![OCR logo](RECOGNISING ACHIEVEMENT)

**ADVANCED SUBSIDIARY GCE**

**MATHEMATICS** **4722**

Core Mathematics 2

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Candidates answer on the Answer Booklet

**OCR Supplied Materials:**
- 8 page Answer Booklet
- List of Formulae (MF1)

**Other Materials Required:**
None

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**Friday 22 May 2009**
**Morning**

**Duration:** 1 hour 30 minutes

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**INSTRUCTIONS TO CANDIDATES**

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the spaces provided on the Answer Booklet.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- 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.
- You are permitted to use a graphical calculator in this paper.

**INFORMATION FOR CANDIDATES**

- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- **You are reminded of the need for clear presentation in your answers.**
- The total number of marks for this paper is **72**.
- This document consists of **4** pages. Any blank pages are indicated.

1   The lengths of the three sides of a triangle are 6.4 cm, 7.0 cm and 11.3 cm.

   **(i)** Find the largest angle in the triangle. **[3]**

   **(ii)** Find the area of the triangle. **[2]**

2   The tenth term of an arithmetic progression is equal to twice the fourth term. The twentieth term of the progression is 44.

   **(i)** Find the first term and the common difference. **[4]**

   **(ii)** Find the sum of the first 50 terms. **[2]**

3   Use logarithms to solve the equation $7^x = 2^{x+1}$, giving the value of $x$ correct to 3 significant figures. **[5]**

4   **(i)** Find the binomial expansion of $(x^2 - 5)^3$, simplifying the terms. **[4]**

   **(ii)** Hence find $\int (x^2 - 5)^3 \, dx$. **[4]**

5   Solve each of the following equations for $0° \leqslant x \leqslant 180°$.

   **(i)** $\sin 2x = 0.5$ **[3]**

   **(ii)** $2 \sin^2 x = 2 - \sqrt{3} \cos x$ **[5]**

6   The gradient of a curve is given by $\dfrac{dy}{dx} = 3x^2 + a$, where $a$ is a constant. The curve passes through the points $(-1, 2)$ and $(2, 17)$. Find the equation of the curve. **[8]**

7   The polynomial $f(x)$ is given by $f(x) = 2x^3 + 9x^2 + 11x - 8$.

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

   **(ii)** Use the factor theorem to show that $(2x - 1)$ is a factor of $f(x)$. **[2]**

   **(iii)** Express $f(x)$ as a product of a linear factor and a quadratic factor. **[3]**

   **(iv)** State the number of real roots of the equation $f(x) = 0$, giving a reason for your answer. **[2]**
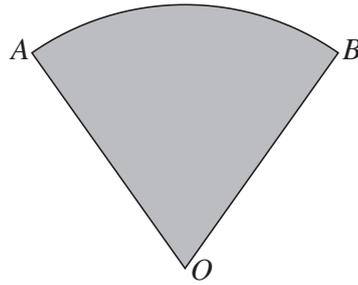
**8**



**Fig. 1**

Fig. 1 shows a sector $AOB$ of a circle, centre $O$ and radius $OA$. The angle $AOB$ is 1.2 radians and the area of the sector is $60\,\text{cm}^2$.

  **(i)** Find the perimeter of the sector. **[4]**

A pattern on a T-shirt, the start of which is shown in Fig. 2, consists of a sequence of similar sectors. The first sector in the pattern is sector $AOB$ from Fig. 1, and the area of each successive sector is $\frac{3}{5}$ of the area of the previous one.
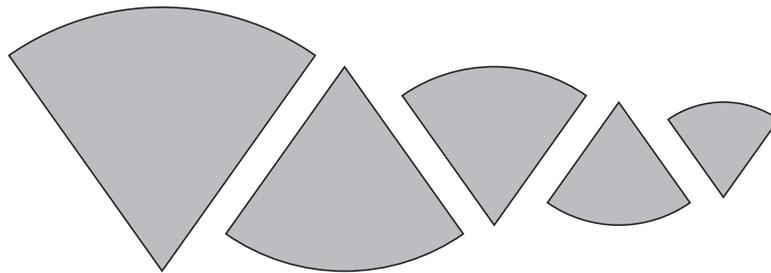


**Fig. 2**

  **(ii) (a)** Find the area of the fifth sector in the pattern. **[2]**

      **(b)** Find the total area of the first ten sectors in the pattern. **[2]**

      **(c)** Explain why the total area will never exceed a certain limit, no matter how many sectors are used, and state the value of this limit. **[3]**

**9**   **(i)** Sketch the graph of $y = 4k^x$, where $k$ is a constant such that $k > 1$. State the coordinates of any points of intersection with the axes. **[2]**

  **(ii)** The point $P$ on the curve $y = 4k^x$ has its $y$-coordinate equal to $20k^2$. Show that the $x$-coordinate of $P$ may be written as $2 + \log_k 5$. **[4]**

  **(iii) (a)** Use the trapezium rule, with two strips each of width $\frac{1}{2}$, to find an expression for the approximate value of

$$\int_0^1 4k^x \, dx.$$ **[3]**

      **(b)** Given that this approximate value is equal to 16, find the value of $k$. **[3]**

      

There are no questions printed on this page.