OXFORD CAMBRIDGE AND RSA EXAMINATIONS

AS GCE

4722

MATHEMATICS

Core Mathematics 2

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.

OCR SUPPLIED MATERIALS:

Printed Answer Book 4722
List of Formulae (MF1)
Insert for question 9 (inserted)

OTHER MATERIALS REQUIRED:

Scientific or graphical calculator

READ INSTRUCTIONS OVERLEAF

DC (CW/SW) 12MPE01167 56978/1

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.**
- **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.**
- **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.**
- **Answer ALL the questions.**
- **Read each question carefully. Make sure you know what you have to do before starting your answer.**
- **You are permitted to use a scientific or graphical calculator in this paper.**
- **Give non-exact numerical answers correct to 3 significant figures unless a different degree of accuracy is specified in the question or is clearly appropriate.**

INFORMATION FOR CANDIDATES

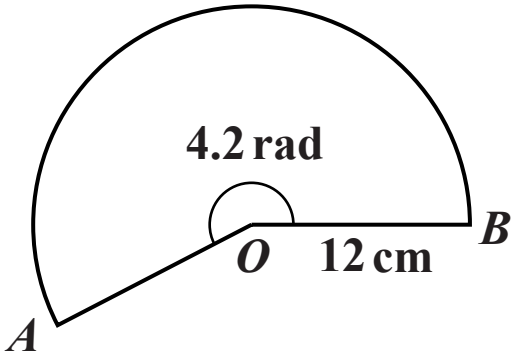
This information is the same on the Printed Answer Book and the Question Paper.

- **The number of marks is given in brackets [ ] at the end of each question or part question on the Question Paper.**
- **YOU ARE REMINDED OF THE NEED FOR CLEAR PRESENTATION IN YOUR ANSWERS.**
- **The total number of marks for this paper is 72.**

INSTRUCTIONS 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.**

1 Look at the following diagram.

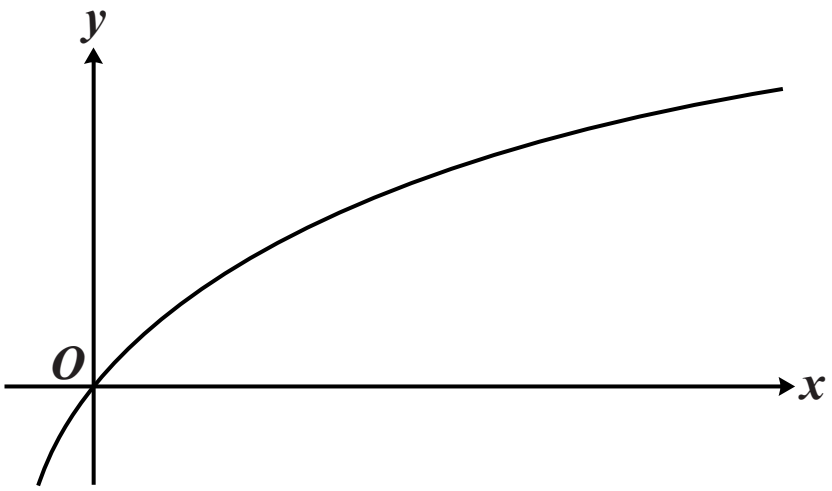


The diagram above shows a sector *AOB* of a circle with centre *O* and radius 12 cm. The reflex angle *AOB* is 4.2 radians.

(i) Find the perimeter of the sector. [3]

(ii) Find the area of the sector. [2]

2 Look at the following diagram.



The diagram above shows the curve $y = \log_{10}(2x + 1)$.

(i) Use the trapezium rule with 4 strips each of width 1.5 to find an approximation to the area of the region bounded by the curve, the x-axis and the lines $x = 4$ and $x = 10$. Give your answer correct to 3 significant figures. [4]

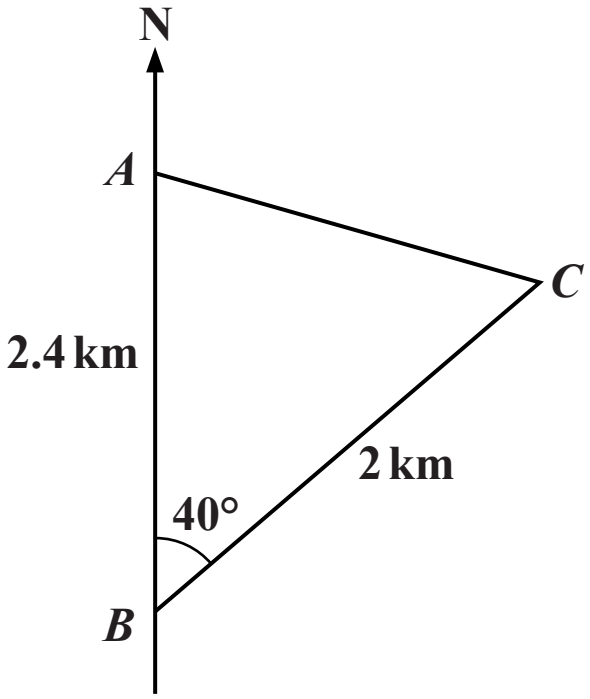
(ii) Explain why this approximation is an under-estimate. [1]

3 One of the terms in the binomial expansion of $(4 + ax)^6$ is $160x^3$.

(i) Find the value of a. [4]

(ii) Using this value of a, find the first two terms in the expansion of $(4 + ax)^6$ in ascending powers of x. [2]

4 Look at the following diagram.



The diagram above shows two points *A* and *B* on a straight coastline, with *A* being 2.4 km due north of *B*.
A stationary ship is at point *C*, on a bearing of 040° and at a distance of 2 km from *B*.

(i) Find the distance *AC*, giving your answer correct to 3 significant figures. [2]

(ii) Find the bearing of *C* from *A*. [3]

(iii) Find the shortest distance from the ship to the coastline. [2]

5 The cubic polynomial f(x) is defined by f(x) = $2x^3 + 3x^2 - 17x + 6$.

(i) Find the remainder when f(x) is divided by ($x - 3$). [2]

(ii) Given that f(2) = 0, express f(x) as the product of a linear factor and a quadratic factor. [4]

(iii) Determine the number of real roots of the equation f(x) = 0, giving a reason for your answer. [2]

6 A sequence $u_1, u_2, u_3, \ldots$ is defined by $u_n = 85 - 5n$ for $n \geqslant 1$.

(i) Write down the values of u_1, u_2 and u_3. [2]

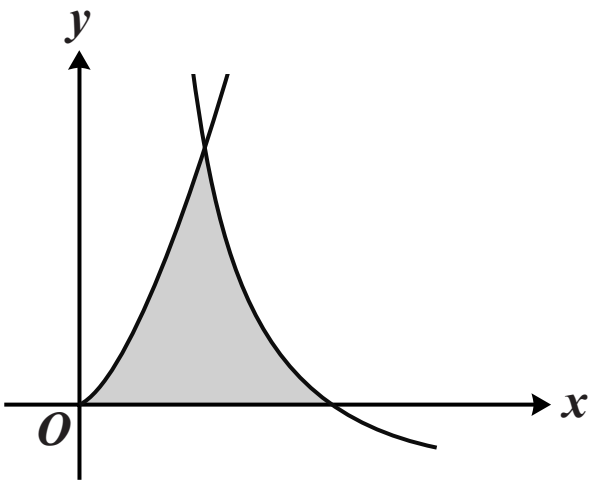
(ii) Find $\sum_{n=1}^{20} u_n$. [3]

(iii) Given that u_1, u_5 and u_p are, respectively, the first, second and third terms of a geometric progression, find the value of p. [4]

(iv) Find the sum to infinity of the geometric progression in part (iii). [2]

7 (a) Find $\int (x^2 + 4)(x - 6)\,dx$. [3]

(b) Look at the following diagram.



The diagram above shows the curve $y = 6x^{\frac{3}{2}}$ and part of the curve $y = \frac{8}{x^2} - 2$, which intersect at the point (1, 6). Use integration to find the area of the shaded region enclosed by the two curves and the x-axis. [8]

8 (a) Use logarithms to solve the equation $7^{w-3} - 4 = 180$, giving your answer correct to 3 significant figures. [4]

(b) Solve the simultaneous equations

$$\log_{10} x + \log_{10} y = \log_{10} 3, \qquad \log_{10}(3x + y) = 1. \qquad [6]$$

9 **(i)** **Sketch the graph of $y = \tan(\frac{1}{2}x)$ for $-2\pi \leqslant x \leqslant 2\pi$ on the axes provided on the insert.**

On the same axes, sketch the graph of $y = 3\cos(\frac{1}{2}x)$ for $-2\pi \leqslant x \leqslant 2\pi$, indicating the point of intersection with the y-axis. [3]

(ii) **Show that the equation $\tan(\frac{1}{2}x) = 3\cos(\frac{1}{2}x)$ can be expressed in the form**

$$3\sin^2(\tfrac{1}{2}x) + \sin(\tfrac{1}{2}x) - 3 = 0.$$

Hence solve the equation

$$\tan(\tfrac{1}{2}x) = 3\cos(\tfrac{1}{2}x) \text{ for } -2\pi \leqslant x \leqslant 2\pi. \qquad [6]$$

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