TAYLOR'S COLLEGE

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CAMBRIDGE A LEVEL PROGRAMME

AS TRIAL EXAMINATION MARCH/APRIL 2011

(June 2010 Intake)

Thursday **31 March 2011** **8.30 am – 10.15 am**

MATHEMATICS 9709/13

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 **6** printed pages.

[Turn over

1 Find the first three terms, in ascending powers of x, of the binomial expansion of $(3+2x)^5$, giving each term in its simplest form. [3]

2 Solve the following simultaneous equations

$$x + y = 2$$

$$x^2 + 2y = 12.$$ [4]

3 Given that

$$\mathbf{p} = 2\mathbf{i} + m\mathbf{j} - 7\mathbf{k} \qquad \text{and} \qquad \mathbf{q} = m\mathbf{i} + 6\mathbf{j} + 4\mathbf{k}$$

respectively, where m can take different values.

(i) Determine the value of m for which **p** and **q** are perpendicular. [3]

(ii) In the case when $m = 4$, find the acute angle between the vectors **p** and **q**, giving your answer to the nearest 0.1°. [3]

4 The rth term of an arithmetic series is $(2r-5)$.

(i) Write down the first three terms of this series. [3]

(ii) State the value of the common difference. [1]

(iii) Find the sum of the arithmetic series -3 -1 + 1 +... + (2n - 5). [3]

5 **(i)** Show that the equation

$$5\cos^2 x = 3(1 + \sin x)$$

can be written as

$$5\sin^2 x + 3\sin x - 2 = 0.$$ [2]

(ii) Hence solve, for $0^\circ \le x < 360^\circ$, the equation

$$5\cos^2 x = 3(1 + \sin x),$$

giving your answers to 1 decimal place where appropriate. [5]

6 The second and fourth terms of a geometric series are 7.2 and 5.832 respectively. Given that the common ratio of the series is positive, find

(i) the common ratio, [2]

(ii) the first term, [1]

(iii) the sum of the first 50 terms, giving your answer to 3 decimal places, [2]

(iv) the difference between the sum to infinity and the sum of the first 50 terms, giving your answer to 3 decimal places. [2]

7 Given that

$$f(x) = x^2 - 6x + 18, \quad x \geq 0.$$

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

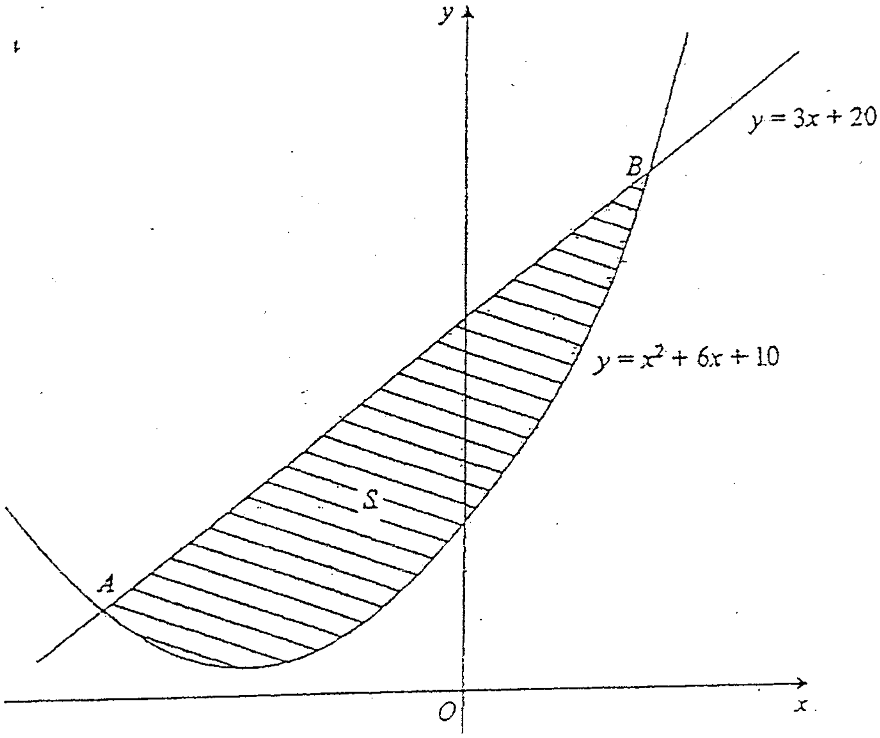
The curve C with equation $y = f(x)$, $x \geq 0$, meets the y-axis at P and has a minimum point at Q.

(ii) Sketch the graph of C, showing the coordinates of P and Q. [3]

The line $y = 41$ meets C at the point R.

(iii) Find the x-coordinate of R, giving your answer in the form $p + q\sqrt{2}$, where p and q are integers. [3]

8



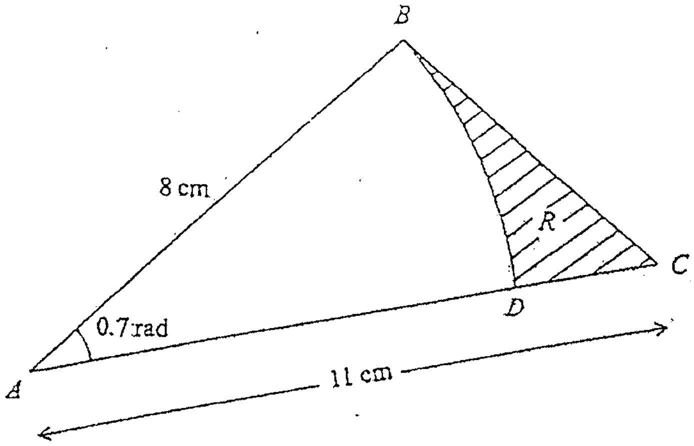
In the diagram, the line with equation $y = 3x + 20$ cuts the curve with equation $y = x^2 + 6x + 10$ at the points A and B.

(i) Find the coordinates of A and B. [4]

The shaded region S is bounded by the line and the curve.

(ii) Find the exact area of S. [5]

9



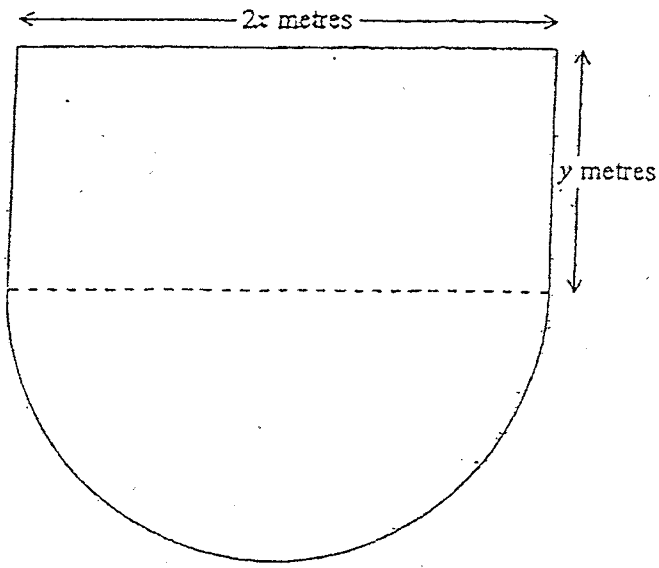
In the diagram, ABC is a triangle with angle $BAC = 0.7$ radians, $AB = 8$cm and $AC = 11$cm. The arc BD, where D lies on AC, is an arc of a circle with centre A and radius 8cm. The region R, shown shaded in diagram, is bounded by the straight lines BC and CD and the arc BD. Find

(i) the length of the arc BD, [2]

(ii) the perimeter of R, giving your answer to 3 significant figures. [4]

(iii) the area of R, giving your answer to 3 significant figures. [5]

10



The diagram shows the plan of a stage in the shape of a rectangle joined to a semicircle. The length of the rectangular part is $2x$ metres and the width is y metres. The perimeter of the stage is 80 metres.

(i) Show that the area, A m^2, of the stage is given by

$$A = 80x - \left(2 + \frac{\pi}{2}\right)x^2.$$ [5]

(ii) Find the value of x at which A has a stationary value. [4]

(iii) Prove that the value of x found in part (ii) gives the maximum value of A. [2]

(iv) Calculate, to the nearest m^2, the maximum area of the stage. [2]