

Tuesday 17 January 2012 – Morning

AS GCE MATHEMATICS (MEI)

4752 Concepts for Advanced Mathematics (C2)

QUESTION PAPER

Candidates answer on the Printed Answer Book.

OCR supplied materials:

- Printed Answer Book 4752
- 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 **12** pages. The Question Paper consists of **4** pages. Any blank pages are indicated.

INSTRUCTION TO EXAMS OFFICER/INVIGILATOR

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Section A (36 marks)

1 Find $\sum_{r=3}^6 r(r+2)$. [2]

2 Find $\int (x^5 + 10x^{\frac{3}{2}}) dx$. [4]

3 Find the set of values of x for which $x^2 - 7x$ is a decreasing function. [3]

4 Given that $a > 0$, state the values of

(i) $\log_a 1$, [1]

(ii) $\log_a (a^3)^6$, [1]

(iii) $\log_a \sqrt{a}$. [1]

5 Figs. 5.1 and 5.2 show the graph of $y = \sin x$ for values of x from 0° to 360° and two transformations of this graph. State the equation of each graph after it has been transformed.

(i)

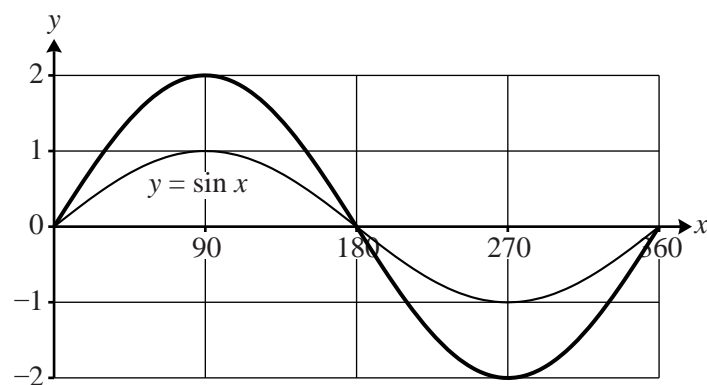


Fig. 5.1

[1]

(ii)

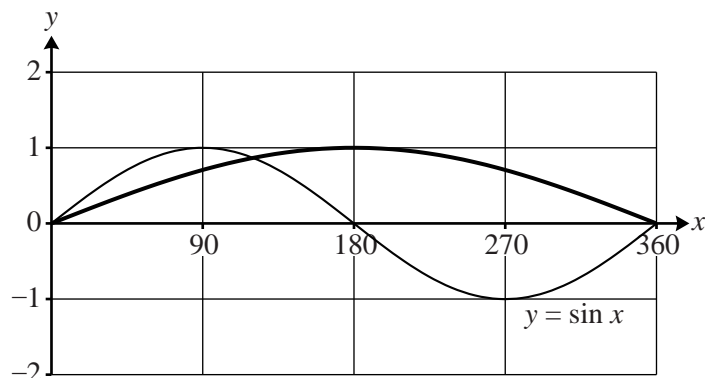


Fig. 5.2

[2]

3

- 6 Use logarithms to solve the equation $235 \times 5^x = 987$, giving your answer correct to 3 decimal places. [3]
- 7 Given that $y = a + x^b$, find $\log_{10} x$ in terms of y , a and b . [3]
- 8 Show that the equation $4 \cos^2 \theta = 1 + \sin \theta$ can be expressed as

$$4 \sin^2 \theta + \sin \theta - 3 = 0.$$
Hence solve the equation for $0^\circ \leq \theta \leq 360^\circ$. [5]
- 9 A geometric progression has a positive common ratio. Its first three terms are 32, b and 12.5.
Find the value of b and find also the sum of the first 15 terms of the progression. [5]
- 10 In an arithmetic progression, the second term is 11 and the sum of the first 40 terms is 3030. Find the first term and the common difference. [5]

Section B (36 marks)

- 11 The point A has x -coordinate 5 and lies on the curve $y = x^2 - 4x + 3$.
- (i) Sketch the curve. [2]
- (ii) Use calculus to find the equation of the tangent to the curve at A. [4]
- (iii) Show that the equation of the normal to the curve at A is $x + 6y = 53$. Find also, using an algebraic method, the x -coordinate of the point at which this normal crosses the curve again. [6]
- 12 The equation of a curve is $y = 9x^2 - x^4$.
- (i) Show that the curve meets the x -axis at the origin and at $x = \pm a$, stating the value of a . [2]
- (ii) Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$.
- Hence show that the origin is a minimum point on the curve. Find the x -coordinates of the maximum points. [6]
- (iii) Use calculus to find the area of the region bounded by the curve and the x -axis between $x = 0$ and $x = a$, using the value you found for a in part (i). [4]

13

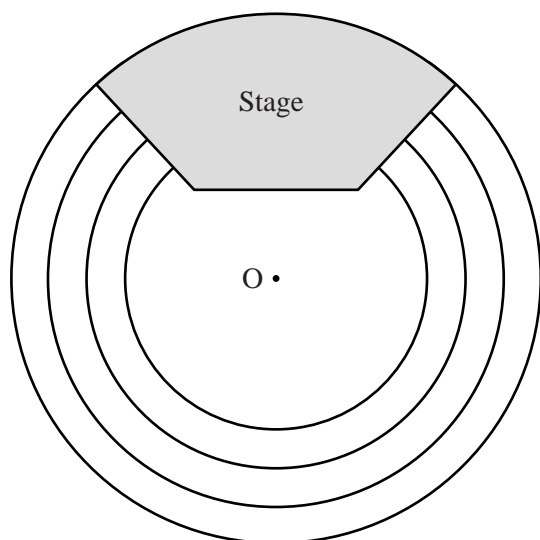


Fig. 13.1

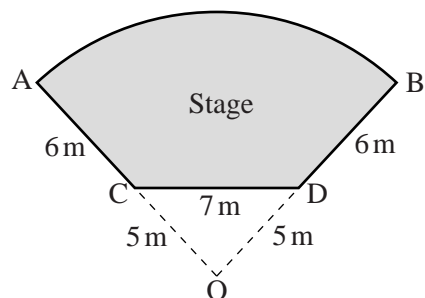


Fig. 13.2

In a concert hall, seats are arranged along arcs of concentric circles, as shown in Fig. 13.1. As shown in Fig. 13.2, the stage is part of a sector ABO of radius 11 m. Fig. 13.2 also gives the dimensions of the stage.

- (i) Show that angle COD = 1.55 radians, correct to 2 decimal places. Hence find the area of the stage. [6]
- (ii) There are four rows of seats, with their backs along arcs, with centre O, of radii 7.4 m, 8.6 m, 9.8 m and 11 m. Each seat takes up 80 cm of the arc.
- (A) Calculate how many seats can fit in the front row. [4]
- (B) Calculate how many more seats can fit in the back row than the front row. [2]

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