

**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**

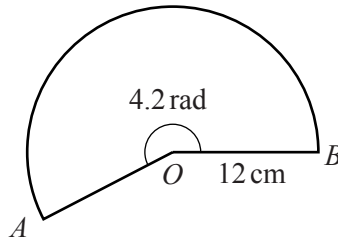
This information is the same on the Printed Answer Book and the Question Paper.

- 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

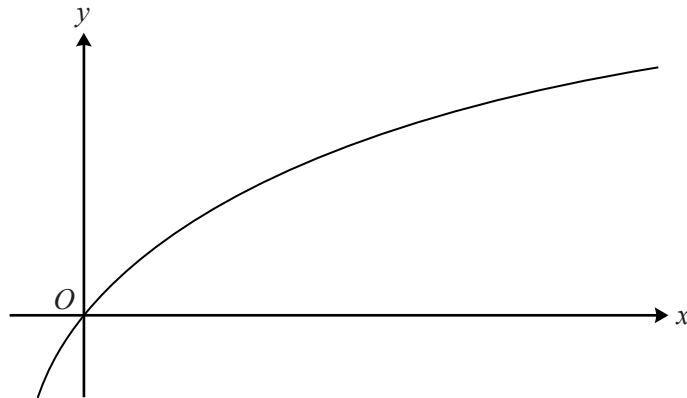


The diagram shows a sector  $AOB$  of a circle with centre  $O$  and radius 12 cm. The reflex angle  $AOB$  is 4.2 radians.

(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]

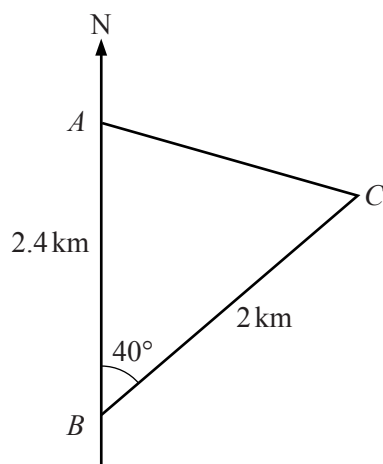
(ii) Explain why this approximation is an under-estimate. [1]

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  $040^\circ$  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]

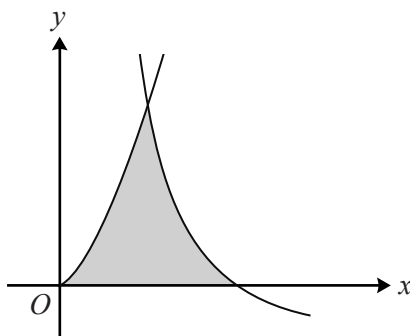
(ii) Find  $\sum_{n=1}^{20} u_n$ . [3]

(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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