UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

ADDITIONAL MATHEMATICS **4037/02**

Paper 2

May/June 2005

2 hours

Additional Materials: Answer Booklet/Paper
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 **6** printed pages and **2** blank pages.

(KN) S71985/3

UNIVERSITY *of* CAMBRIDGE International Examinations

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Mathematical Formulae

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

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

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

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

1 A curve has the equation $y = \dfrac{8}{2x - 1}$.

(i) Find an expression for $\dfrac{dy}{dx}$. [3]

(ii) Given that y is increasing at a rate of 0.2 units per second when $x = -0.5$, find the corresponding rate of change of x. [2]

2 A flower show is held over a three-day period – Thursday, Friday and Saturday. The table below shows the entry price per day for an adult and for a child, and the number of adults and children attending on each day.

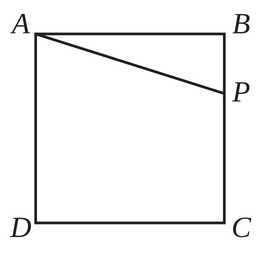
	Thursday	Friday	Saturday
Price ($) – Adult	12	10	10
Price ($) – Child	5	4	4
Number of adults	300	180	400
Number of children	40	40	150

(i) Write down two matrices such that their product will give the amount of entry money paid on Thursday and hence calculate this product. [2]

(ii) Write down two matrices such that the elements of their product give the amount of entry money paid for each of Friday and Saturday and hence calculate this product. [2]

(iii) Calculate the total amount of entry money paid over the three-day period. [1]

3



The diagram shows a square $ABCD$ of area $60\,\text{m}^2$. The point P lies on BC and the sum of the lengths of AP and BP is 12 m. Given that the lengths of AP and BP are x m and y m respectively, form two equations in x and y and hence find the length of BP. [5]

4 The functions f and g are defined by

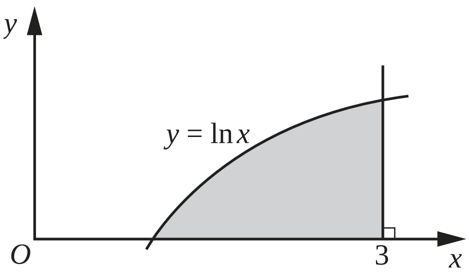
$$\mathrm{f} : x \mapsto \sin x, \quad 0 \leqslant x \leqslant \frac{\pi}{2},$$

$$\mathrm{g} : x \mapsto 2x - 3, \quad x \in \mathbb{R}.$$

Solve the equation $\mathrm{g}^{-1}\mathrm{f}(x) = \mathrm{g}^2(2.75)$. [5]

5 **(i)** Differentiate $x\ln x - x$ with respect to x. [2]

(ii)



The diagram shows part of the graph of $y = \ln x$. Use your result from part **(i)** to evaluate the area of the shaded region bounded by the curve, the line $x = 3$ and the x-axis. [4]

6 A curve has the equation $y = \dfrac{e^{2x}}{\sin x}$, for $0 < x < \pi$.

(i) Find $\dfrac{dy}{dx}$ and show that the x-coordinate of the stationary point satisfies $2\sin x - \cos x = 0$. [4]

(ii) Find the x-coordinate of the stationary point. [2]

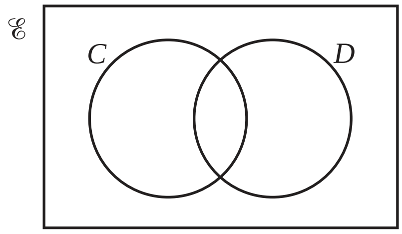
7 Solve, for x and y, the simultaneous equations

$$125^x = 25(5^y),$$

$$7^x \div 49^y = 1.$$

[6]

8



The Venn diagram above represents the sets

$\mathscr{E}$ = {homes in a certain town},

C = {homes with a computer},

D = {homes with a dishwasher}.

It is given that

$n(C \cap D) = k$,

$n(C) = 7 \times n(C \cap D)$,

$n(D) = 4 \times n(C \cap D)$,

and $n(\mathscr{E}) = 6 \times n(C' \cap D')$.

(i) Copy the Venn diagram above and insert, in each of its four regions, the number, in terms of k, of homes represented by that region. [5]

(ii) Given that there are 165 000 homes which do not have both a computer and a dishwasher, calculate the number of homes in the town. [2]

9 A plane, whose speed in still air is 300 km h^{-1}, flies directly from X to Y. Given that Y is 720 km from X on a bearing of 150° and that there is a constant wind of 120 km h^{-1} blowing towards the west, find the time taken for the flight. [7]

10 **(a)** Solve, for $0° < x < 360°$,

$$4\tan^2 x + 15\sec x = 0.$$ [4]

(b) Given that $y > 3$, find the smallest value of y such that

$$\tan(3y - 2) = -5.$$ [4]

11 **(a)** **(i)** Expand $(2 + x)^5$. [3]

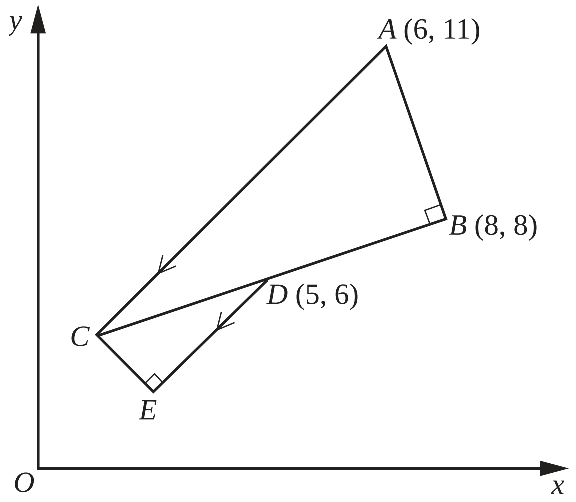
(ii) Use your answer to part **(i)** to find the integers a and b for which $(2 + \sqrt{3})^5$ can be expressed in the form $a + b\sqrt{3}$. [3]

(b) Find the coefficient of x in the expansion of $\left(x - \frac{4}{x}\right)^7$. [3]

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

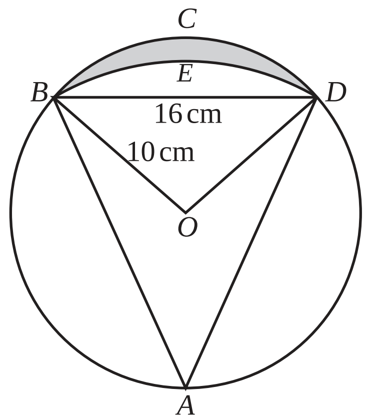
EITHER

Solutions to this question by accurate drawing will not be accepted.



The diagram, which is not drawn to scale, shows a right-angled triangle ABC, where A is the point (6, 11) and B is the point (8, 8).
The point D (5, 6) is the mid-point of BC. The line DE is parallel to AC and angle DEC is a right-angle.
Find the area of the entire figure $ABDECA$. [11]

OR



The diagram, which is not drawn to scale, shows a circle $ABCDA$, centre O and radius 10 cm.
The chord BD is 16 cm long. BED is an arc of a circle, centre A.

(i) Show that the length of AB is approximately 17.9 cm.

For the shaded region enclosed by the arcs BCD and BED, find

(ii) its perimeter, **(iii)** its area.

[11]

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