

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

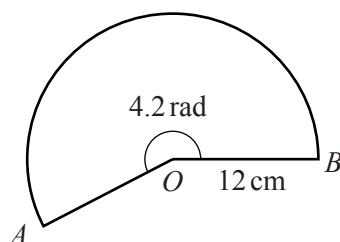
This information is the same on the Printed Answer Book and the Question Paper.

- 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

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1

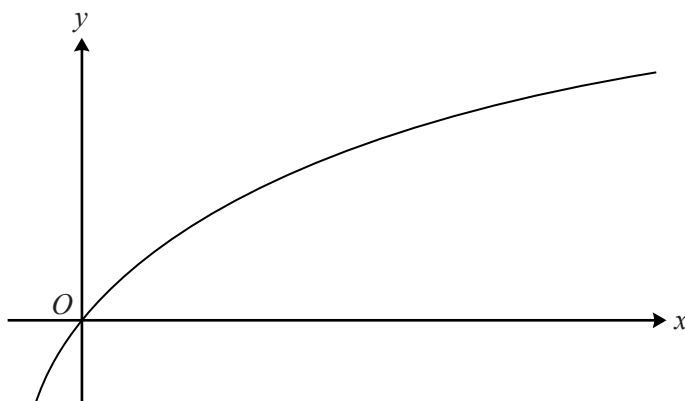


The diagram shows a sector AOB of a circle with centre O and radius 12 cm. The reflex angle AOB is 4.2 radians.

(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]

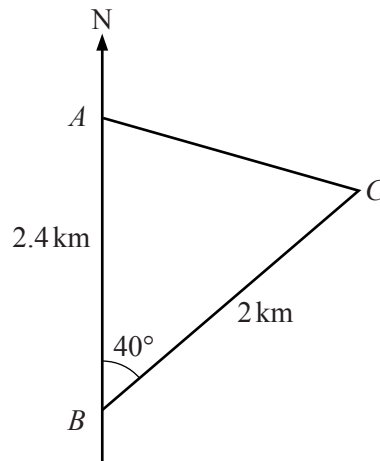
(ii) Explain why this approximation is an under-estimate. [1]

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]

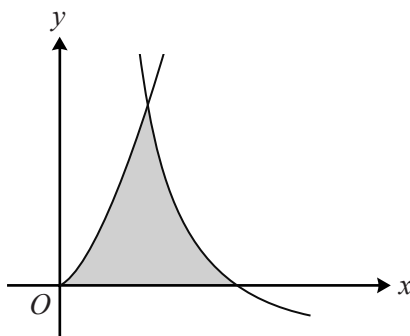
(ii) Find $\sum_{n=1}^{20} u_n$. [3]

(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]

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