

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.

## Section A (36 marks)

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

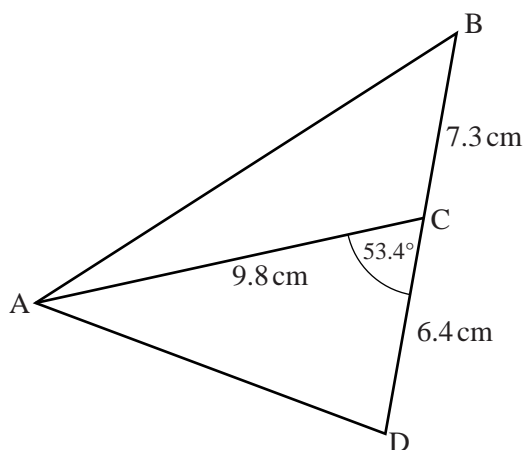
2 Find the second and third terms in the sequence given by

$$u_1 = 5,$$

$$u_{n+1} = u_n + 3.$$

Find also the sum of the first 50 terms of this sequence. [4]

3



Not to scale

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]

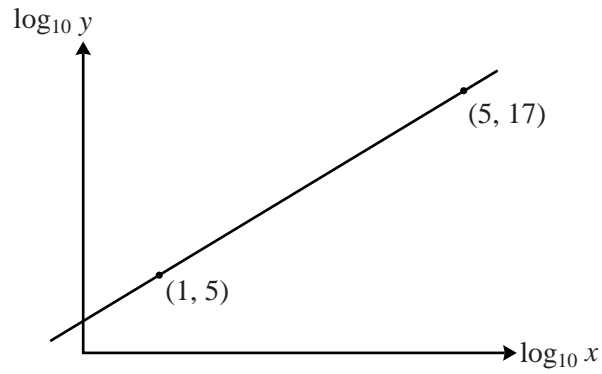
4 The point P (6, 3) lies on the curve  $y = f(x)$ . State the coordinates of the image of P after the transformation which maps  $y = f(x)$  onto

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

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

5 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]

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



**Fig. 6**

Find  $y$  in terms of  $x$ .

[5]

- 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.

(i)

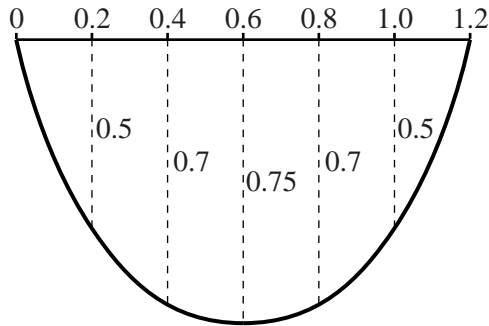


Fig. 9.1

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.

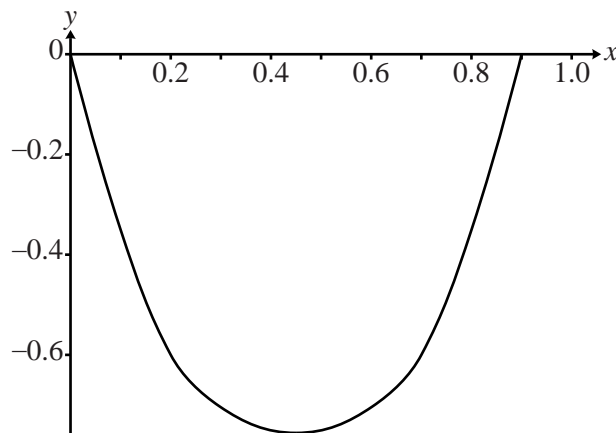


Fig. 9.2

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  $r$ . [7]
- (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]