OCR
RECOGNISING ACHIEVEMENT

ADVANCED SUBSIDIARY GCE

MATHEMATICS **4722**

Core Mathematics 2

Candidates answer on the Answer Booklet

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

Other Materials Required:
None

Tuesday 13 January 2009
Morning

Duration: 1 hour 30 minutes

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

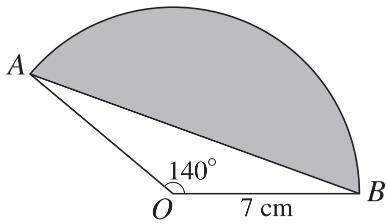
- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- **You are reminded of the need for clear presentation in your answers.**
- The total number of marks for this paper is **72**.
- This document consists of **4** pages. Any blank pages are indicated.

1 Find

(i) $\int (x^3 + 8x - 5)\,\mathrm{d}x$, **[3]**

(ii) $\int 12\sqrt{x}\,\mathrm{d}x$. **[3]**

2



The diagram shows a sector OAB of a circle, centre O and radius 7 cm. The angle AOB is 140°.

(i) Express 140° in radians, giving your answer in an exact form as simply as possible. **[2]**

(ii) Find the perimeter of the segment shaded in the diagram, giving your answer correct to 3 significant figures. **[4]**

3 A sequence of terms $u_1, u_2, u_3, \ldots$ is defined by

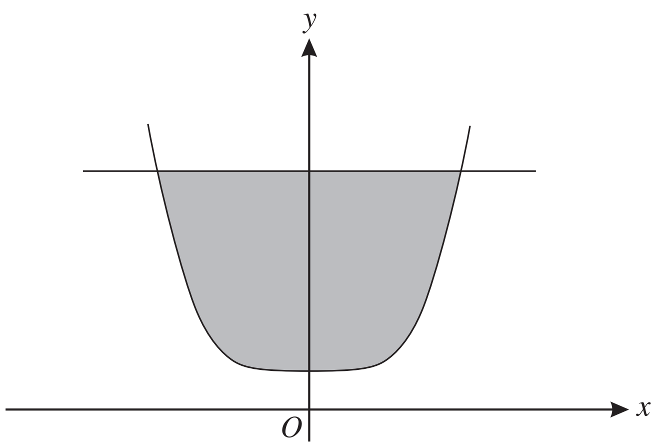
$$u_n = 24 - \tfrac{2}{3}n.$$

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

(ii) Find the value of k such that $u_k = 0$. **[2]**

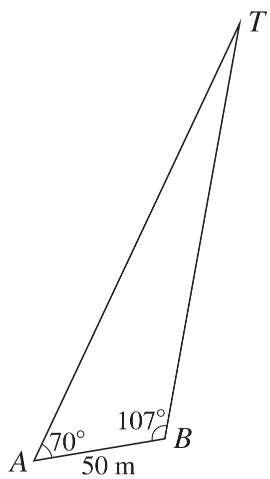
(iii) Find $\sum_{n=1}^{20} u_n$. **[3]**

4



The diagram shows the curve $y = x^4 + 3$ and the line $y = 19$ which intersect at $(-2, 19)$ and $(2, 19)$. Use integration to find the exact area of the shaded region enclosed by the curve and the line. **[7]**

5



Some walkers see a tower, T, in the distance and want to know how far away it is. They take a bearing from a point A and then walk for 50 m in a straight line before taking another bearing from a point B. They find that angle TAB is 70° and angle TBA is 107° (see diagram).

(i) Find the distance of the tower from A. **[2]**

(ii) They continue walking in the same direction for another 100 m to a point C, so that AC is 150 m. What is the distance of the tower from C? **[3]**

(iii) Find the shortest distance of the walkers from the tower as they walk from A to C. **[2]**

6 A geometric progression has first term 20 and common ratio 0.9.

(i) Find the sum to infinity. **[2]**

(ii) Find the sum of the first 30 terms. **[2]**

(iii) Use logarithms to find the smallest value of p such that the pth term is less than 0.4. **[4]**

7 In the binomial expansion of $(k + ax)^4$ the coefficient of x^2 is 24.

(i) Given that a and k are both positive, show that $ak = 2$. **[3]**

(ii) Given also that the coefficient of x in the expansion is 128, find the values of a and k. **[4]**

(iii) Hence find the coefficient of x^3 in the expansion. **[2]**

8 **(a)** Given that $\log_a x = p$ and $\log_a y = q$, express the following in terms of p and q.

(i) $\log_a(xy)$ **[1]**

(ii) $\log_a\left(\frac{a^2x^3}{y}\right)$ **[3]**

(b) **(i)** Express $\log_{10}(x^2 - 10) - \log_{10} x$ as a single logarithm. **[1]**

(ii) Hence solve the equation $\log_{10}(x^2 - 10) - \log_{10} x = 2\log_{10} 3$. **[5]**

9 **(i)** The polynomial $f(x)$ is defined by

$$f(x) = x^3 - x^2 - 3x + 3.$$

Show that $x = 1$ is a root of the equation $f(x) = 0$, and hence find the other two roots. **[6]**

(ii) Hence solve the equation

$$\tan^3 x - \tan^2 x - 3\tan x + 3 = 0$$

for $0 \leqslant x \leqslant 2\pi$. Give each solution for x in an exact form. **[6]**