OCR
RECOGNISING ACHIEVEMENT

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

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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 nth term of a sequence, u_n, is given by

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

(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

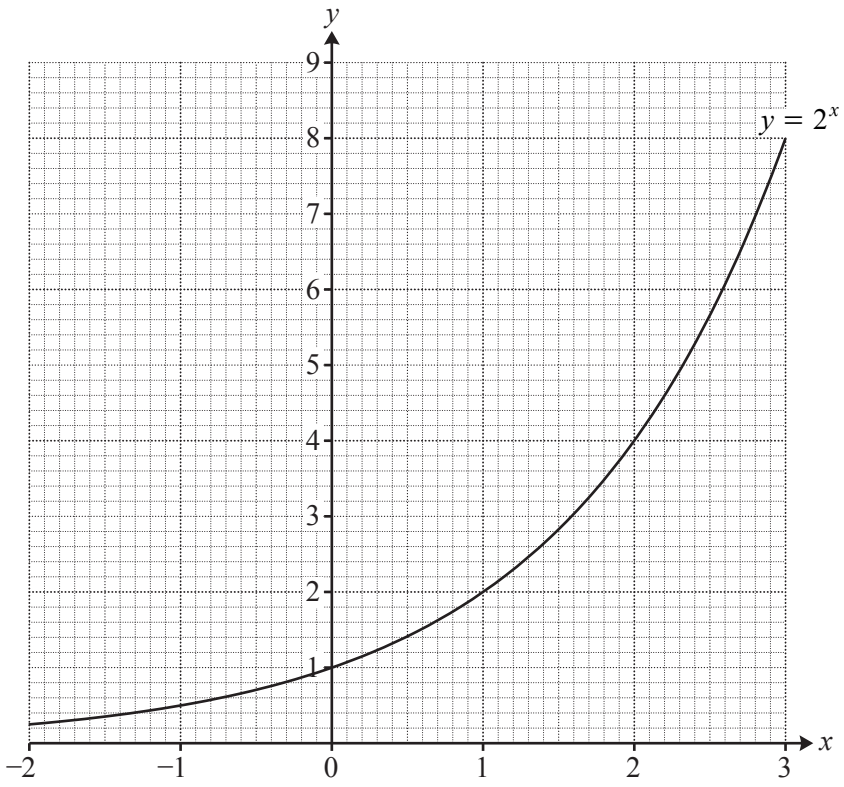


Fig. 5

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.

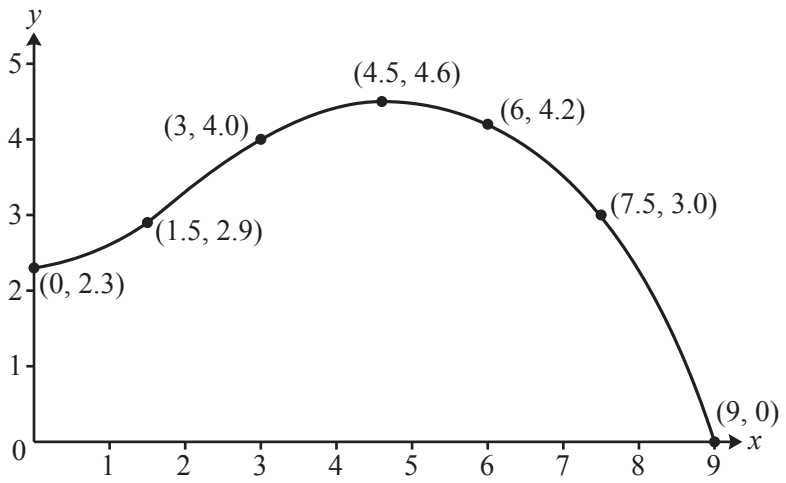


Fig. 7

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 $y = g(x)$.

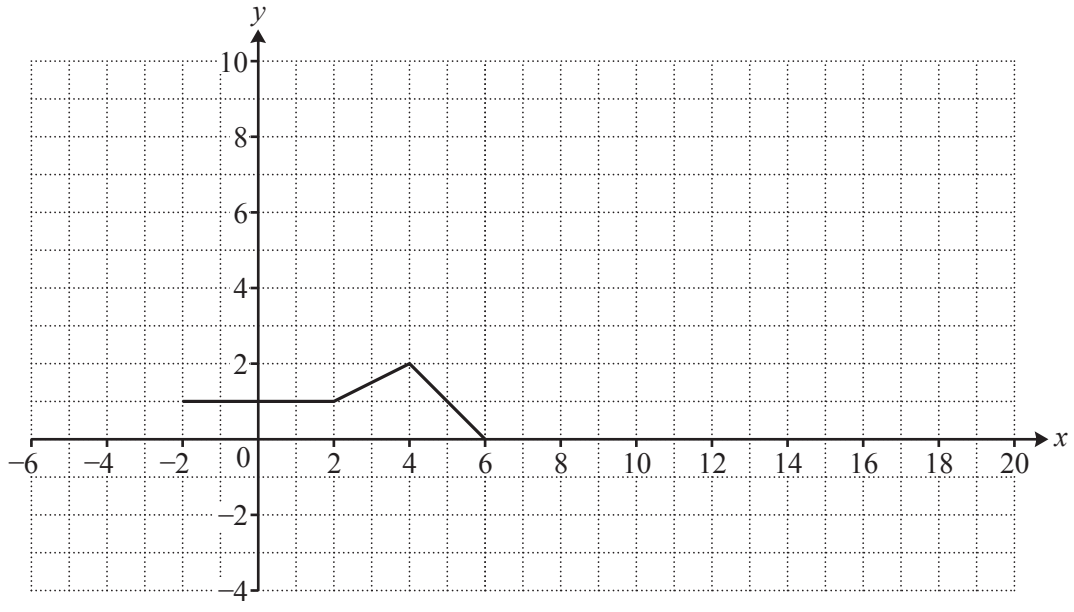


Fig. 8

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 $y = 6x + 24$.

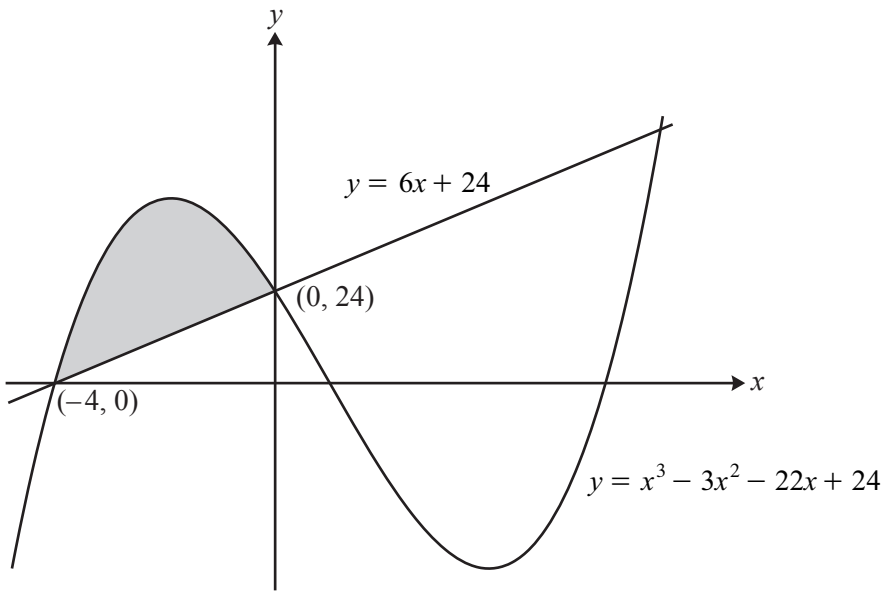


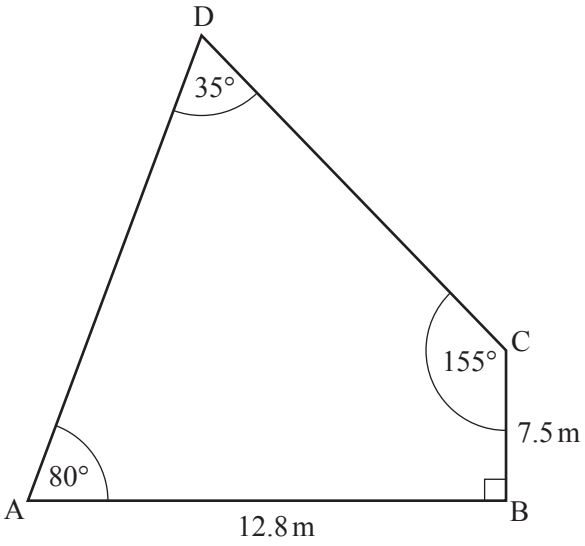
Fig. 9

(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 $-4 \leqslant x \leqslant 0$, 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.

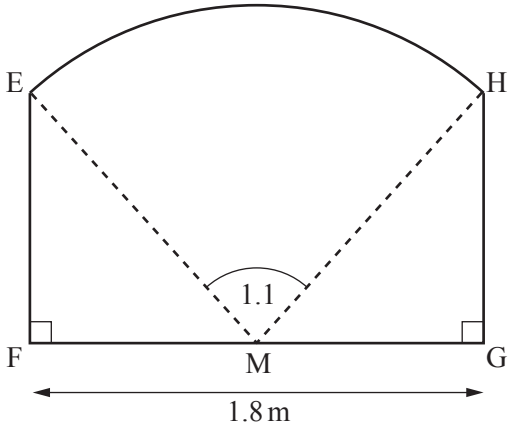


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Fig. 10.2

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]**

THERE ARE NO QUESTIONS PRINTED ON THIS PAGE.