OCR

Friday 6 June 2014 – Afternoon

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 inside 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 **12** 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 $\int 7x^{\frac{5}{2}}\mathrm{d}x$. **[3]**

2 **(i)** Find $\sum_{r=1}^{5}\frac{21}{r+2}$. **[2]**

(ii) A sequence is defined by

$$u_1 = a, \text{ where } a \text{ is an unknown constant,}$$
$$u_{n+1} = u_n + 5.$$

Find, in terms of a, the tenth term and the sum of the first ten terms of this sequence. **[3]**

3 The points $\mathrm{P}(2, 3.6)$ and $\mathrm{Q}(2.2, 2.4)$ lie on the curve $y = \mathrm{f}(x)$. Use P and Q to estimate the gradient of the curve at the point where $x = 2$. **[2]**

4 The point $\mathrm{R}(6, -3)$ is on the curve $y = \mathrm{f}(x)$.

(i) Find the coordinates of the image of R when the curve is transformed to $y = \frac{1}{2}\mathrm{f}(x)$. **[2]**

(ii) Find the coordinates of the image of R when the curve is transformed to $y = \mathrm{f}(3x)$. **[2]**

5

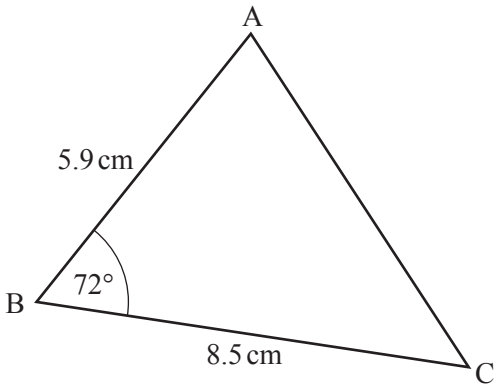

Fig. 5

Fig. 5 shows triangle ABC, where angle $\mathrm{ABC} = 72°$, $\mathrm{AB} = 5.9\,\mathrm{cm}$ and $\mathrm{BC} = 8.5\,\mathrm{cm}$. Calculate the length of AC. **[3]**

6

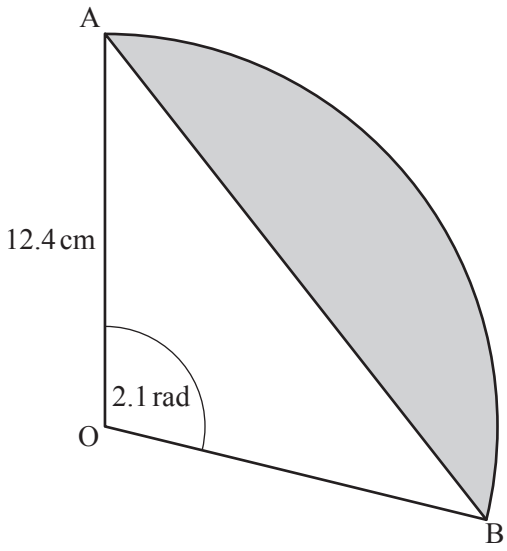

Fig. 6

A circle with centre O has radius 12.4 cm. A segment of the circle is shown shaded in Fig. 6. The segment is bounded by the arc AB and the chord AB, where the angle AOB is 2.1 radians. Calculate the area of the segment. **[4]**

7 The second term of a geometric progression is 24. The sum to infinity of this progression is 150. Write down two equations in a and r, where a is the first term and r is the common ratio. Solve your equations to find the possible values of a and r. **[5]**

8 Simplify $\dfrac{\sqrt{1-\cos^2\theta}}{\tan\theta}$, where θ is an acute angle. **[3]**

9 Solve the equation $\tan 2\theta = 3$ for $0° < \theta < 360°$. **[3]**

10 Use logarithms to solve the equation $3^{x+1} = 5^{2x}$. Give your answer correct to 3 decimal places. **[4]**

Section B (36 marks)

11

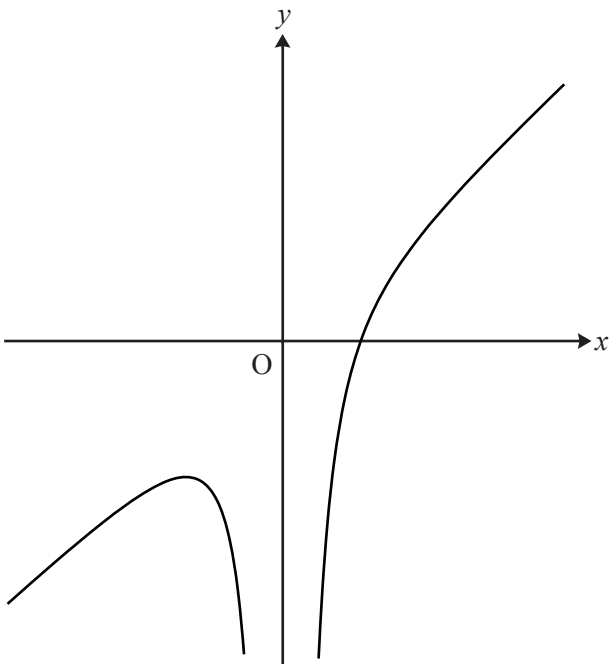

Fig. 11

Fig. 11 shows a sketch of the curve with equation $y = x - \frac{4}{x^2}$.

(i) Find $\frac{dy}{dx}$ and show that $\frac{d^2y}{dx^2} = -\frac{24}{x^4}$. **[3]**

(ii) Hence find the coordinates of the stationary point on the curve. Verify that the stationary point is a maximum. **[5]**

(iii) Find the equation of the normal to the curve when $x = -1$. Give your answer in the form $ax + by + c = 0$. **[5]**

12 Oskar is designing a building. Fig. 12 shows his design for the end wall and the curve of the roof. The units for x and y are metres.

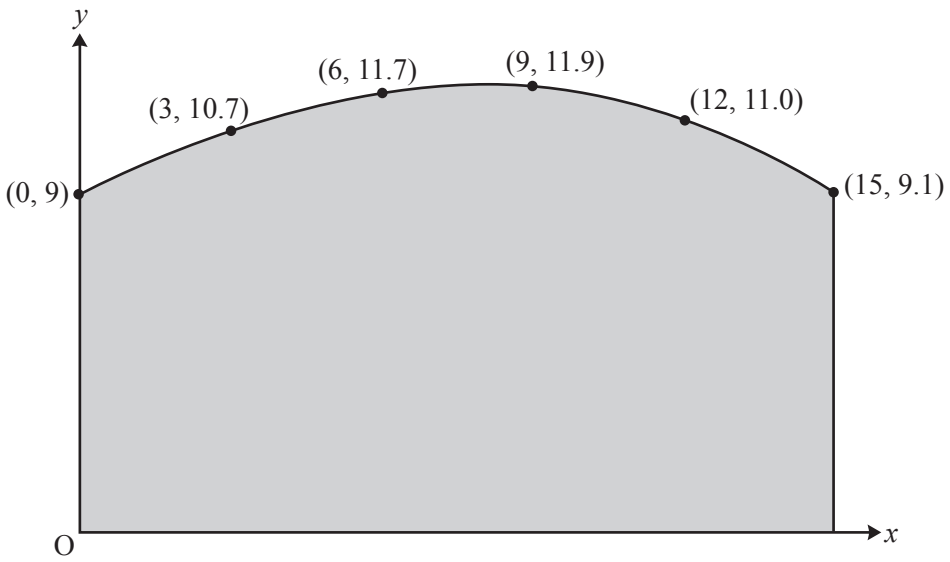

Fig. 12

(i) Use the trapezium rule with 5 strips to estimate the area of the end wall of the building. **[4]**

(ii) Oskar now uses the equation $y = -0.001x^3 - 0.025x^2 + 0.6x + 9$, for $0 \leqslant x \leqslant 15$, to model the curve of the roof.

(*A*) Calculate the difference between the height of the roof when $x = 12$ given by this model and the data shown in Fig. 12. **[2]**

(*B*) Use integration to find the area of the end wall given by this model. **[4]**

Question 13 begins on page 6

13 The thickness of a glacier has been measured every five years from 1960 to 2010.
The table shows the reduction in thickness from its measurement in 1960.

Year	1965	1970	1975	1980	1985	1990	1995	2000	2005	2010
Number of years since 1960 (t)	5	10	15	20	25	30	35	40	45	50
Reduction in thickness since 1960 (h m)	0.7	1.0	1.7	2.3	3.6	4.7	6.0	8.2	12	15.9

An exponential model may be used for these data, assuming that the relationship between h and t is of the form $h = a \times 10^{bt}$, where a and b are constants to be determined.

(i) Show that this relationship may be expressed in the form $\log_{10} h = mt + c$, stating the values of m and c in terms of a and b. **[2]**

(ii) Complete the table of values in the answer book, giving your answers correct to 2 decimal places, and plot the graph of $\log_{10} h$ against t, drawing by eye a line of best fit. **[4]**

(iii) Use your graph to find h in terms of t for this model. **[4]**

(iv) Calculate by how much the glacier will reduce in thickness between 2010 and 2020, according to the model. **[2]**

(v) Give one reason why this model will not be suitable in the long term. **[1]**

END OF QUESTION PAPER