

Tuesday 17 January 2012 – Morning

AS GCE MATHEMATICS

4722 Core Mathematics 2

QUESTION PAPER

Candidates answer on the Printed Answer Book.

OCR supplied materials:

- Printed Answer Book 4722
- List of Formulae (MF1)

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.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Do **not** write in the bar codes.
- 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

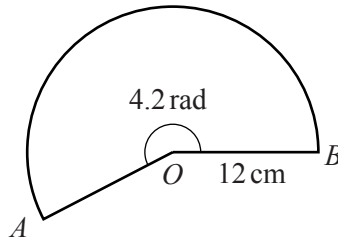
This information is the same on the Printed Answer Book and the Question Paper.

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

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

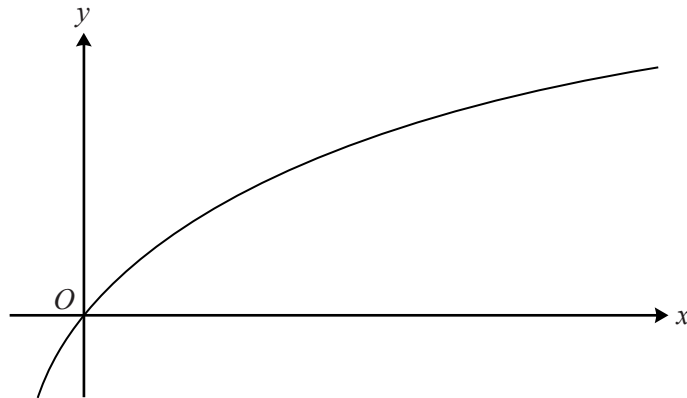


The diagram shows a sector AOB of a circle with centre O and radius 12 cm . The reflex angle AOB is 4.2 radians.

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

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

2



The diagram 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]

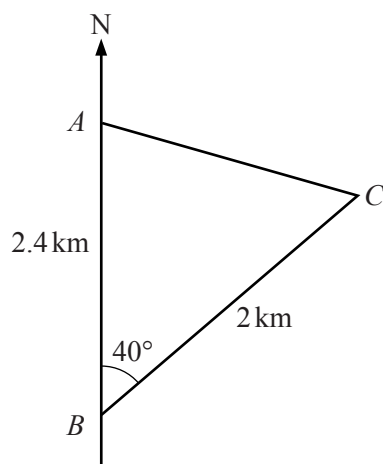
(ii) Explain why this approximation is an under-estimate. [1]

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



The diagram 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, \dots is defined by $u_n = 85 - 5n$ for $n \geq 1$.

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

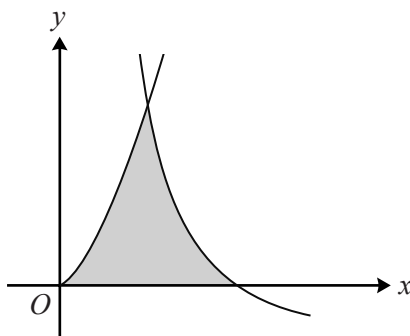
(ii) Find $\sum_{n=1}^{20} u_n$. [3]

(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)



The diagram 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

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

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

On the same axes, sketch the graph of $y = 3\cos(\frac{1}{2}x)$ for $-2\pi \leq x \leq 2\pi$, 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

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

Hence solve the equation $\tan(\frac{1}{2}x) = 3\cos(\frac{1}{2}x)$ for $-2\pi \leq x \leq 2\pi$. [6]

Copyright Information

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download from our public website (www.ocr.org.uk) after the live examination series.

If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact the Copyright Team, First Floor, 9 Hills Road, Cambridge CB2 1GE.

OCR is part of the Cambridge Assessment Group; Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.