1+ax)(2-x)^6$ is 64. [5]

4. The position vectors of three points A, B and C with respect to a fixed origin O are $2\mathbf{i} - 2\mathbf{j} + \mathbf{k}$, $4\mathbf{i} + 2\mathbf{j} + \mathbf{k}$ and $\mathbf{i} + \mathbf{j} + 3\mathbf{k}$ respectively.
   a) Find a unit vector in the direction of $\overrightarrow{CB}$. [3]
   b) Calculate angle ACB in degrees, correct to 1 decimal place. [3]

5. A length of 200 cm is divided into 25 sections whose lengths follow an arithmetic progression. Given that the sum of the lengths of the three smallest sections is 4.2 cm, find the length of the largest section. [6]

6. The radius of a solid cylinder is always equal to its height. Given that the volume of the cylinder is increasing at a constant rate of 0.05 m^3s^{-1}, calculate the rate of change of the total surface area of the cylinder when its radius is 0.5m. [7]

Section B: Statistics (S1)

10. The depth of water in a lake was measured at 50 different points on the surface of the lake. The depths, x metres, are summarized by $\sum x = 934.5$ and $\sum x^2 = 19275.81$.

 a) Find the mean and variance of the depths. [2]

 b) Some weeks later the water level in the lake rose by 0.23m. What would be the mean and variance of the depth taken at the same points on the lake as before? [2]

11. A test was set to a group of students and marked out of 70. The minimum mark for a Grade A is 48, and the minimum mark for a Grade B is 36. Marks of 35 or less are given Grade C. The results can be represented by the following stem-and-leaf diagram.

stem	leaf
1	1 5
2	2 8
3	2 5 7 9 9
4	0 3 3 5 5 6 6 8
5	1 3 3 9
6	0 4 9

Key: 3 | 9 means 39 marks

 a) How many students took the test? [1]

 b) Sketch a suitable diagram illustrating the percentage of students in the various grades. [4]

 c) State the median mark and find the interquartile range [4]

 d) The test was set to another group of students, and the results were classified as follows.

Mark	10-19	20-29	30-39	40-49	50-59
Number of students	5	8	10	7	5

Calculate an estimate of the mean mark for this group of 35 students. [3]