OCR
RECOGNISING ACHIEVEMENT

# 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

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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 **12** pages. The Question Paper consists of **4** 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 $\sum_{r=3}^{6} r(r+2)$. **[2]**

**2** Find $\int \left(x^5 + 10x^{\frac{3}{2}}\right)\mathrm{d}x$. **[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

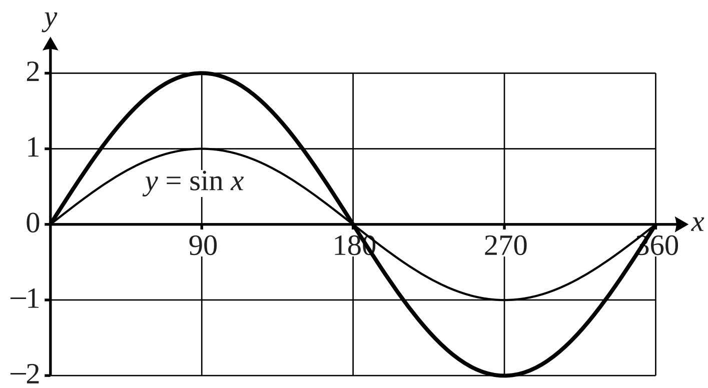
**(i)** $\log_a 1$, **[1]**

**(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.

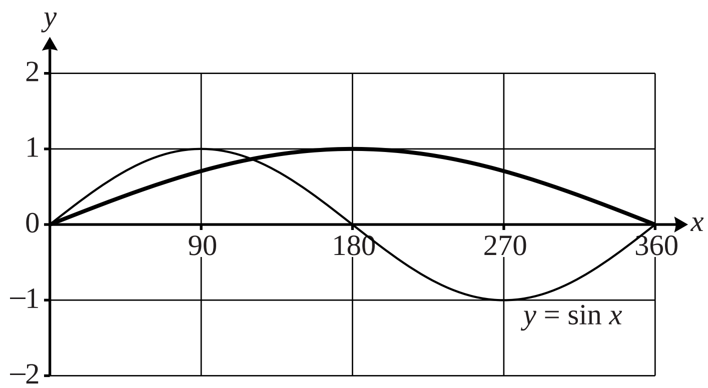
**(i)**




**[1]**

**Fig. 5.1**

**(ii)**




**[2]**

**Fig. 5.2**

**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 $0° \leqslant \theta \leqslant 360°$. **[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 $\dfrac{dy}{dx}$ and $\dfrac{d^2y}{dx^2}$.

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**

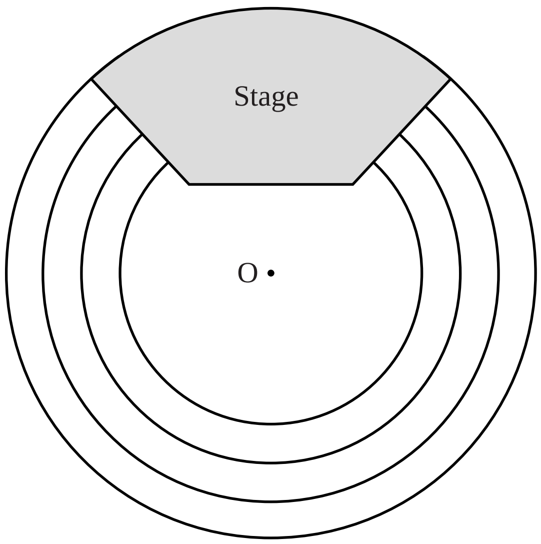



**Fig. 13.1**

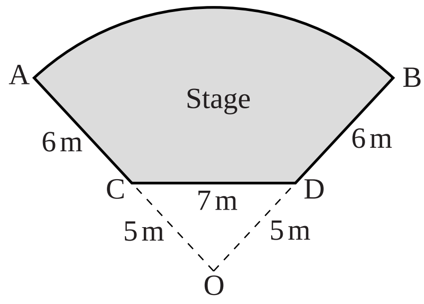



**Fig. 13.2**

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]**