

**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  $y = f(x)$ .

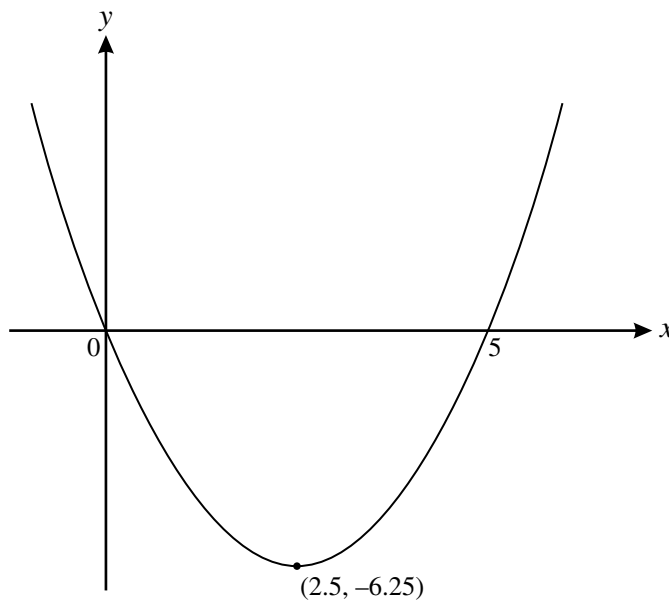


Fig. 4

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  $\theta$  between  $0^\circ$  and  $360^\circ$ . [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)

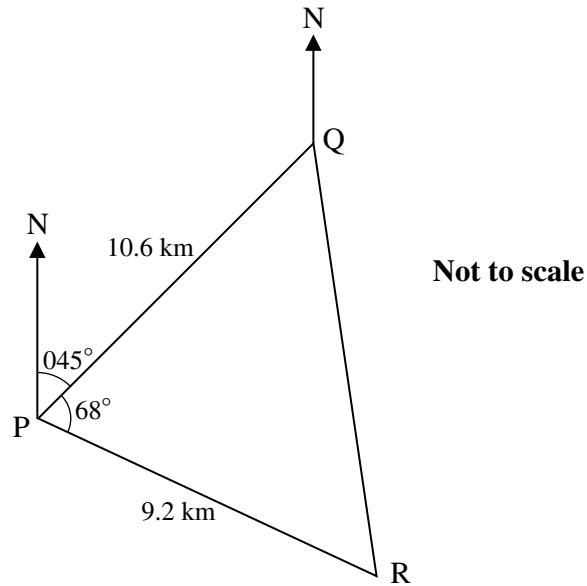


Fig. 11.1

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  $045^\circ$ . R is 9.2 km from P on a bearing of  $113^\circ$ , so that angle QPR is  $68^\circ$ .

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.

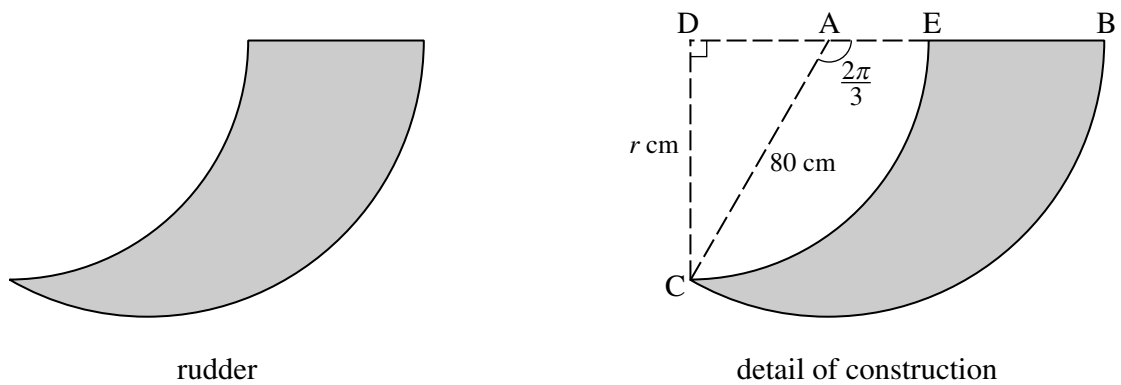


Fig. 11.2

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]

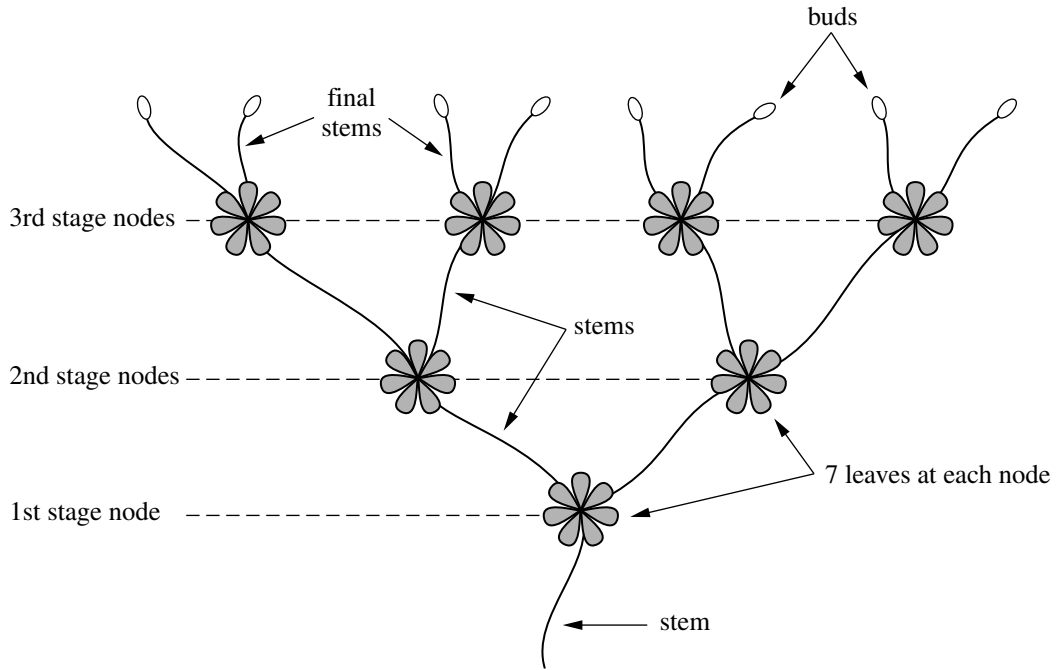


Fig. 12

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]

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**Section A (36 marks)**

<b>1</b>	
<b>2 (i)</b>	
<b>2 (ii)</b>	





<b>6</b>	
<b>7</b>	
<b>8</b>	

<b>9</b>	

**Section B (36 marks)**

<b>10 (i)</b>	

<b>10 (ii)</b>	
<b>10 (iii)</b> <i>(A), (B)</i> and <i>(C)</i>	

<b>11 (a)</b>	
<b>11 (b) (i)</b>	



<b>11(b)(ii)</b>	

<b>11(b)(iii)</b>	

<b>12(i)(A)</b>	
<b>12(i)(B)</b>	
<b>12(ii)(A)</b>	

<b>12(ii)(B)</b>	

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