OCR
RECOGNISING ACHIEVEMENT

ADVANCED SUBSIDIARY GCE
MATHEMATICS (MEI) 4752
Concepts for Advanced Mathematics (C2)

Candidates answer on the Answer Booklet

OCR Supplied Materials:
- 8 page Answer Booklet
- Insert for Question 12 (inserted)
- MEI Examination Formulae and Tables (MF2)

Other Materials Required:
None

Friday 15 January 2010
Afternoon

Duration: 1 hour 30 minutes

* 4 7 5 2 *

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the spaces provided on the Answer Booklet.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- There is an **insert** for use in Question **12**.
- You are permitted to use a graphical calculator in this paper.
- Final answers should be given to a degree of accuracy appropriate to the context.

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.
- The total number of marks for this paper is **72**.
- This document consists of **8** pages. Any blank pages are indicated.

Section A (36 marks)

1 Find $\int \left(x - \frac{3}{x^2}\right) \mathrm{d}x$. **[3]**

2 A sequence begins

$$1 \quad 3 \quad 5 \quad 3 \quad 1 \quad 3 \quad 5 \quad 3 \quad 1 \quad 3 \quad \ldots$$

and continues in this pattern.

(i) Find the 55th term of this sequence, showing your method. **[1]**

(ii) Find the sum of the first 55 terms of the sequence. **[2]**

3 You are given that $\sin\theta = \frac{\sqrt{2}}{3}$ and that θ is an acute angle. Find the **exact** value of $\tan\theta$. **[3]**

4 A sector of a circle has area $8.45\,\mathrm{cm}^2$ and sector angle 0.4 radians. Calculate the radius of the sector. **[3]**

5

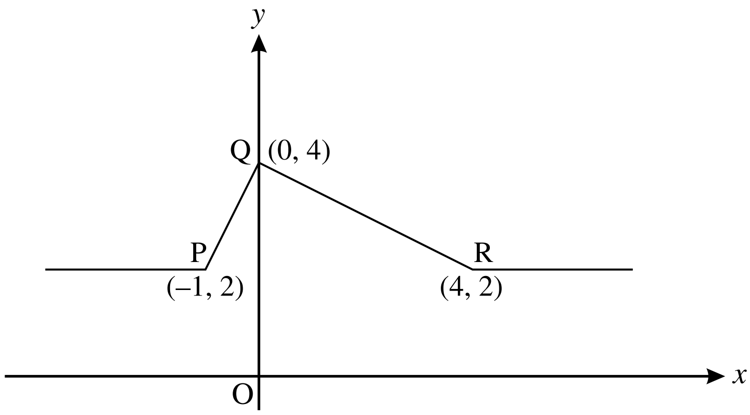

Fig. 5

Fig. 5 shows a sketch of the graph of $y = \mathrm{f}(x)$. On separate diagrams, sketch the graphs of the following, showing clearly the coordinates of the points corresponding to P, Q and R.

(i) $y = \mathrm{f}(2x)$ **[2]**

(ii) $y = \frac{1}{4}\mathrm{f}(x)$ **[2]**

6 **(i)** Find the 51st term of the sequence given by

$$u_1 = 5,$$
$$u_{n+1} = u_n + 4.$$ **[3]**

(ii) Find the sum to infinity of the geometric progression which begins

$$5 \quad 2 \quad 0.8 \quad \dots .$$ **[2]**

7

Not to scale

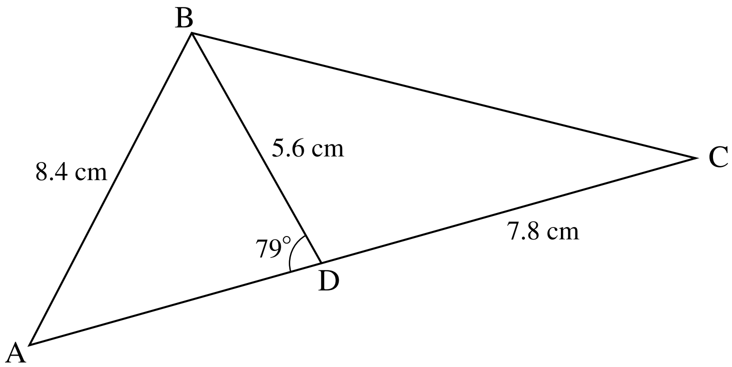

Fig. 7

Fig. 7 shows triangle ABC, with AB = 8.4 cm. D is a point on AC such that angle ADB = 79°, BD = 5.6 cm and CD = 7.8 cm.

Calculate

(i) angle BAD, **[2]**

(ii) the length BC. **[3]**

8 Find the equation of the tangent to the curve $y = 6\sqrt{x}$ at the point where $x = 16$. **[5]**

9 **(i)** Sketch the graph of $y = 3^x$. **[2]**

(ii) Use logarithms to solve $3^{2x+1} = 10$, giving your answer correct to 2 decimal places. **[3]**

Section B (36 marks)

10 **(i)** Differentiate $x^3 - 3x^2 - 9x$. Hence find the x-coordinates of the stationary points on the curve $y = x^3 - 3x^2 - 9x$, showing which is the maximum and which the minimum. **[6]**

(ii) Find, in exact form, the coordinates of the points at which the curve crosses the x-axis. **[3]**

(iii) Sketch the curve. **[2]**

11 Fig. 11 shows the cross-section of a school hall, with measurements of the height in metres taken at 1.5 m intervals from O.

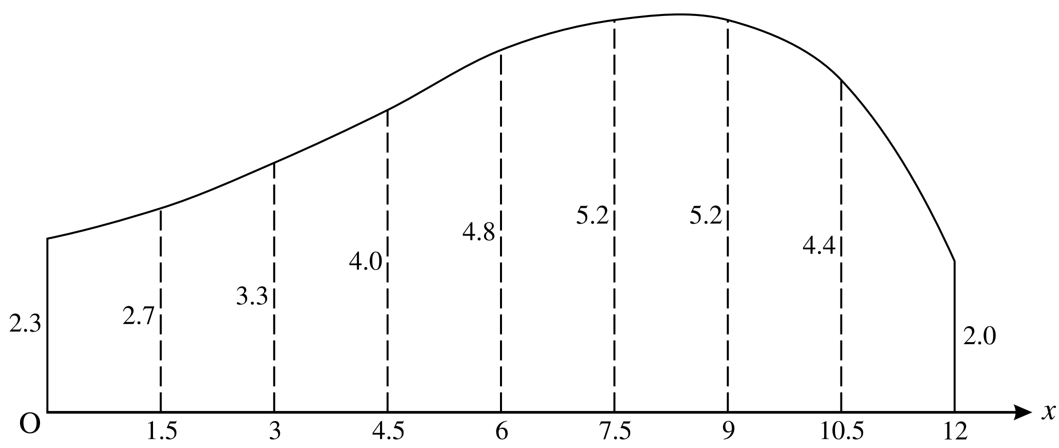

Fig. 11

(i) Use the trapezium rule with 8 strips to calculate an estimate of the area of the cross-section. **[4]**

(ii) Use 8 rectangles to calculate a lower bound for the area of the cross-section. **[2]**

The curve of the roof may be modelled by $y = -0.013x^3 + 0.16x^2 - 0.082x + 2.4$, where x metres is the horizontal distance from O across the hall, and y metres is the height.

(iii) Use integration to find the area of the cross-section according to this model. **[4]**

(iv) Comment on the accuracy of this model for the height of the hall when $x = 7.5$. **[2]**

12 Answer part (ii) of this question on the insert provided.

Since 1945 the populations of many countries have been growing. The table shows the estimated population of 15- to 59-year-olds in Africa during the period 1955 to 2005.

Year	1955	1965	1975	1985	1995	2005
Population (millions)	131	161	209	277	372	492

Source: United Nations

Such estimates are used to model future population growth and world needs of resources. One model is $P = a10^{bt}$, where the population is P millions, t is the number of years after 1945 and a and b are constants.

(i) Show that, using this model, the graph of $\log_{10} P$ against t is a straight line of gradient b. State the intercept of this line on the vertical axis. **[3]**

(ii) **On the insert**, complete the table, giving values correct to 2 decimal places, and plot the graph of $\log_{10} P$ against t. Draw, by eye, a line of best fit on your graph. **[3]**

(iii) Use your graph to find the equation for P in terms of t. **[4]**

(iv) Use your results to estimate the population of 15- to 59-year-olds in Africa in 2050. Comment, with a reason, on the reliability of this estimate. **[3]**