

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
AS GCE
4752
MATHEMATICS (MEI)
Concepts for Advanced Mathematics (C2)
QUESTION PAPER

FRIDAY 18 MAY 2012: Morning
DURATION: 1 hour 30 minutes
plus your additional time allowance

MODIFIED ENLARGED

Candidates answer on the Printed Answer Book or any suitable paper provided by the centre. The Printed Answer Book may be enlarged by the centre.

OCR SUPPLIED MATERIALS:

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

OTHER MATERIALS REQUIRED:

Scientific or graphical calculator

READ INSTRUCTIONS OVERLEAF

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.**
- **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.**

INSTRUCTION TO EXAMS OFFICER/INVIGILATOR

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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 The following diagram is Fig. 3.

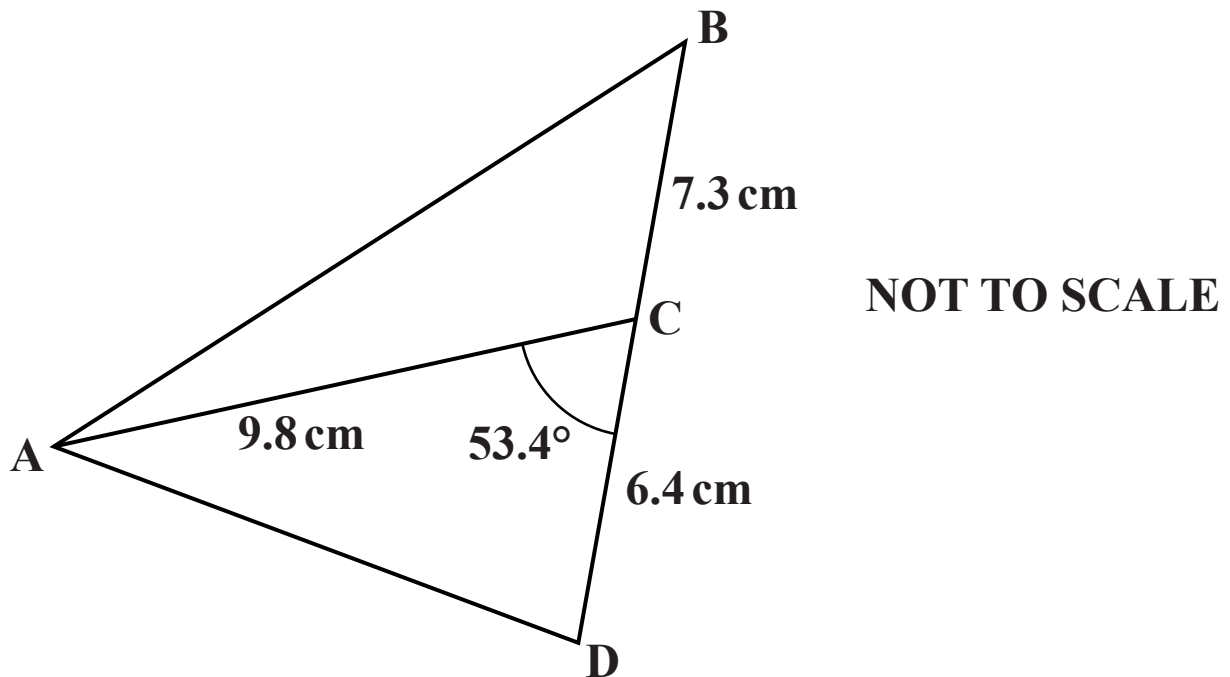


Fig. 3

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]

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

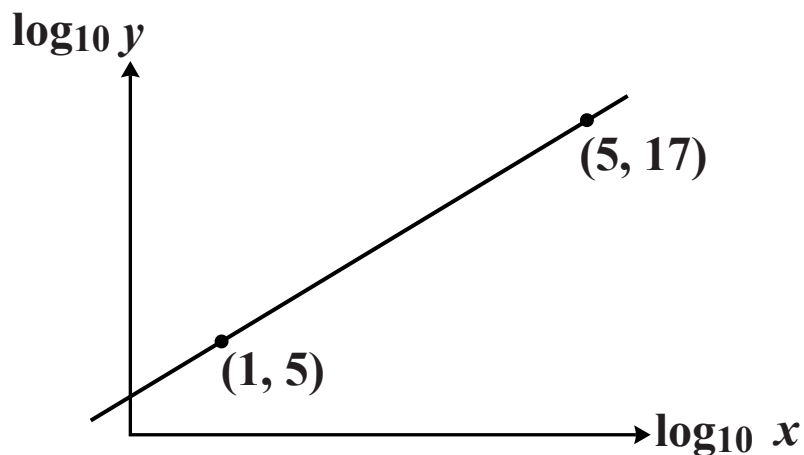


Fig. 6

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]**

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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) The following diagram is Fig. 9.1.

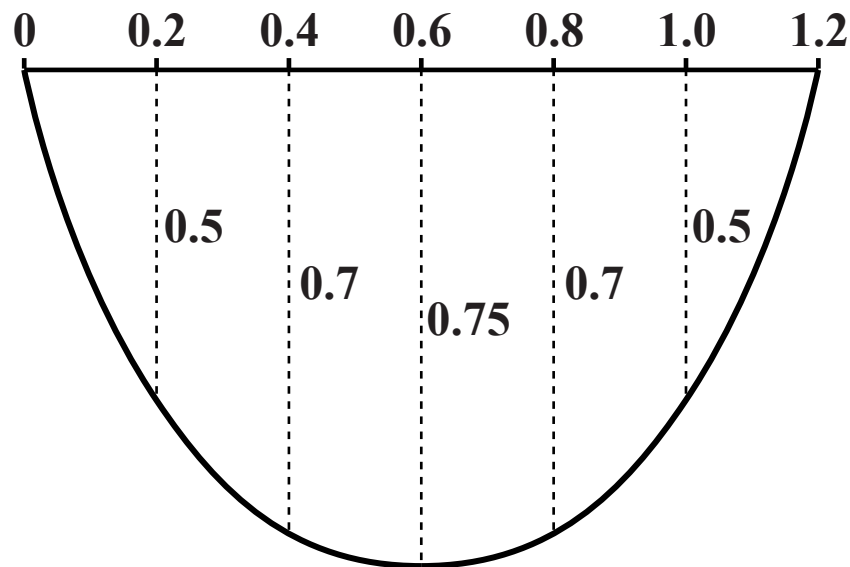


Fig. 9.1

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 below.

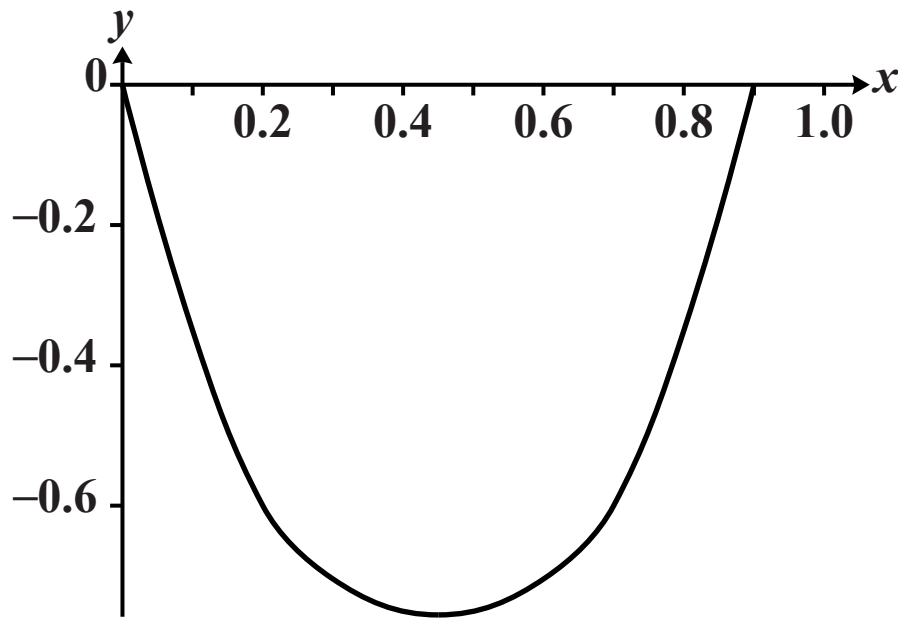


Fig. 9.2

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]

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