TAYLOR'S UNIVERSITY COLLEGE
Wisdom · Integrity · Excellence

CAMBRIDGE A LEVEL PROGRAMME

SEMESTER ONE EXAMINATION JUNE 2009

(March 2009 Intake)

Thursday **11 June 2009** **8.15 am – 10.15 am**

MATHEMATICS

9709/1,6

2 hours

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 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 **5** printed pages.

[Turn over

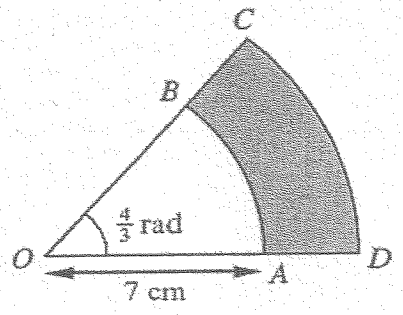
Section A: Pure Mathematics (P1)

1 A building society offers 6% interest per year on investments. Mr. Arun deposits £4000 in an account and leaves the interest to accumulate. Find the total value of the investment (to the nearest £) after 6 years. [3]

2 **(a)** Express $6 + 4x - x^2$ in the form $a - (x + b)^2$, where a and b are integers. [2]

(b) Hence, or otherwise, find the coordinates of the turning point of the curve $y = 6 + 4x - x^2$ and state its nature. [2]

3

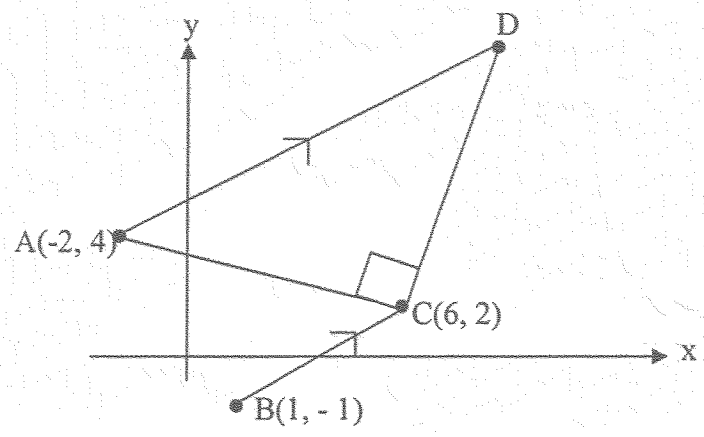


The diagram shows a sector COD of a circle, centre O, in which angle COD = $\frac{4}{3}$ radians. The points A and B lie on OD and OC respectively, and AB is an arc of a circle, centre O, of radius 7 cm. Given that the area of the shaded region ABCD is 48 cm^2, find the perimeter of this shaded region. [7]

4 **(a)** Show that $(\cos\theta)\left(\frac{1}{1-\sin\theta} - \frac{1}{1+\sin\theta}\right)$ can be written in the form $k\tan\theta$, where k is a constant. [4]

(b) Solve the equation $3\sin^2\theta - 2\cos\theta - 3 = 0$, for $0° \leq \theta \leq 180°$. [4]

5



In the diagram, the points A, B and C have coordinates (-2, 4), (1, -1) and (6,2) respectively. The line AD is parallel to BC and angle ACD = 90°

(i) Find the equations of AD and CD. [6]

(ii) Find the coordinates of D. [2]

6 The points A and B have position vectors $\mathbf{a} = 2\mathbf{i} + 3\mathbf{j} + \mathbf{k}$, $\mathbf{b} = 3\mathbf{i} - 5\mathbf{j} + 9\mathbf{k}$ respectively, with respect to a fixed origin O.

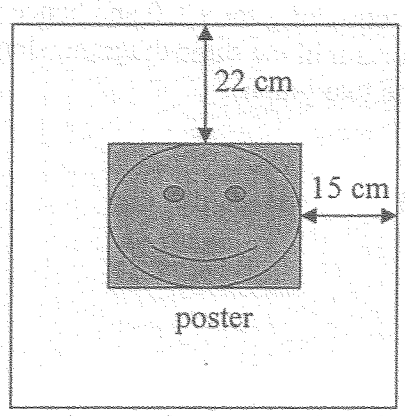
(a) Find a unit vector in the same direction of **a.** [2]

(b) Show that **a** and **b** are perpendicular. [2]

(c) Find, by vector method, the position vector of M which is the mid-point of AB. [3]

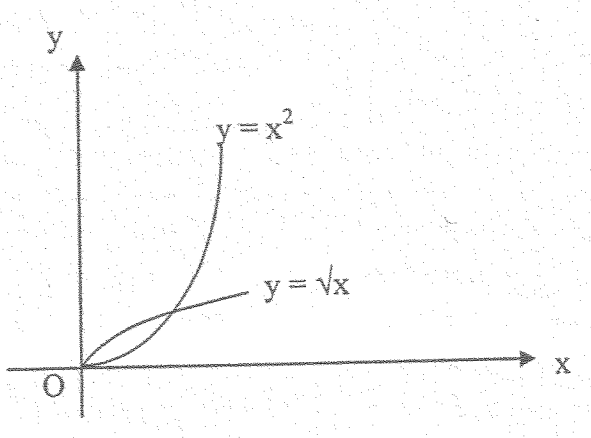
(d) Find the exact area of triangle OAM. [2]

7



The diagram shows a sheet of paper for a poster is to be 1.5 m^2 in area. The margins at the top and bottom are to be 22 cm, and the margins at the sides 15 cm. What should be the dimensions of the sheet to maximize 'the printed area of the poster'? Give your answer in metre, correct to two decimal places. (You are required to show that it is a maximum value.) [9]

8



The diagram shows the curve $y = x^2$ and $y = \sqrt{x}$ for $x \geq 0$.

(i) Find the area of the region A, lying between these two curves. [4]

(ii) That part of the region A for which $0 \leq y \leq \frac{2}{3}$ is rotated about the y-axis through four right angles to form a solid of revolution. Find the volume of the solid so formed as a fraction of π. [6]

9 Given that each of the following functions $S \rightarrow S$,
where $S = \{ x : x \text{ is real and } x \neq 0,1 \}$.

$f : x \rightarrow 1 - x$, $g : x \rightarrow 1 - \frac{1}{x}$ and $h : x \rightarrow \frac{1}{x}$.

(i) Find their inverse functions. [4]

(ii) Give a sketch of the function of g for $x < 0$ and hence sketch the inverse function of g of this portion in the same diagram, showing clearly the relationship between the two graphs. [2]

(iii) Show that

(a) $gf(x) = hg(x)$ and [3]

(b) $hgf(x) = g(x)$. [2]

Section B: Statistics (S1)

10 A school entered 88 students for an examination. The results of the examination are shown in the table below.

Mark (x)	Frequency
$0 < x \leq 10$	3
$10 < x \leq 20$	6
$20 < x \leq 30$	9
$30 < x \leq 40$	10
$40 < x \leq 50$	12
$50 < x \leq 60$	18
$60 < x \leq 70$	14
$70 < x \leq 80$	11
$80 < x \leq 90$	5

(i) Calculate, showing your working and giving your answers correct to two decimal places, the mean mark and the variance. [4]

(ii) Draw, on graph paper, a cumulative frequency polygon to illustrate the distribution of the examination marks. [3]

(iii) Use your graph to estimate

(a) the median mark, [1]

(b) the interquartile range. [2]

The lowest mark required to obtain a grade A in the examination was 75.

(iv) Estimate from your graph the number of students who were awarded a grade A for this examination. [1]