UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

ADDITIONAL MATHEMATICS **4037/01**

Paper 1 **For Examination from 2013**

SPECIMEN PAPER

2 hours

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** the questions.
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.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

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.

This document consists of **15** printed pages and **1** blank page.

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 $\binom{n}{r} = \dfrac{n!}{(n-r)!\,r!}$.

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1.$$

$$\sec^2 A = 1 + \tan^2 A.$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A.$$

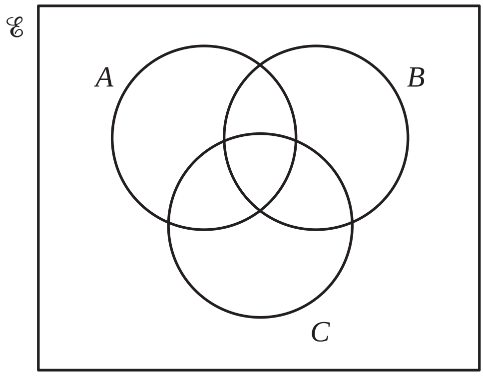
Formulae for ΔABC

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

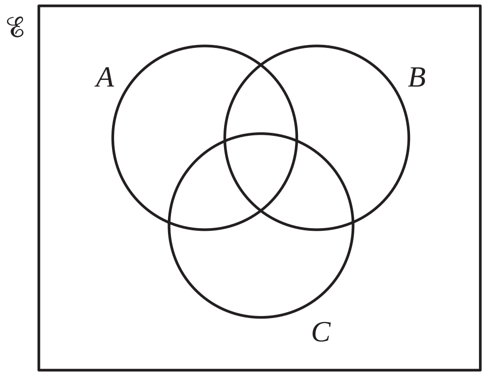
$$a^2 = b^2 + c^2 - 2bc \cos A.$$

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

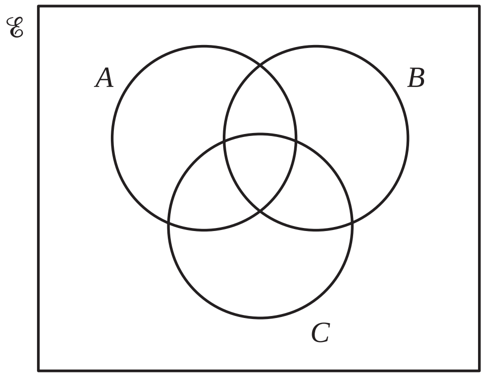
1 Shade the region corresponding to the set given below each Venn diagram.



$A \cup (B \cap C)$



$A \cap (B \cup C)$



$(A \cup B \cup C)'$ [3]

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2 Find the set of values of x for which $(2x + 1)^2 > 8x + 9$. [4]

For Examiner's Use

3 Prove that $\dfrac{\sin A}{1+\cos A}+\dfrac{1+\cos A}{\sin A}\equiv 2\operatorname{cosec}A$. [4]

For Examiner's Use

4 A function f is such that $f(x) = ax^3 + bx^2 + 3x + 4$. When $f(x)$ is divided by $x - 1$, the remainder is 3. When $f(x)$ is divided by $2x + 1$, the remainder is 6. Find the value of a and of b. [5]

For Examiner's Use

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5 **(i)** Solve the equation $2t = 9 + \frac{5}{t}$. [3]

(ii) Hence, or otherwise, solve the equation $2x^{\frac{1}{2}} = 9 + 5x^{-\frac{1}{2}}$. [3]

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6 Given that $\mathbf{a} = 5\mathbf{i} - 12\mathbf{j}$ and that $\mathbf{b} = p\mathbf{i} + \mathbf{j}$, find

(i) the unit vector in the direction of $\mathbf{a}$, [2]

(ii) the values of the constants p and q such that $q\mathbf{a} + \mathbf{b} = 19\mathbf{i} - 23\mathbf{j}$. [3]

For Examiner's Use

7 **(i)** Express $4x^2 - 12x + 3$ in the form $(ax + b)^2 + c$, where a, b and c are constants and $a > 0$. [3]

For Examiner's Use

(ii) Hence, or otherwise, find the coordinates of the stationary point of the curve $y = 4x^2 - 12x + 3$. [2]

(iii) Given that $f(x) = 4x^2 - 12x + 3$, write down the range of f. [1]

For Examiner's Use

8 A curve is such that $\frac{d^2y}{dx^2} = 4e^{-2x}$. Given that $\frac{dy}{dx} = 3$ when $x = 0$ and that the curve passes through the point $(2, e^{-4})$, find the equation of the curve. [6]

9 **(i)** Find, in ascending powers of x, the first 3 terms in the expansion of $(2 - 3x)^5$. [3]

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The first 3 terms in the expansion of $(a + bx)(2 - 3x)^5$ in ascending powers of x are $64 - 192x + cx^2$.

(ii) Find the value of a, of b and of c. [5]

For Examiner's Use

10 **(a)** Functions f and g are defined, for $x \in \mathbb{R}$, by

$$f(x) = 3 - x,$$
$$g(x) = \frac{x}{x+2}, \quad \text{where } x \neq 2.$$

(i) Find $fg(x)$. [2]

(ii) Hence find the value of x for which $fg(x) = 10$. [2]

(b) A function h is defined, for $x \in \mathbb{R}$, by $h(x) = 4 + \ln x$, where $x > 1$.

(i) Find the range of h. [1]

(ii) Find the value of $h^{-1}(9)$. [2]

(iii) On the same axes, sketch the graphs of $y = \mathrm{h}(x)$ and $y = \mathrm{h}^{-1}(x)$. [3]

For Examiner's Use

11 Solve the following equations.

For Examiner's Use

(i) $\tan 2x - 3\cot 2x$, for $0° < x < 180°$ [4]

(ii) $\text{cosec}\,y = 1 - 2\cot^2 y$, for $0° \leqslant y \leqslant 360°$ [5]

(iii) $\sec(z + \frac{\pi}{2}) = -2$, for $0 < z < \pi$ radians. [3]

For Examiner's Use

For Examiner's Use

12 A curve has equation $y = \dfrac{x^2}{x+1}$.

(i) Find the coordinates of the stationary points of the curve. [5]

The normal to the curve at the point where $x = 1$ meets the x-axis at M. The tangent to the curve at the point where $x = -2$ meets the y-axis at N.

For Examiner's Use

(ii) Find the area of the triangle MNO, where O is the origin. [6]

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