

Friday 17 May 2013 – Morning

AS GCE MATHEMATICS (MEI)

4752/01 Concepts for Advanced Mathematics (C2)

QUESTION PAPER

Candidates answer on the Printed Answer Book.

OCR supplied materials:

- Printed Answer Book 4752/01
- 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 **16** 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
- (i) $y = 2x^{-5}$, [2]
 - (ii) $y = \sqrt[3]{x}$. [3]
- 2 The n th 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 $\cos 30^\circ = \frac{\sqrt{3}}{2}$. [2]
 - (ii) Solve the equation $2 \sin \theta = -1$ for $0 \leq \theta \leq 2\pi$, giving your answers in terms of π . [3]

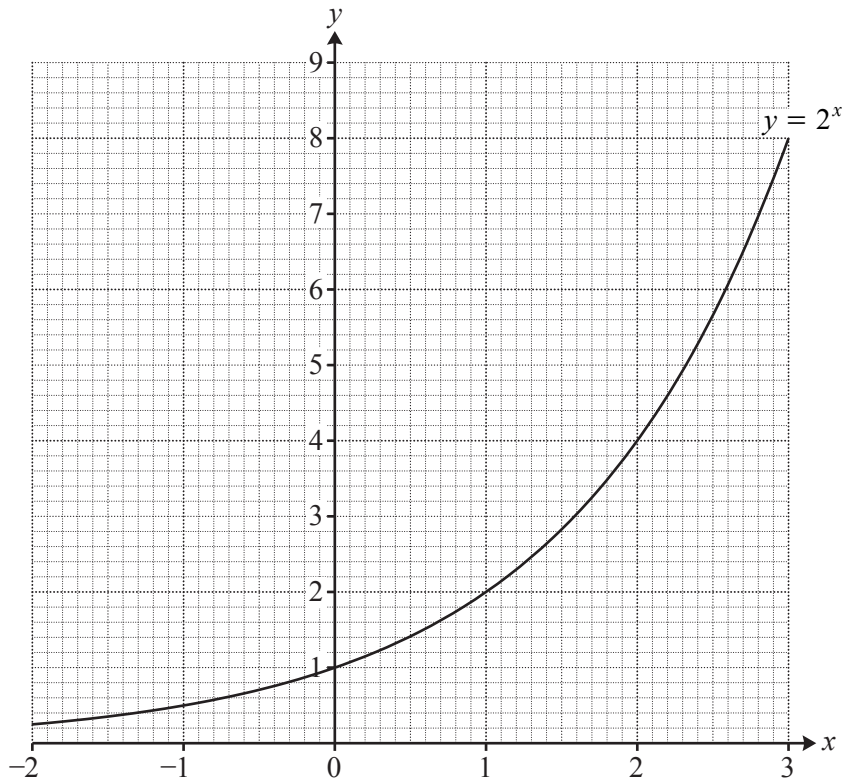


Fig. 5

Fig. 5 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 shows a curve and the coordinates of some points on it.

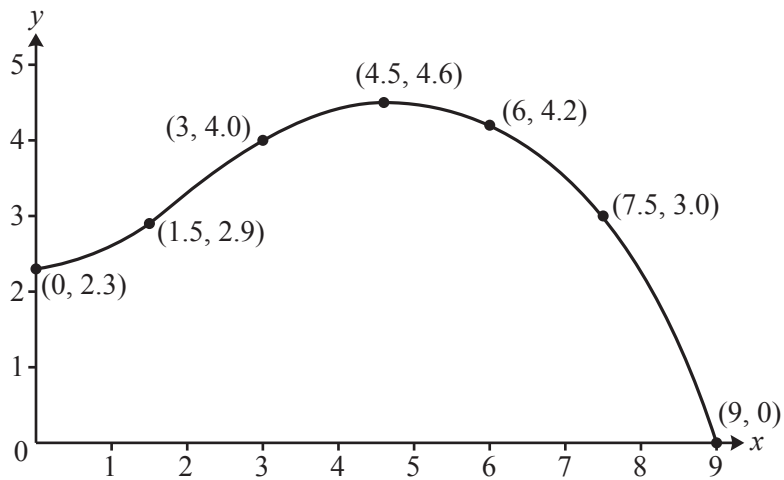


Fig. 7

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

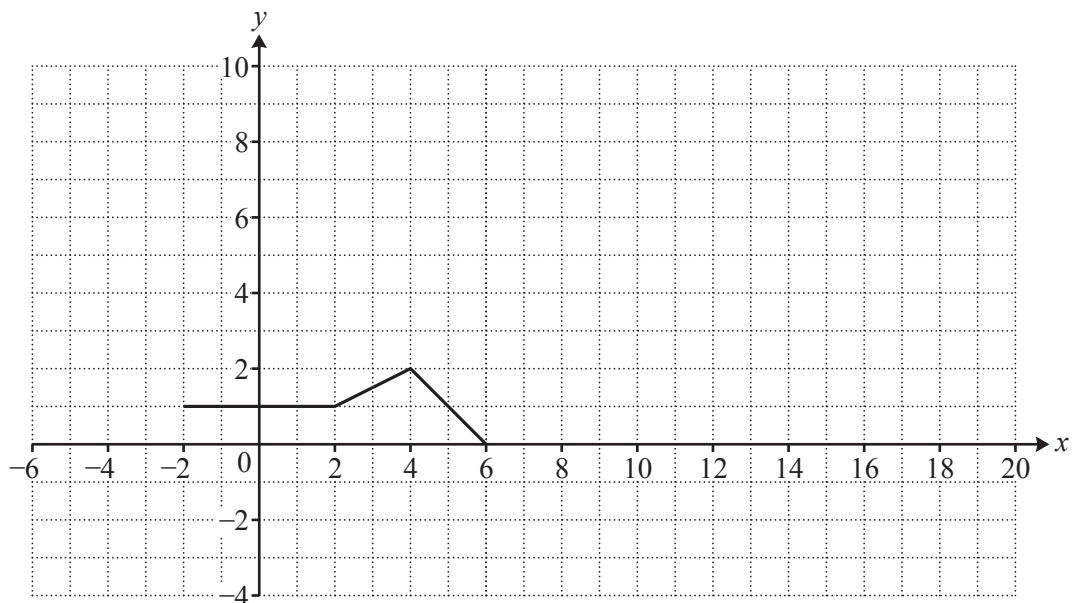


Fig. 8

Draw the graph of

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

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

Section B (36 marks)

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

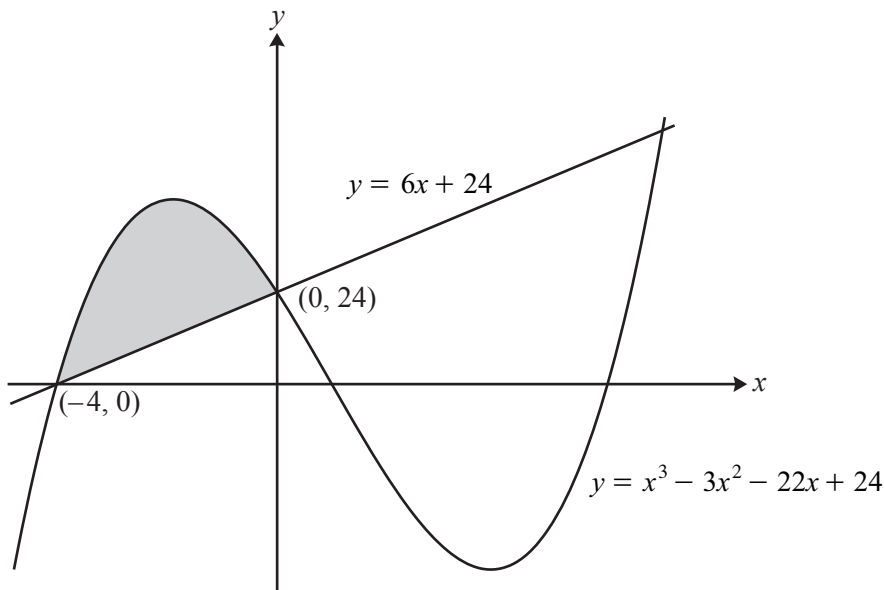
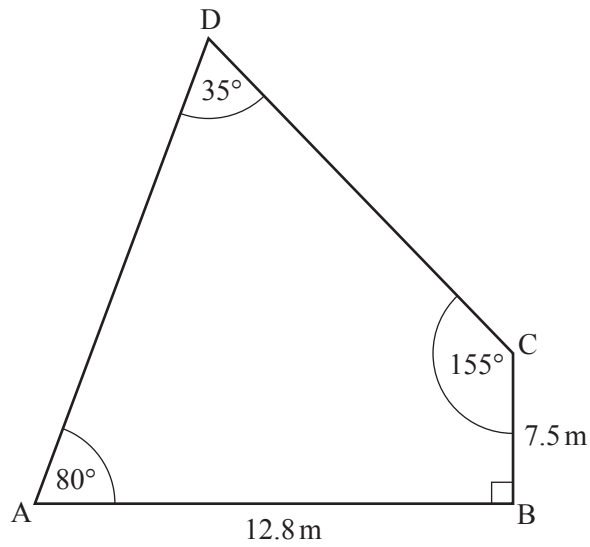


Fig. 9

- (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 $-4 \leq x \leq 0$, shown shaded on Fig. 9. [4]

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



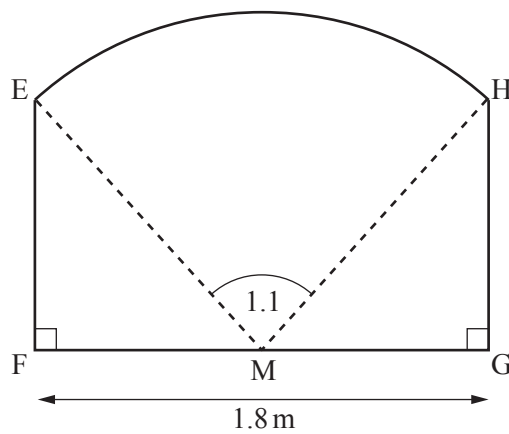
Not to scale

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. 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.



Not to scale

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, $d^{\circ}\text{C}$, 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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