OXFORD CAMBRIDGE AND RSA EXAMINATIONS

AS GCE

4752/01

MATHEMATICS (MEI)

Concepts for Advanced Mathematics (C2)

QUESTION PAPER

WEDNESDAY 6 JUNE 2018: Morning

DURATION: 1 hour 30 minutes
plus your additional time allowance

MODIFIED ENLARGED 24pt

Candidates answer on the Printed Answer Book sent with the standard paper or any suitable paper supplied by the centre. The Printed Answer Book may be enlarged by the centre.

OCR SUPPLIED MATERIALS:

Printed Answer Book 4752/01 sent with the standard paper
MEI Examination Formulae and Tables (MF2) sent with the standard paper
Insert for questions 11(iii) and 11(iv)

OTHER MATERIALS REQUIRED:

Scientific or graphical calculator

READ INSTRUCTIONS OVERLEAF

DC (LK/FC) 167951/2

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INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the spaces provided on the Printed Answer Book or on the paper provided. Please write clearly and in capital letters.

If you use the Printed Answer Book, write your answer to each question in the space provided. If additional space is required, you should use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.

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**.

INSTRUCTION TO EXAMS OFFICER / INVIGILATOR

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Section A (36 marks)

1 **(i)** Find $\frac{\mathrm{d}y}{\mathrm{d}x}$ when $y = 6\sqrt{x}$. **[2]**

(ii) Find $\int 35x^{\frac{5}{2}}\,\mathrm{d}x$. **[3]**

2 **(i)** An arithmetic progression (AP) has first term 3.5. The sum of the first 50 terms of the AP is 910. Find the value of the common difference. **[2]**

(ii) A geometric progression (GP) has first term 25 and common ratio 1.6. Find the sum of the first 12 terms of the GP, giving your answer correct to the nearest integer. **[2]**

3 A sequence has nth term $\sin\left(\frac{n\pi}{6}\right)$.

(i) Evaluate each of the first four terms of this sequence, giving your answers in exact form. **[2]**

(ii) Show that this sequence is periodic, stating the number of terms after which the sequence repeats. **[2]**

4 A sector OAB of a circle centre O has arc length 12 cm and area 45 cm^2. Find the radius of the circle in centimetres and the sector angle in radians. Hence find the area of the segment bounded by the chord AB and the arc AB. **[5]**

5 Fig. 5.1 shows the cross-section of a bus shelter, with measurements of the height, in metres, taken at 0.5 m intervals from O. O is at the front of the shelter.

Fig. 5.1

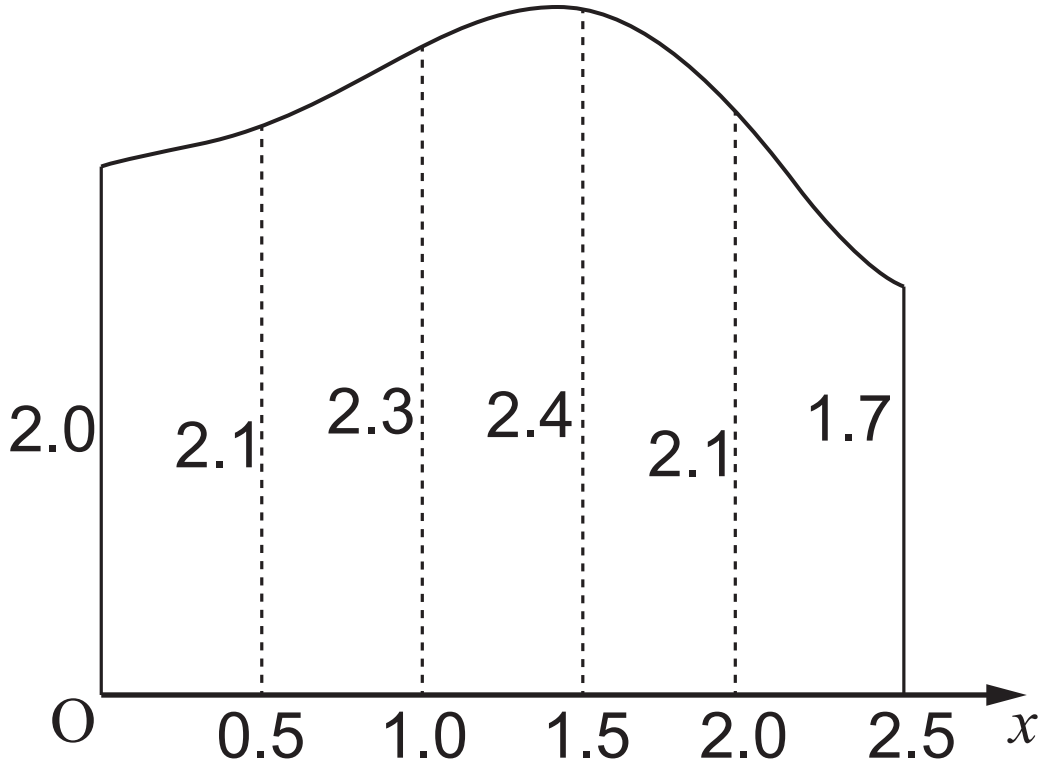

Fig. 5.2

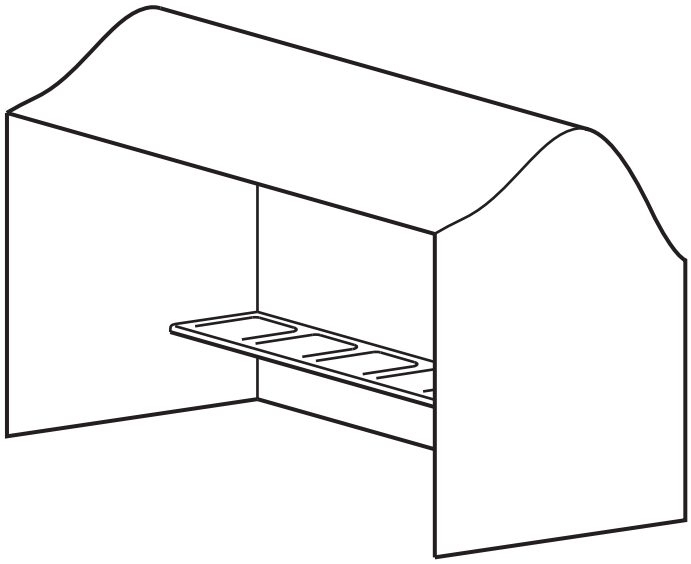

Fig. 5.2 shows a sketch of the shelter, which has two identical side walls and a back wall but no front wall. The length of the shelter is 3.5 m. The outsides of the walls are to be painted. A litre of the type of paint to be used covers 15 m^2. Use the trapezium rule with 5 strips to calculate an estimate of the area of a side wall. Hence find the amount of paint that will be needed. **[5]**

6 You are given that $\cos\theta + 5 = 6\sin^2\theta$ and that $0 \leqslant \theta \leqslant 2\pi$.
Show that $6\cos^2\theta + \cos\theta - 1 = 0$ and hence find the values of θ satisfying this equation. **[5]**

7 Use logarithms to solve the equation $5^{x+2} = 3^x$, showing your method and giving your answer correct to 3 significant figures. **[3]**

8 An arithmetic progression (AP) and geometric progression (GP) both have the same second term, which is 40. They also have the same fourth term, 250.

(i) Find the first term of the AP. **[2]**

(ii) Find the possible values of the first term of the GP. **[3]**

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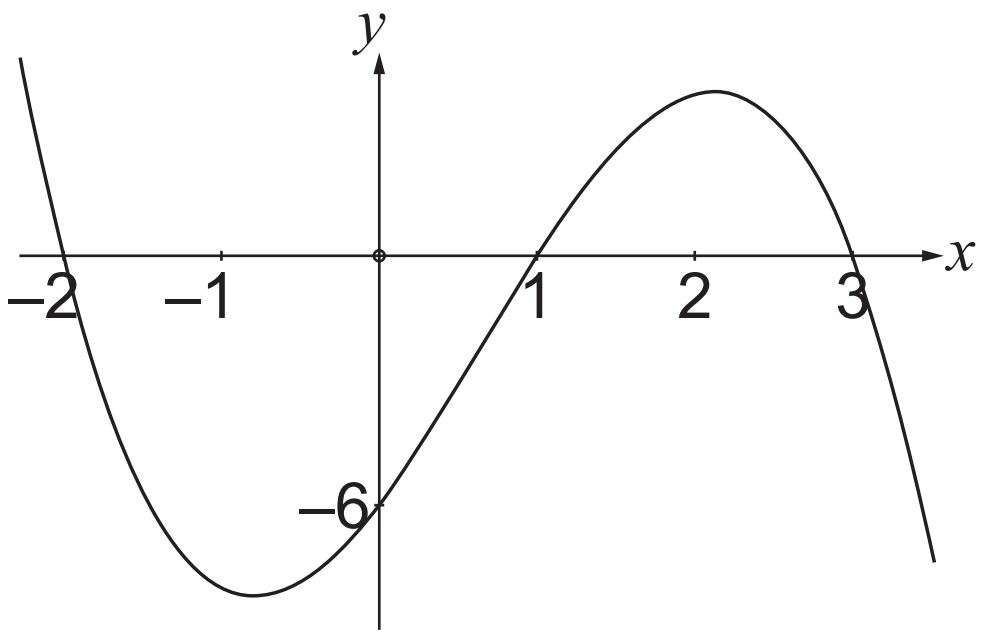
Section B (36 marks)

9 Fig. 9 below shows the curve $y = \mathrm{f}(x)$, where $\mathrm{f}(x) = -x^3 + 2x^2 + 5x - 6$.

Fig. 9



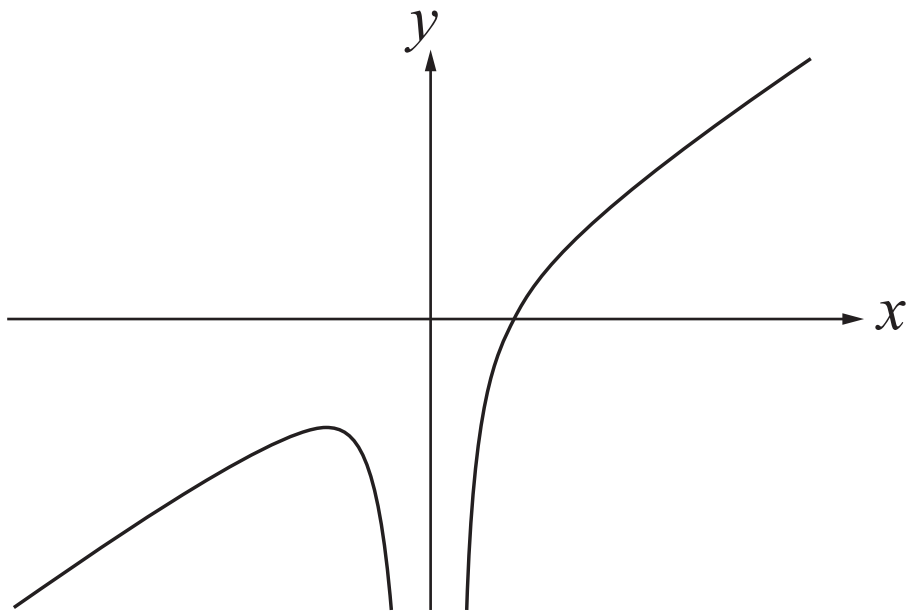
(i) Use calculus to find $\int_{-2}^{1} \left(-x^3 + 2x^2 + 5x - 6\right) \mathrm{d}x$ and state what this represents. **[5]**

(ii) Find the x-coordinates of the turning points of the curve $y = \mathrm{f}(x)$, giving your answers in exact form. Hence state the set of values of x for which $\mathrm{f}(x)$ is a decreasing function. **[5]**

(iii) You are given that $\mathrm{g}(x) = \mathrm{f}(2x)$. State the x-coordinates of the turning points of the curve $y = \mathrm{g}(x)$ and also the coordinates of the curve's intersection with the y-axis. **[2]**

10 Fig. 10 below is a sketch of the graph of $y = x - \frac{1}{2x^2}$.

Fig. 10



(i) Find $\frac{dy}{dx}$ and show that $\frac{d^2y}{dx^2} = -\frac{3}{x^4}$. **[2]**

(ii) Show that this curve has only one turning point and verify that it is a maximum. **[3]**

(iii) (*A*) Show that the equation of the tangent to the curve at the point where $x = 1$ is $y = 2x - 1.5$. **[3]**

(*B*) Show that where this tangent meets the curve, $2x^3 - 3x^2 + 1 = 0$. Hence find the coordinates of the point where this tangent meets the curve again. **[4]**

11 This question is about the Gross Domestic Product (GDP) of China. G, in billions of US dollars, is the GDP in year t after 2010. So, for example, $t = 5$ gives the year 2015.

Year	2011	2012	2013	2014	2015
t	1	2	3	4	5
GDP (G billion US$)	7573	8561	9607	10482	11010

G can be modelled by the equation

$G = 6100 \times \left(1 + \frac{r}{100}\right)^t$, where $r\%$ is a constant representing the average annual growth rate of the GDP.

(i) What does the 6100 in this equation represent? **[1]**

(ii) Use logarithms to show that, using this model, a graph of $\log_{10} G$ against t will be a straight line. **[2]**

(iii) Complete the table in the answer book and plot the points on the grid provided. Draw by eye a line of best fit. **[3]**

(iv) Use your line of best fit to estimate the value of r. **[4]**

(v) Hence estimate the GDP of China in 2018, showing your method. Comment on the reliability of this estimate. **[2]**

END OF QUESTION PAPER