

# Friday 18 May 2012 – Morning

## AS GCE MATHEMATICS (MEI)

4752 Concepts for Advanced Mathematics (C2)

#### **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 **Duration:** 1 hour 30 minutes

### **INSTRUCTIONS TO CANDIDATES**

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

- The Question Paper will be found in the centre of the Printed Answer Book.
- Write your name, centre number and candidate number in the spaces provided on the Printed Answer Book. Please write clearly and in capital letters.
- 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. HB pencil may be used for graphs and diagrams only.
- Read each question carefully. Make sure 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 scientific or 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 recycled. Please contact OCR Copyright should you wish to re-use this document.



[4]

#### Section A (36 marks)

1 Find 
$$\frac{dy}{dx}$$
 when  $y = \sqrt{x} + \frac{3}{x}$ . [3]

 $u_1$ 

2 Find the second and third terms in the sequence given by

$$u_1 = 5,$$
  
 $u_{n+1} = u_n + 3.$ 

Find also the sum of the first 50 terms of this sequence.

3

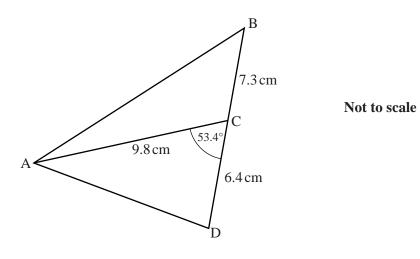


Fig. 3

In Fig. 3, BCD is a straight line. AC = 9.8 cm, BC = 7.3 cm and CD = 6.4 cm; angle  $ACD = 53.4^{\circ}$ .

(i) Calculate the length AD.	[3]
(ii) Calculate the area of triangle ABC.	[2]

4 The point P (6, 3) lies on the curve y = f(x). State the coordinates of the image of P after the transformation which maps y = f(x) onto

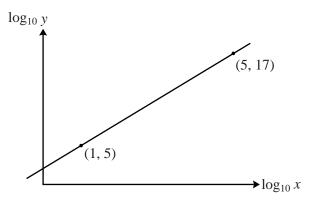
(i) $y = 3f(x)$ ,		[2]

(ii) 
$$y = f(4x)$$
. [2]

A sector of a circle has angle 1.6 radians and area  $45 \text{ cm}^2$ . Find the radius and perimeter of the sector. 5 [5]

[5]

**6** Fig. 6 shows the relationship between  $\log_{10} x$  and  $\log_{10} y$ .





Find y in terms of x.

- 7 The gradient of a curve is given by  $\frac{dy}{dx} = 6x^{\frac{1}{2}} 5$ . Given also that the curve passes through the point (4, 20), find the equation of the curve. [5]
- 8 Solve the equation  $\sin 2\theta = 0.7$  for values of  $\theta$  between 0 and  $2\pi$ , giving your answers in radians correct to 3 significant figures. [5]

#### Section B (36 marks)

**9** A farmer digs ditches for flood relief. He experiments with different cross-sections. Assume that the surface of the ground is horizontal.



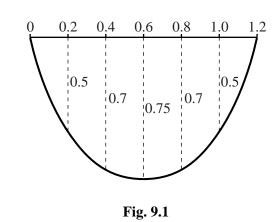


Fig. 9.1 shows the cross-section of one ditch, with measurements in metres. The width of the ditch is 1.2 m and Fig. 9.1 shows the depth every 0.2 m across the ditch.

Use the trapezium rule with six intervals to estimate the area of cross-section. Hence estimate the volume of water that can be contained in a 50-metre length of this ditch. [5]

(ii) Another ditch is 0.9 m wide, with cross-section as shown in Fig. 9.2.

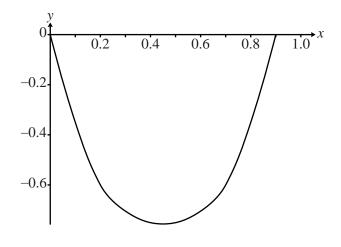


Fig. 9.2

With x- and y-axes as shown in Fig. 9.2, the curve of the ditch may be modelled closely by  $y = 3.8x^4 - 6.8x^3 + 7.7x^2 - 4.2x$ .

- (*A*) The actual ditch is 0.6 m deep when x = 0.2. Calculate the difference between the depth given by the model and the true depth for this value of *x*. [2]
- (*B*) Find  $\int (3.8x^4 6.8x^3 + 7.7x^2 4.2x) dx$ . Hence estimate the volume of water that can be contained in a 50-metre length of this ditch. [5]

- 10 (i) Use calculus to find, correct to 1 decimal place, the coordinates of the turning points of the curve  $y = x^3 5x$ . [You need not determine the nature of the turning points.] [4]
  - (ii) Find the coordinates of the points where the curve  $y = x^3 5x$  meets the axes and sketch the curve. [4]
  - (iii) Find the equation of the tangent to the curve  $y = x^3 5x$  at the point (1, -4). Show that, where this tangent meets the curve again, the *x*-coordinate satisfies the equation

$$x^3 - 3x + 2 = 0.$$

Hence find the *x*-coordinate of the point where this tangent meets the curve again. [6]

- 11 A geometric progression has first term a and common ratio r. The second term is 6 and the sum to infinity is 25.
  - (i) Write down two equations in *a* and *r*. Show that one possible value of *a* is 10 and find the other possible value of *a*. Write down the corresponding values of *r*.
  - (ii) Show that the ratio of the *n*th terms of the two geometric progressions found in part (i) can be written as  $2^{n-2}: 3^{n-2}$ . [3]