OXFORD CAMBRIDGE AND RSA EXAMINATIONS
AS GCE
4752
MATHEMATICS (MEI)

Concepts for Advanced Mathematics (C2)

QUESTION PAPER

TUESDAY 17 JANUARY 2012: Morning
DURATION: 1 hour 30 minutes

SUITABLE FOR VISUALLY IMPAIRED CANDIDATES

Candidates answer on the Printed Answer Book or any suitable paper provided by the centre. The Printed Answer Book may be enlarged by the centre.

<u>OCR SUPPLIED MATERIALS:</u>

Printed Answer Book 4752
MEI Examination Formulae and Tables (MF2)

<u>OTHER MATERIALS REQUIRED:</u>

Scientific or graphical calculator

<u>READ INSTRUCTIONS OVERLEAF</u>

INSTRUCTIONS TO CANDIDATES

- 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.

- 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 <u>NO MARKS</u> 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 <u>72</u>.**

INSTRUCTION TO EXAMS OFFICER/INVIGILATOR

- **Please contact OCR Copyright should you wish to re-use this document.**

SECTION A (36 marks)

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

2   Find $\displaystyle\int \left(x^5 + 10x^{\frac{3}{2}} \right) dx$. [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 below show the graph of $y = \sin x$ for values of x from 0° to 360° and two transformations of this graph. On each diagram the graph $y = \sin x$ is shown by a dashed line and the transformation is a solid line. State the equation of each graph after it has been transformed.
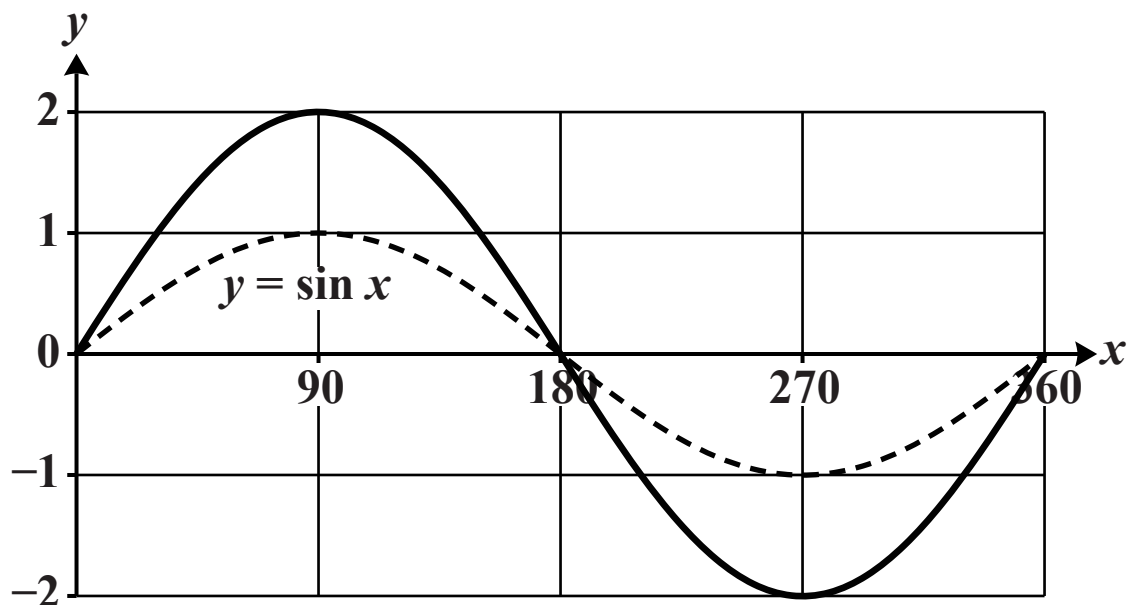
(i)

[1]

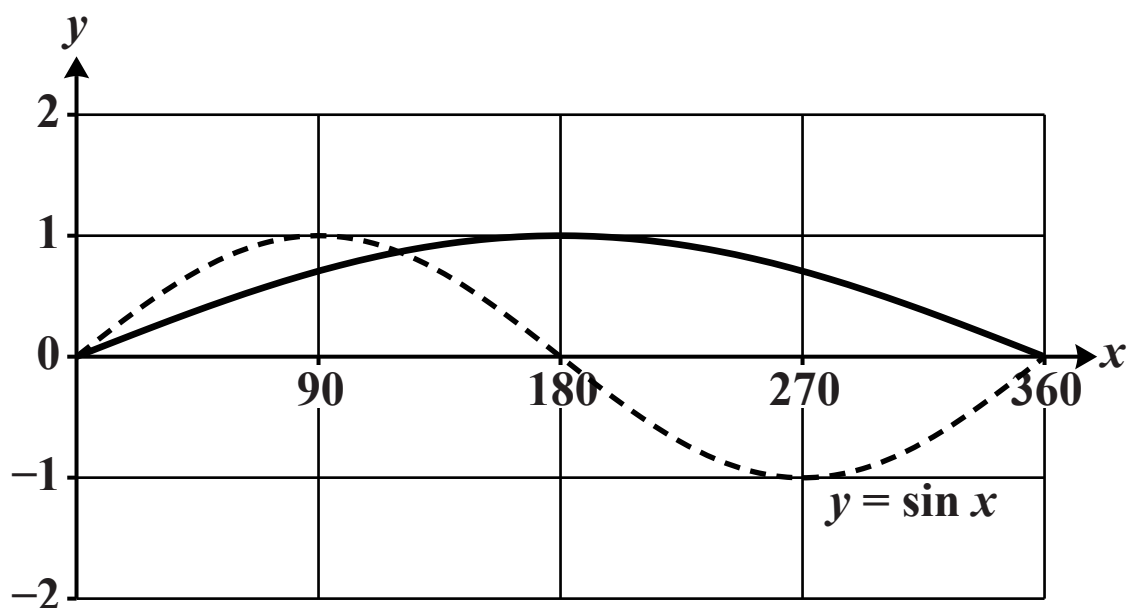**Fig. 5.1**

(ii)

[2]

Fig. 5.2

5

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 The following diagrams are Fig. 13.1 and Fig. 13.2.

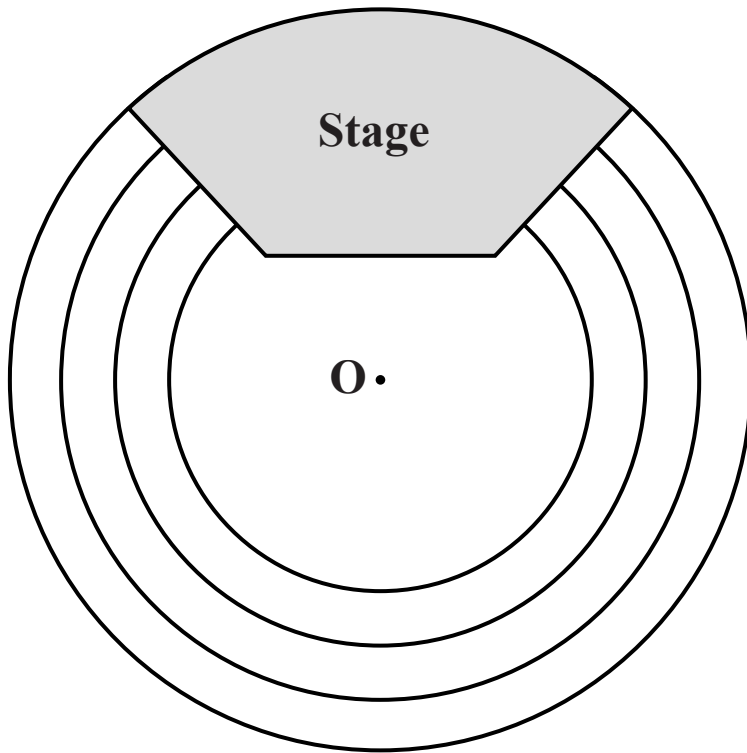<div style="text-align:center">
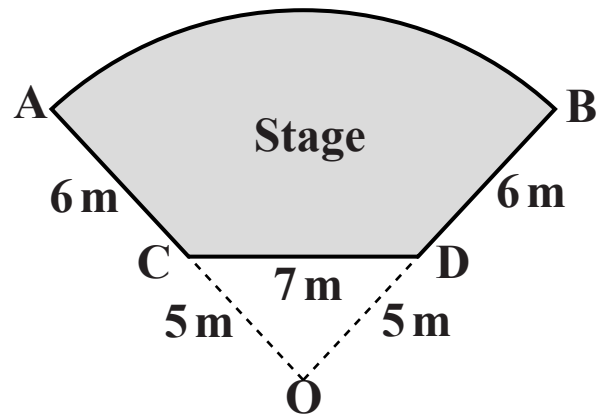
Fig. 13.1   **Fig. 13.2**

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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]