OCR
RECOGNISING ACHIEVEMENT

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)

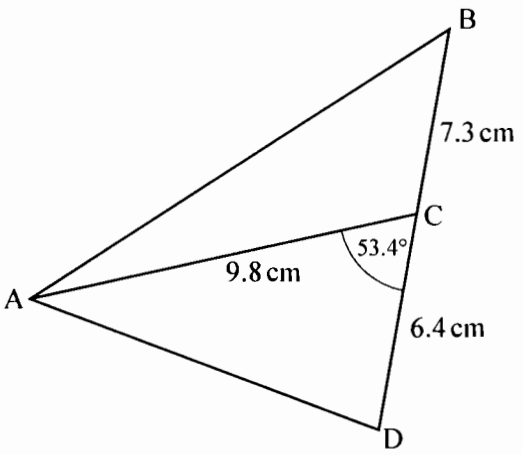
1 Find $\frac{dy}{dx}$ when $y = \sqrt{x} + \frac{3}{x}$. **[3]**

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°.

(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 cm^2. Find the radius and perimeter of the sector. **[5]**

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

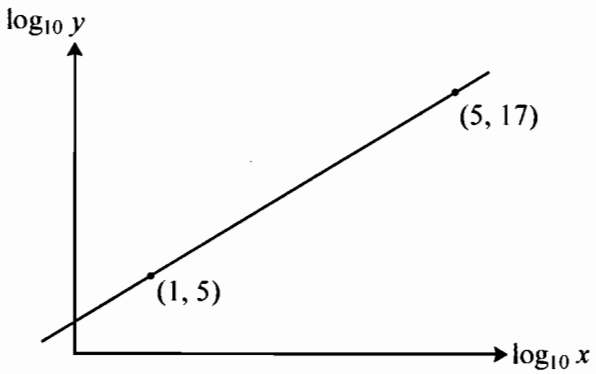


Fig. 6

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 θ between 0 and 2π, 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)

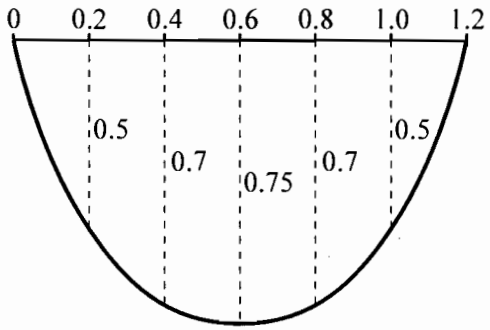


Fig. 9.1

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.

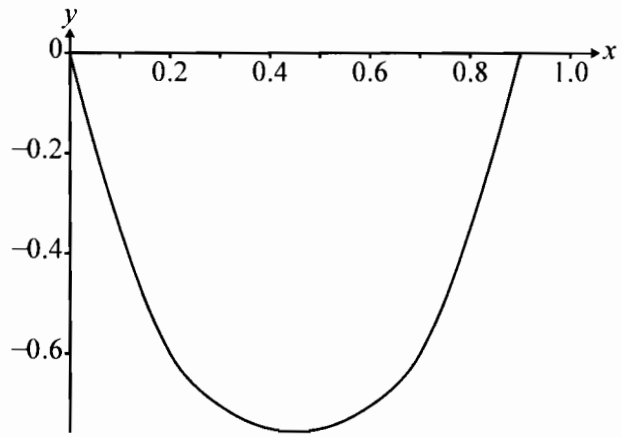


Fig. 9.2

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 nth terms of the two geometric progressions found in part **(i)** can be written as $2^{n-2} : 3^{n-2}$. **[3]**