

**ADVANCED SUBSIDIARY GCE
MATHEMATICS (MEI)**

Concepts for Advanced Mathematics (C2)

4752

QUESTION PAPER

Candidates answer on the Printed Answer Book

OCR Supplied Materials:

- Printed Answer Book 4752
- MEI Examination Formulae and Tables (MF2)

Other Materials Required:

- Scientific or graphical calculator

**Thursday 27 May 2010
Morning**

Duration: 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

These instructions are the same on the Printed Answer Book and the Question Paper.

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the spaces provided on the Printed Answer Book.
- **The questions are on the inserted Question Paper.**
- **Write your answer to each question in the space provided in the Printed Answer Book.** Additional paper may be used if necessary but you must clearly show your Candidate Number, Centre Number and question number(s).
- 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.
- 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

This information is the same on the Printed Answer Book and the Question Paper.

- The number of marks is given in brackets [] at the end of each question or part question on the Question Paper.
- 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**.
- The Printed Answer Book consists of **12** pages. The Question Paper consists of **8** pages. Any blank pages are indicated.

INSTRUCTION TO EXAMS OFFICER / INVIGILATOR

- Do not send this Question Paper for marking; it should be retained in the centre or destroyed.

Section A (36 marks)

- 1** You are given that

$$u_1 = 1,$$

$$u_{n+1} = \frac{u_n}{1 + u_n}.$$

Find the values of u_2 , u_3 and u_4 . Give your answers as fractions.

[2]

- 2** (i) Evaluate $\sum_{r=2}^5 \frac{1}{r-1}$.

[2]

- (ii) Express the series $2 \times 3 + 3 \times 4 + 4 \times 5 + 5 \times 6 + 6 \times 7$ in the form $\sum_{r=2}^a f(r)$ where $f(r)$ and a are to be determined.

[2]

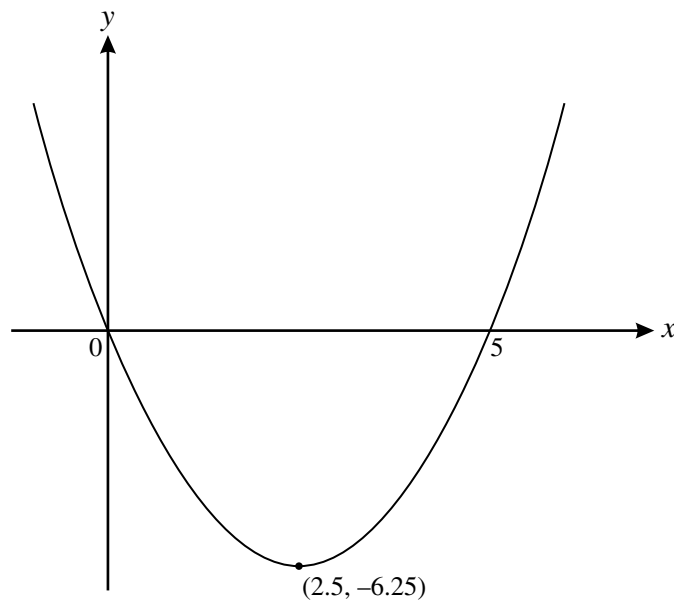
- 3** (i) Differentiate $x^3 - 6x^2 - 15x + 50$.

[2]

- (ii) Hence find the x -coordinates of the stationary points on the curve $y = x^3 - 6x^2 - 15x + 50$.

[3]

- 4** In this question, $f(x) = x^2 - 5x$. Fig. 4 shows a sketch of the graph of $y = f(x)$.

**Fig. 4**

On separate diagrams, sketch the curves $y = f(2x)$ and $y = 3f(x)$, labelling the coordinates of their intersections with the axes and their turning points.

[4]

- 5 Find $\int_2^5 \left(1 - \frac{6}{x^3}\right) dx$. [4]
- 6 The gradient of a curve is $6x^2 + 12x^{\frac{1}{2}}$. The curve passes through the point (4, 10). Find the equation of the curve. [5]
- 7 Express $\log_a x^3 + \log_a \sqrt{x}$ in the form $k \log_a x$. [2]
- 8 Showing your method clearly, solve the equation $4 \sin^2 \theta = 3 + \cos^2 \theta$, for values of θ between 0° and 360° . [5]
- 9 The points (2, 6) and (3, 18) lie on the curve $y = ax^n$.
Use logarithms to find the values of a and n , giving your answers correct to 2 decimal places. [5]

Section B (36 marks)

- 10 (i) Find the equation of the tangent to the curve $y = x^4$ at the point where $x = 2$. Give your answer in the form $y = mx + c$. [4]
- (ii) Calculate the gradient of the chord joining the points on the curve $y = x^4$ where $x = 2$ and $x = 2.1$. [2]
- (iii) (A) Expand $(2 + h)^4$. [3]
- (B) Simplify $\frac{(2 + h)^4 - 2^4}{h}$. [2]
- (C) Show how your result in part (iii) (B) can be used to find the gradient of $y = x^4$ at the point where $x = 2$. [2]

11 (a)

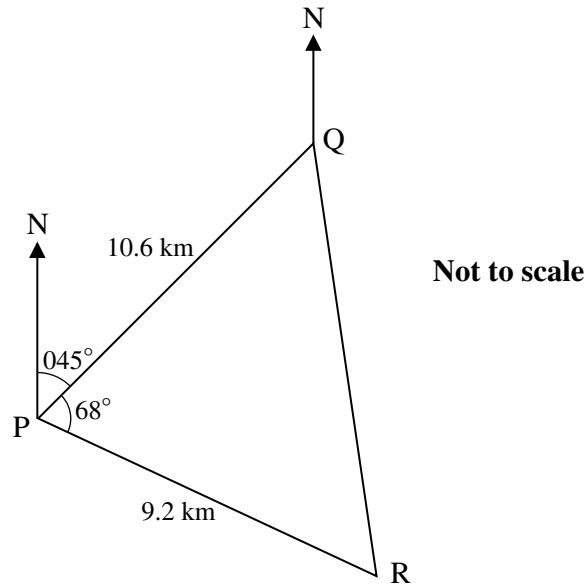


Fig. 11.1

A boat travels from P to Q and then to R. As shown in Fig. 11.1, Q is 10.6 km from P on a bearing of 045° . R is 9.2 km from P on a bearing of 113° , so that angle QPR is 68° .

Calculate the distance and bearing of R from Q.

[5]

(b) Fig. 11.2 shows the cross-section, EBC, of the rudder of a boat.

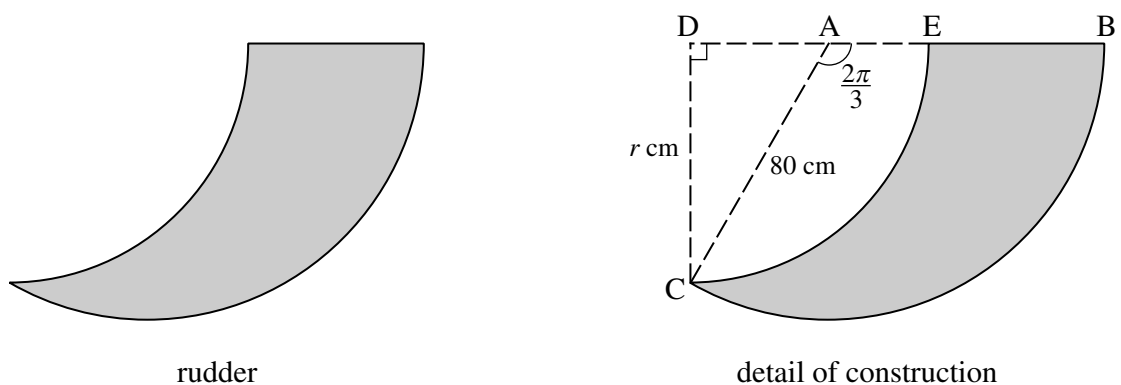


Fig. 11.2

BC is an arc of a circle with centre A and radius 80 cm. Angle $CAB = \frac{2\pi}{3}$ radians.

EC is an arc of a circle with centre D and radius r cm. Angle CDE is a right angle.

- (i) Calculate the area of sector ABC. [2]
- (ii) Show that $r = 40\sqrt{3}$ and calculate the area of triangle CDA. [3]
- (iii) Hence calculate the area of cross-section of the rudder. [3]

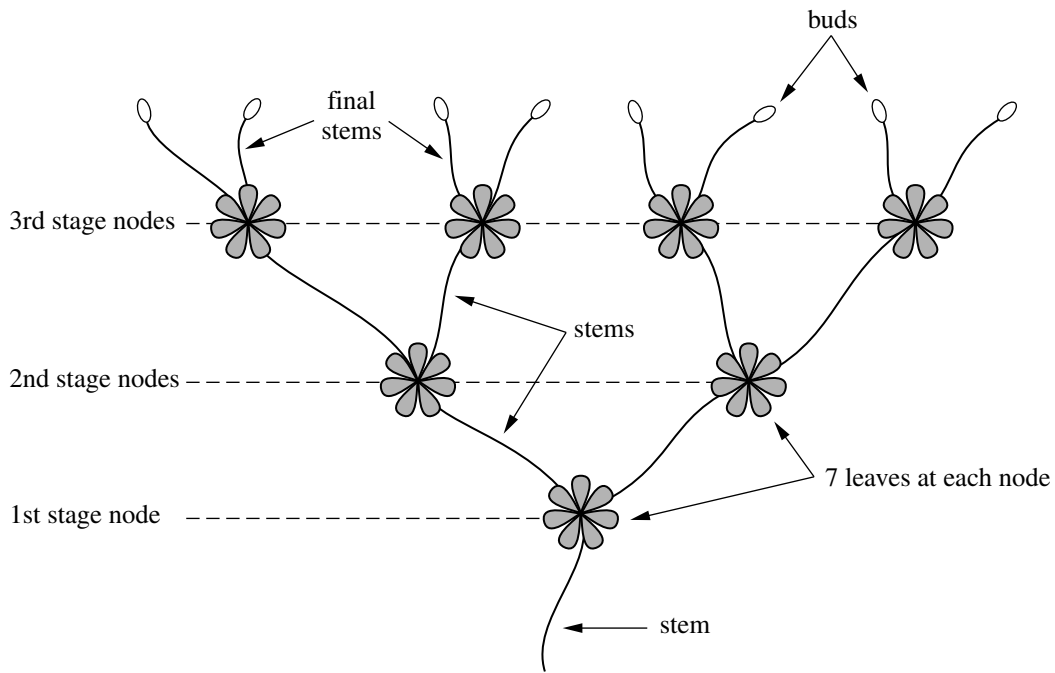


Fig. 12

A branching plant has stems, nodes, leaves and buds.

- There are 7 leaves at each node.
- From each node, 2 new stems grow.
- At the end of each final stem, there is a bud.

Fig. 12 shows one such plant with 3 stages of nodes. It has 15 stems, 7 nodes, 49 leaves and 8 buds.

(i) One of these plants has 10 stages of nodes.

(A) How many buds does it have? [2]

(B) How many stems does it have? [2]

(ii) (A) Show that the number of leaves on one of these plants with n stages of nodes is

$$7(2^n - 1). \quad [2]$$

(B) One of these plants has n stages of nodes and more than 200 000 leaves. Show that n satisfies the inequality $n > \frac{\log_{10} 200\,007 - \log_{10} 7}{\log_{10} 2}$. Hence find the least possible value of n .

[4]