OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Advanced Subsidiary General Certificate of Education
Advanced General Certificate of Education

MEI STRUCTURED MATHEMATICS   2601

Pure Mathematics 1

Tuesday   **10 JANUARY 2006**   Afternoon   1 hour 20 minutes

Additional materials:
    One 8-page answer booklet
    Graph paper
    MEI Examination Formulae and Tables (MF12)

TIME   1 hour 20 minutes

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the spaces provided on the answer booklet.

- Answer **all** the questions.

- You are permitted to use only a scientific calculator in this paper.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [ ] at the end of each question or part question.

- You are advised that an answer may receive **no marks** unless you show sufficient detail of the working to indicate that a correct method is being used.

- Final answers should be given to a degree of accuracy appropriate to the context.

- The total number of marks for this paper is 60.

This question paper consists of 4 printed pages.

Section A (30 marks)

1 Find $\int 6x^2 \, dx$. [2]

2 Multiply out and simplify $(x - 3)(2x^2 + 7x - 5)$. [2]

3 When $x^3 + 3x + c$ is divided by $(x + 2)$, there is a remainder of 8. Find the value of c. [3]

4 Find the **exact** value of $\cos \theta$, given that $\tan \theta = \frac{1}{2}$ and that θ is an acute angle. [3]

5 Sketch the graph of $y = \cos x$ for $0 \leqslant x \leqslant 2\pi$.

Solve the equation $\cos x = 0.45$ for $0 \leqslant x \leqslant 2\pi$. [4]

6 Find the *x*-coordinates of the turning points on the curve $y = x^3 - 6x$. [4]
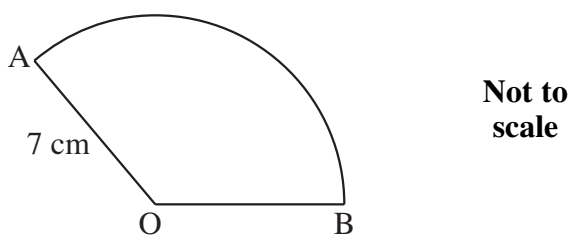
7

Not to scale

7 cm

Fig. 7

Fig. 7 shows a sector of a circle with centre O and radius 7 cm. The length of the arc AB is 12.6 cm.

Calculate the sector angle, in radians.

Calculate also the area of the sector. [4]

8 Find the coefficient of x^3 in the binomial expansion of $(2 - 3x)^5$. [4]

9 Express $2x^2 - 12x + 5$ in the form $a(x - b)^2 - c$. [4]
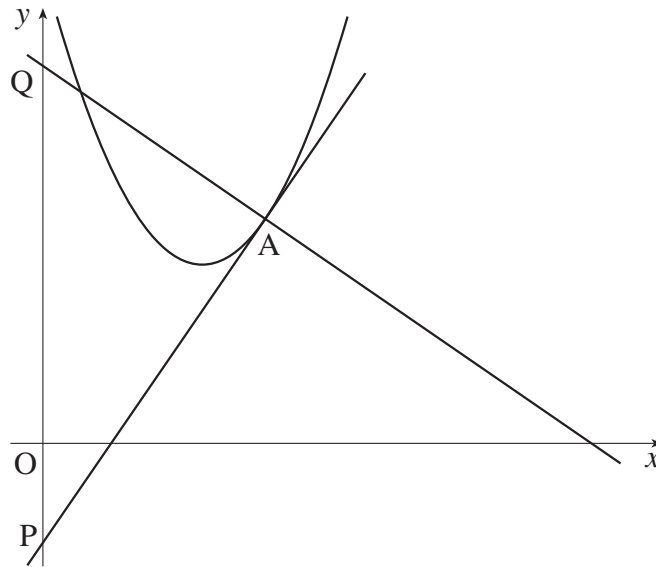
Section B (30 marks)

10

Fig. 10

Fig. 10 shows a sketch of the graph of $y = x^2 - 6x + 14$, together with the tangent and normal to the curve at the point A where $x = 4$.

(i) Find, in the form $y = mx + c$, the equation of the tangent at A. Hence show that the tangent crosses the y-axis at P$(0, -2)$. [6]

(ii) Show that the normal at A crosses the y-axis at Q$(0, 8)$. [4]

(iii) Find the equation of the circle with PQ as diameter.

Find the coordinates of the points of intersection of this circle with the x-axis. [5]

(iv) Explain how you can tell that this circle passes through A. [1]

[Total 16]

[Question 11 is printed overleaf.]

11 Jenny goes cycling. This table shows readings of her speed taken every two minutes during the first 10 minutes.

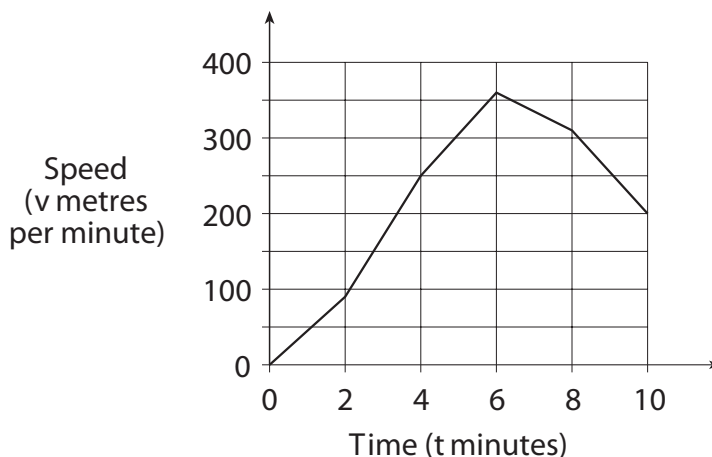| Time (t minutes)	0	2	4	6	8	10
Speed (v metres per minute)	0	90	250	360	310	200

From these, Jenny drew the graph shown in Fig. 11.

Fig. 11

(i) Estimate the distance Jenny has travelled, by using the trapezium rule with 5 strips to calculate the area of the region bounded by the straight line segments, the v-axis and the line $t = 10$. [4]

(ii) Jenny modelled her speed for $0 \leqslant t \leqslant 10$ by the cubic equation $v = -1.15t^3 + 9t^2 + 45t$.

(A) Show that this model gives the correct values of v at $t = 0$ and $t = 10$. [1]

(B) Find the relative errors in the values of v that this model gives when $t = 4$ and $t = 8$. [4]

(C) Evaluate $\int_0^{10} v \, dt$ for this model. [3]

(iii) Make two comments on the suitability or otherwise of Jenny's model in part (ii). [2]

[Total 14]