UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

ADDITIONAL MATHEMATICS 0606/01

Paper 1

October/November 2004

2 hours

Additional Materials: Answer Booklet/Paper
Electronic calculator
Graph paper
Mathematical tables

READ THESE INSTRUCTIONS FIRST

If you have been given an Answer Booklet, follow the instructions on the front cover of the Booklet.
Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a soft pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** the questions.
Write your answers on the separate Answer Booklet/Paper provided.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

This document consists of **5** printed pages and **3** blank pages.

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}.$$

Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1} a^{n-1}b + \binom{n}{2} a^{n-2}b^2 + \ldots + \binom{n}{r} a^{n-r}b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!\, r!}$.

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1.$$
$$\sec^2 A = 1 + \tan^2 A.$$
$$\operatorname{cosec}^2 A = 1 + \cot^2 A.$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}.$$

$$a^2 = b^2 + c^2 - 2bc \cos A.$$

$$\Delta = \tfrac{1}{2} bc \sin A.$$

1 The position vectors of points A, B and C, relative to an origin O, are $\mathbf{i} + 9\mathbf{j}$, $5\mathbf{i} - 3\mathbf{j}$ and respectively, where k is a constant. Given that C lies on the line AB, find the value of k.

2 A youth club has facilities for members to play pool, darts and table-tennis. Every member plays at least one of the three games. P, D and T represent the sets of members who play pool, darts and table-tennis respectively. Express each of the following in set language and illustrate each by means of a Venn diagram.

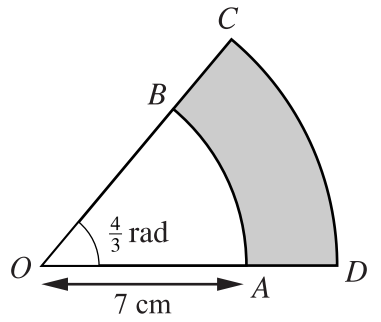
(i) The set of members who only play pool. [2]

(ii) The set of members who play exactly 2 games, neither of which is darts. [2]

3 Without using a calculator, solve, for x and y, the simultaneous equations

$$8^x \div 2^y = 64,$$
$$3^{4x} \times \left(\tfrac{1}{9}\right)^{y-1} = 81.$$ [5]

4



The diagram shows a sector COD of a circle, centre O, in which angle $COD = \frac{4}{3}$ radians. The points A and B lie on OD and OC respectively, and AB is an arc of a circle, centre O, of radius 7 cm. Given that the area of the shaded region $ABCD$ is 48 cm^2, find the perimeter of this shaded region. [6]

5 Given that the expansion of $(a + x)(1 - 2x)^n$ in ascending powers of x is $3 - 41x + bx^2 + \ldots$, find the values of the constants a, n and b. [6]

6 The function f is defined, for $0 < x < \pi$, by $\mathrm{f}(x) = 5 + 3\cos 4x$. Find

(i) the amplitude and the period of f, [2]

(ii) the coordinates of the maximum and minimum points of the curve $y = \mathrm{f}(x)$. [4]

7 (a) Find the number of different arrangements of the 9 letters of the word SINGAPORE in which S does **not** occur as the first letter. [2]

(b) 3 students are selected to form a chess team from a group of 5 girls and 3 boys. Find the number of possible teams that can be selected in which there are more girls than boys. [4]

8 The function f is defined, for $x \in \mathbb{R}$, by

$$f : x \mapsto \frac{3x + 11}{x - 3}, \quad x \neq 3.$$

(i) Find f^{-1} in terms of x and explain what this implies about the symmetry of the graph of $y = f(x)$. [3]

The function g is defined, for $x \in \mathbb{R}$, by

$$g : x \mapsto \frac{x - 3}{2}.$$

(ii) Find the values of x for which $f(x) = g^{-1}(x)$. [3]

(iii) State the value of x for which $gf(x) = -2$. [1]

9 **(a)** Solve, for $0° \leqslant x \leqslant 360°$, the equation $\sin^2 x = 3\cos^2 x + 4\sin x$. [4]

(b) Solve, for $0 < y < 4$, the equation $\cot 2y = 0.25$, giving your answers in radians correct to 2 decimal places. [4]

10 A curve has the equation $y = x^3 \ln x$, where $x > 0$.

(i) Find an expression for $\frac{dy}{dx}$. [2]

Hence

(ii) calculate the value of $\ln x$ at the stationary point of the curve, [2]

(iii) find the approximate increase in y as x increases from e to $e + p$, where p is small, [2]

(iv) find $\int x^2 \ln x \, dx$. [3]

11 The line $4y = 3x + 1$ intersects the curve $xy = 28x - 27y$ at the point $P(1, 1)$ and at the point Q. The perpendicular bisector of PQ intersects the line $y = 4x$ at the point R. Calculate the area of triangle PQR. [9]

12 Answer only **one** of the following two alternatives.

EITHER

(a) At the beginning of 1960, the number of animals of a certain species was estimated at 20 000. This number decreased so that, after a period of n years, the population was

$$20\,000e^{-0.05n}.$$

Estimate

(i) the population at the beginning of 1970, [1]

(ii) the year in which the population would be expected to have first decreased to 2000. [3]

(b) Solve the equation $3^{x+1} - 2 = 8 \times 3^{x-1}$. [6]

OR

A curve has the equation $y = e^{\frac{1}{2}x} + 3e^{-\frac{1}{2}x}$.

(i) Show that the exact value of the y-coordinate of the stationary point of the curve is $2\sqrt{3}$. [4]

(ii) Determine whether the stationary point is a maximum or a minimum. [2]

(iii) Calculate the area enclosed by the curve, the x-axis and the lines $x = 0$ and $x = 1$. [4]

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