OXFORD CAMBRIDGE AND RSA EXAMINATIONS
AS GCE

4752/01

MATHEMATICS (MEI)

Concepts for Advanced Mathematics (C2)

QUESTION PAPER

FRIDAY 17 MAY 2013: Morning

DURATION: 1 hour 30 minutes
plus your additional time allowance

MODIFIED ENLARGED

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

OCR SUPPLIED MATERIALS:

Printed Answer Book 4752/01
MEI Examination Formulae and Tables (MF2)

OTHER MATERIALS REQUIRED:

Scientific or graphical calculator

READ INSTRUCTIONS OVERLEAF

DC (NF/CGW) 1647165827 79965/1

INSTRUCTIONS TO CANDIDATES

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

- **Write your name, centre number and candidate number in the spaces provided on the Printed Answer Book or on the paper provided by the centre. Please write clearly and in capital letters.**
- **IF YOU USE THE PRINTED ANSWER BOOK, WRITE YOUR ANSWER TO EACH QUESTION IN THE SPACE PROVIDED. 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

- **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.**
- **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

(i) $y = 2x^{-5}$, [2]

(ii) $y = \sqrt[3]{x}$. [3]

2 The nth term of a sequence, u_n, is given by

$u_n = 12 - \frac{1}{2}n$.

(i) Write down the values of u_1, u_2 and u_3. State what type of sequence this is. [2]

(ii) Find $\sum_{n=1}^{30} u_n$. [3]

3 The gradient of a curve is given by $\frac{dy}{dx} = \frac{18}{x^3} + 2$. The curve passes through the point (3, 6). Find the equation of the curve. [5]

4 (i) Starting with an equilateral triangle, prove that $\cos 30° = \frac{\sqrt{3}}{2}$. [2]

(ii) Solve the equation $2\sin\theta = -1$ for $0 \leqslant \theta \leqslant 2\pi$, giving your answers in terms of π. [3]

5 The following diagram is Fig. 5.

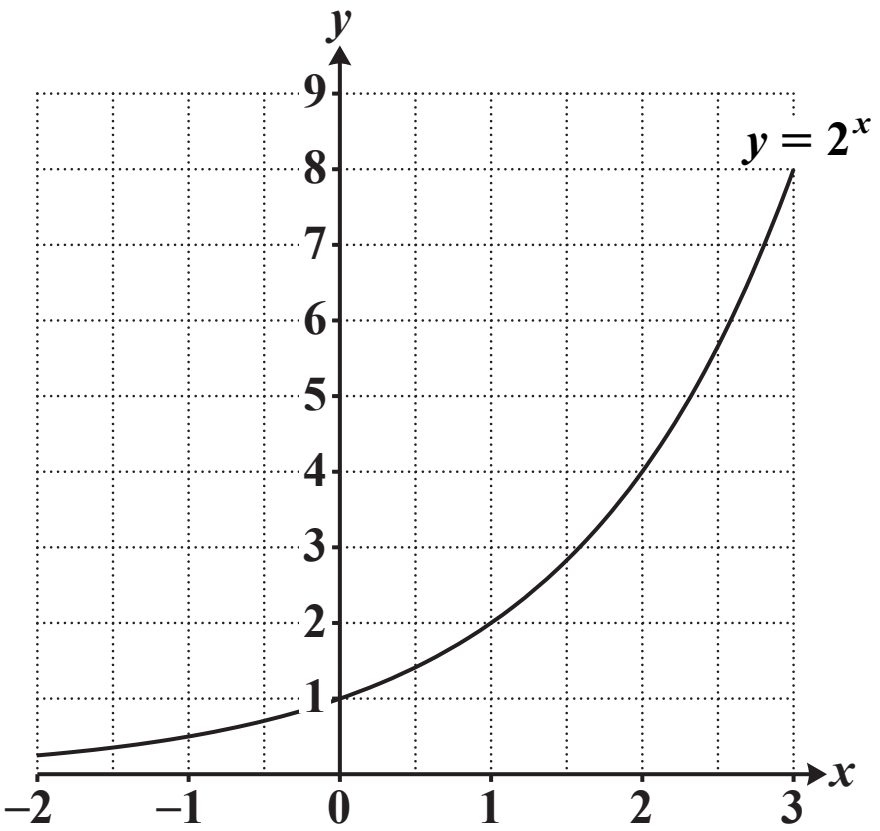

FIG. 5

Fig. 5 above shows the graph of $y = 2^x$.

(i) On the copy of Fig. 5, draw by eye a tangent to the curve at the point where $x = 2$. Hence find an estimate of the gradient of $y = 2^x$ when $x = 2$. [3]

(ii) Calculate the y-values on the curve when $x = 1.8$ and $x = 2.2$. Hence calculate another approximation to the gradient of $y = 2^x$ when $x = 2$. [2]

6 *S* is the sum to infinity of a geometric progression with first term *a* and common ratio *r*.

(i) Another geometric progression has first term $2a$ and common ratio *r*. Express the sum to infinity of this progression in terms of *S*. [1]

(ii) A third geometric progression has first term *a* and common ratio r^2. Express, in its simplest form, the sum to infinity of this progression in terms of *S* and *r*. [2]

7 Fig. 7 below shows a curve and the coordinates of some points on it.

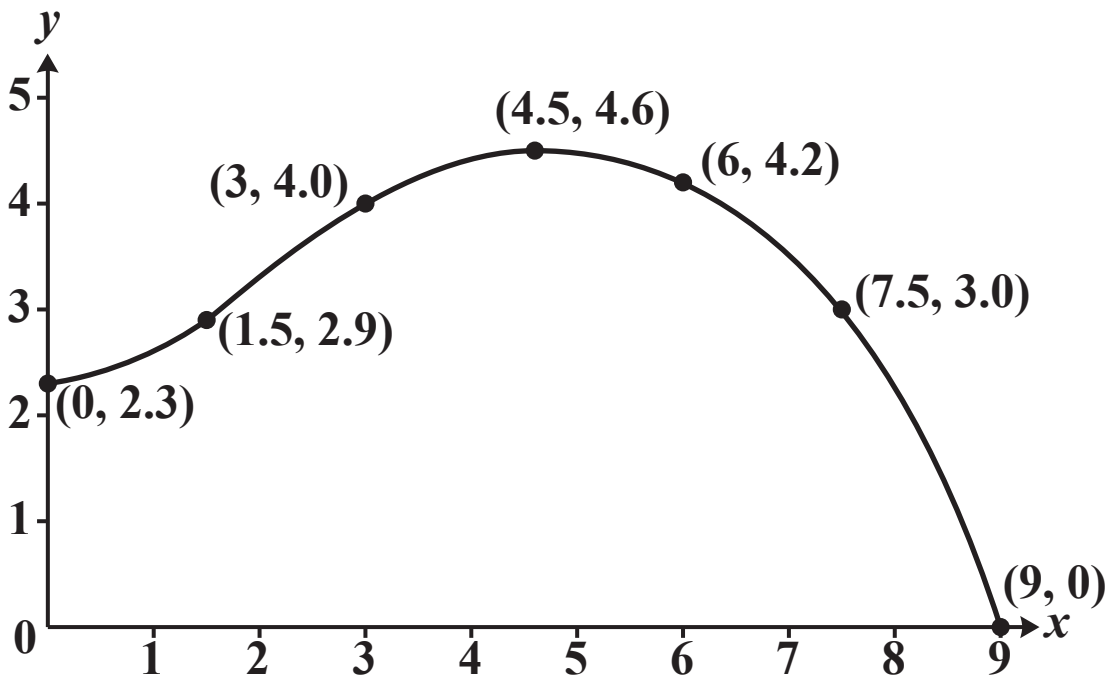

FIG. 7

Use the trapezium rule with 6 strips to estimate the area of the region bounded by the curve and the positive *x*- and *y*-axes. [4]

8 Fig. 8 below shows the graph of $y = g(x)$.

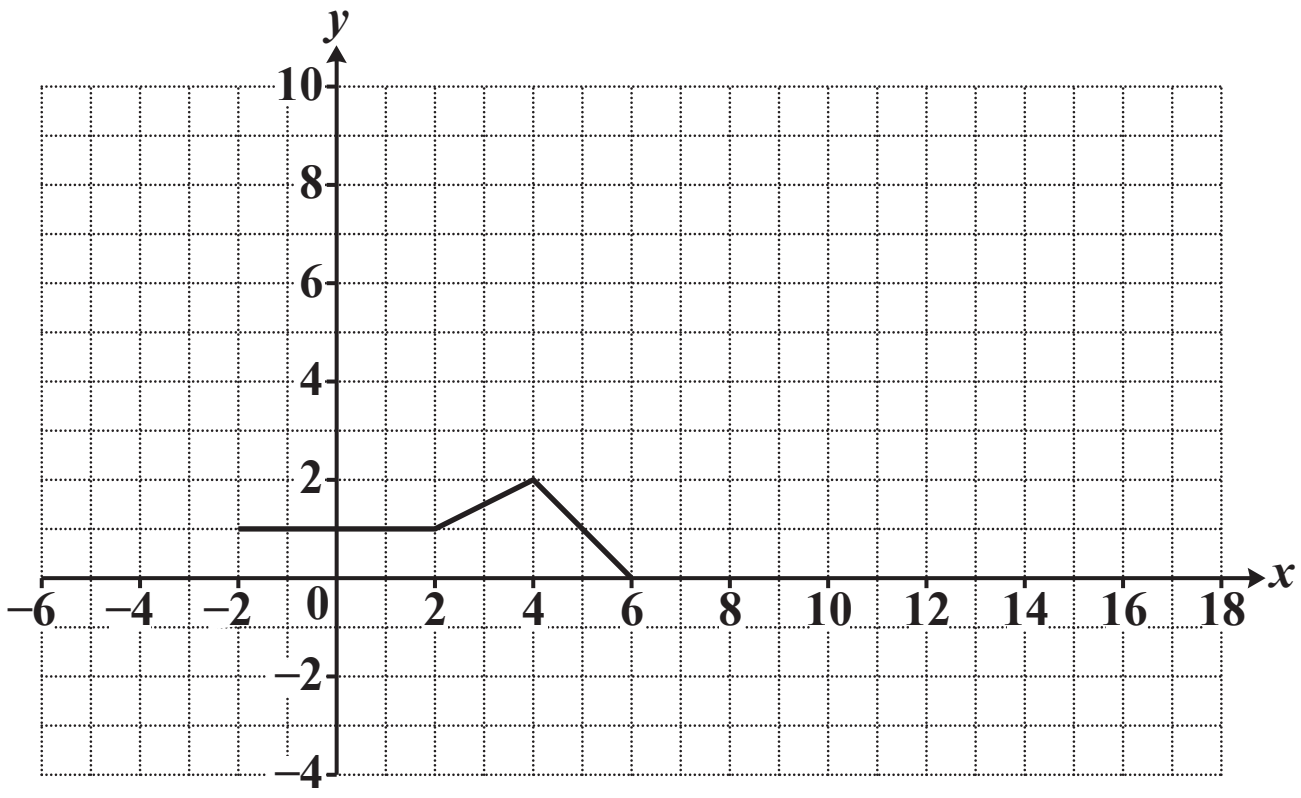

FIG. 8

Draw the graph of

(i) $y = g(2x)$, [2]

(ii) $y = 3g(x)$. [2]

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SECTION B (36 marks)

9 Fig. 9 below shows a sketch of the curve $y = x^3 - 3x^2 - 22x + 24$ and the line $y = 6x + 24$.

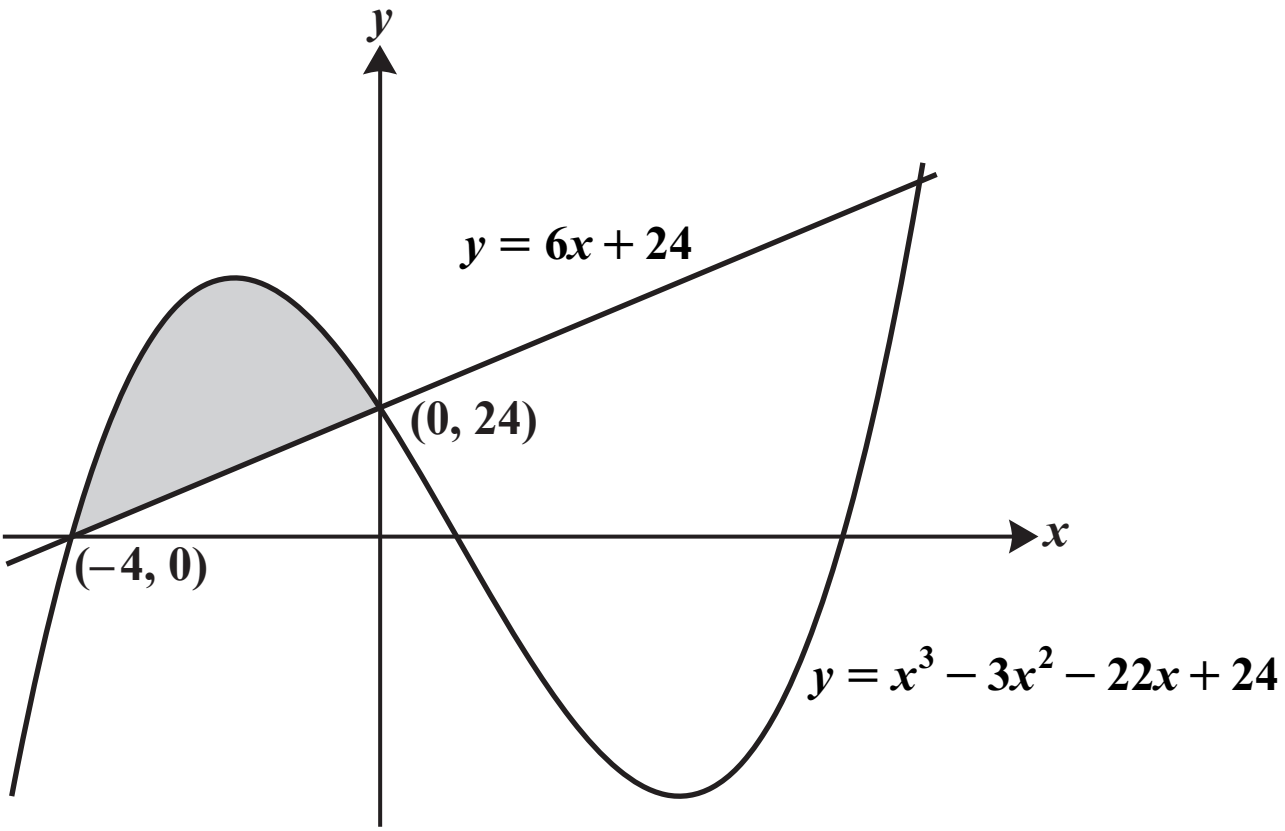

FIG. 9

(i) Differentiate $y = x^3 - 3x^2 - 22x + 24$ and hence find the x-coordinates of the turning points of the curve. Give your answers to 2 decimal places. [4]

(ii) You are given that the line and the curve intersect when $x = 0$ and when $x = -4$. Find algebraically the x-coordinate of the other point of intersection. [3]

(iii) Use calculus to find the area of the region bounded by the curve and the line $y = 6x + 24$ for $-4 \leqslant x \leqslant 0$, shown shaded on Fig. 9. [4]

10 Fig. 10.1 below shows Jean's back garden. This is a quadrilateral ABCD with dimensions as shown.

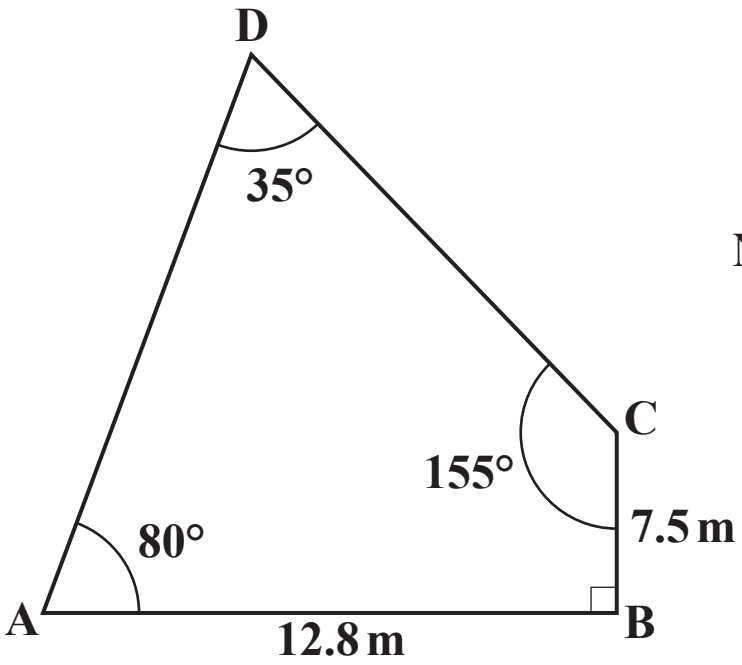

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FIG. 10.1

(i) (*A*) Calculate AC and angle ACB. Hence calculate AD. [6]

(*B*) Calculate the area of the garden. [3]

(ii) The shape of the fence panels used in the garden is shown in Fig. 10.2 below. EH is the arc of a sector of a circle with centre at the midpoint, M, of side FG, and sector angle 1.1 radians, as shown. FG = 1.8 m.

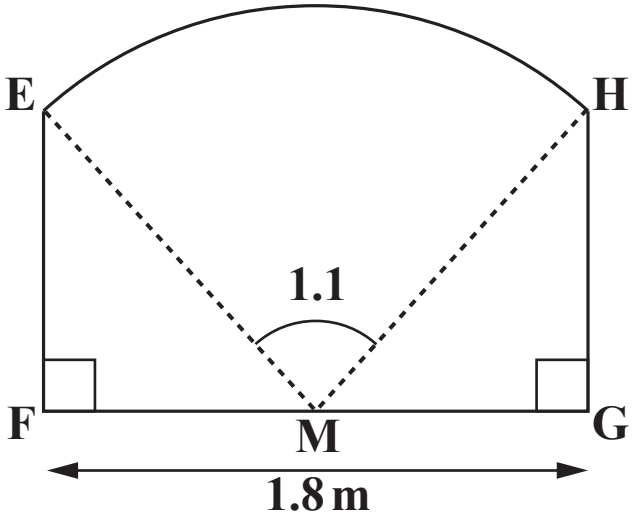

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FIG. 10.2

Calculate the area of one of these fence panels. [5]

11 A hot drink when first made has a temperature which is 65°C higher than room temperature. The temperature difference, d°C, between the drink and its surroundings decreases by 1.7% each minute.

(i) Show that 3 minutes after the drink is made, $d = 61.7$ to 3 significant figures. [2]

(ii) Write down an expression for the value of d at time n minutes after the drink is made, where n is an integer.[1]

(iii) Show that when $d < 3$, n must satisfy the inequality

$$n > \frac{\log_{10} 3 - \log_{10} 65}{\log_{10} 0.983}.$$

Hence find the least integer value of n for which $d < 3$. [4]

(iv) The temperature difference at any time t minutes after the drink is made can also be expressed as $d = 65 \times 10^{-kt}$, for some constant k. Use the value of d for 1 minute after the drink is made to calculate the value of k. Hence find the temperature difference 25.3 minutes after the drink is made. [4]

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