TAYLOR'S UNIVERSITY COLLEGE
Wisdom · Integrity · Excellence

CAMBRIDGE A LEVEL PROGRAMME

AS TRIAL EXAMINATION AUGUST/SEPTEMBER 2009

(January & March 2009 Intake)

Thursday **10 September 2009** **8.30 am – 10.15 am**

MATHEMATICS 9709/12

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.

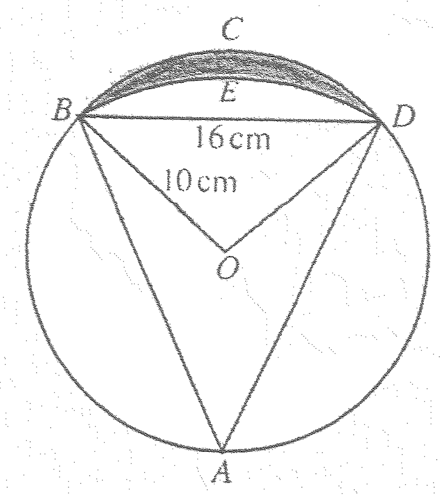
This document consists of **5** printed pages.

[Turn over

1 Find the term independent of x in the expansion of $\left(2x - \frac{3}{x}\right)^8$. [3]

2 In the series 1, 2, 3, 4, 5, etc., every third term is multiplied by 2 so that the series become 1, 2, 6, 4, 5, 12 etc. Find the sum of the first 60 terms of this series. [4]

3



The diagram, which is not drawn to scale, shows a circle $ABCDA$, centre O and radius 10 cm. The chord BD is 16 cm long. BED is an arc of a circle, centre A.
Given that the length of AB is approximately 17.9 cm, find the perimeter of the shaded region enclosed by the arcs BCD and BED. [4]

4 The functions $f(x)$ and $g(x)$ are defined for

$$f(x) = (x-2)^2 + 1, \quad x \le 2$$
$$g(x) = \sqrt{x-1}, \quad x \ge 1$$

(i) Find $f^{-1}(x)$. [2]

(ii) Find $gf(x)$ for $x \le 2$. [2]

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

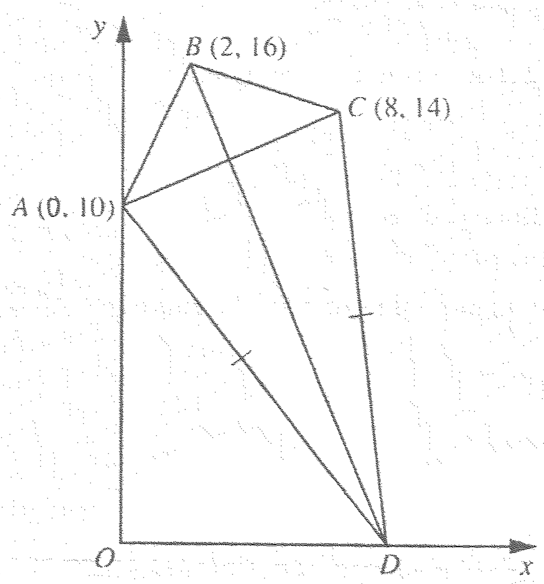
(iv) State the geometrical relationship between the graphs of $f(x)$ and $f^{-1}(x)$. [1]

5 (i) Show that $\dfrac{\sin A}{1+\cos A}+\dfrac{1+\cos A}{\sin A}\equiv\dfrac{2}{\sin A}$ [3]

(ii) Solve the following equation for $0° \le \theta \le 360°$.

$$\sin^2\theta + 5\cos^2\theta - 2\sin\theta = 0$$ [4]

6



The diagram, which is not drawn to scale, shows a quadrilateral $ABCD$ in which A is (0,10), B is (2,16) and C is (8,14). The point D lies on the x-axis and is such that $AD = CD$. Given that triangle ABC is isosceles. Find

(i) the coordinates of D, [4]

(ii) the ratio of the area of triangle ABC to the area of triangle ACD. [3]

7 Given that $x^2+2x+3\equiv(x+a)^2+b$,

(i) find the values of the constants a and b. [2]

(ii) sketch the graph of $y=x^2+2x+3$, indicating clearly the coordinates of the turning point and any intersection with the coordinates axes. [3]

(iii) find the values of x satisfying the inequality $x^2+2x+3\ge 11$. [3]

[Turn over

8 The position vectors of points A, B, C are $\mathbf{a} = 4\mathbf{i} - 9\mathbf{j} - \mathbf{k}$, $\mathbf{b} = \mathbf{i} + 3\mathbf{j} + 5\mathbf{k}$ and $\mathbf{c} = p\mathbf{i} - \mathbf{j} + 3\mathbf{k}$.

(i) Find the unit vector parallel to the vector **AB**. [3]

(ii) Find the value of p such that A, B, C are collinear. [3]

(iii) If $p = -2$ and $ABCD$ is a parallelogram,

(a) find the position vector of D. [3]

(b) show that $ABCD$ is not a rectangle. [2]

9 (a) Differentiate with respect to x, $\dfrac{(x+4)^2}{x}$ [2]

Hence, find the equation of normal of the curve $y = \dfrac{(x+4)^2}{x}$ at $x = 2$. [3]

(b)

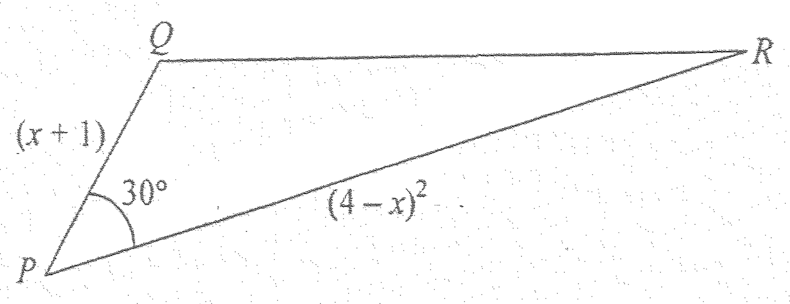


Figure above shows a triangle PQR. The size of an angle QPR is $30°$, the length of PQ is $(x + 1)$ and the length of PR is $(4 - x)^2$.

(i) Show that the area A of the triangle is given by

$$A = \frac{1}{4}\left(x^3 - 7x^2 + 8x + 16\right)$$ [2]

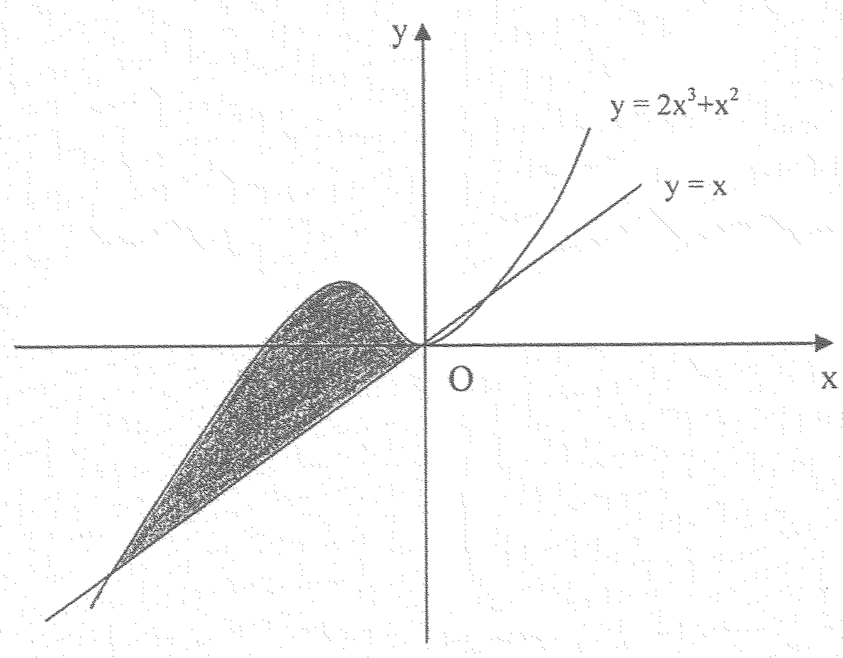
(ii) Use calculus to find the maximum area of triangle PQR. [5]

10 (a) Find

(i) $\int x(x-1)^3 \, dx$ [3]

(ii) $\int \sqrt{3x-1} \, dx$ [3]

(b)



Find the shaded area between the curve $y = 2x^3 + x^2$ and the line $y = x$ in the region $x < 0$. [6]