UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

ADDITIONAL MATHEMATICS **4037/11**

Paper 1 **May/June 2010**

2 hours

Additional Materials: Answer Booklet/Paper

1688115268

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.
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.
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 **5** printed pages and **3** blank pages.

DC (KN) 12929/4

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 Differentiate with respect to x

(i) $\sqrt{1 + x^3}$,

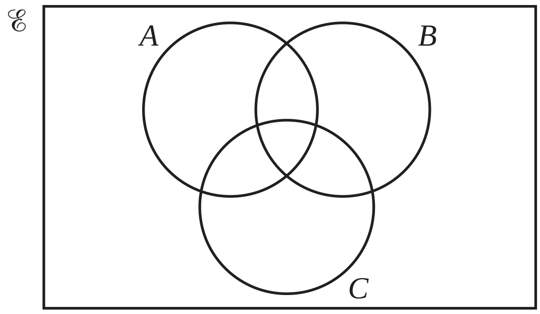
(ii) $x^2 \cos 2x$.

2 **(i)** Find the first 3 terms of the expansion, in ascending powers of x, of $(1 + 3x)^6$. [2]

(ii) Hence find the coefficient of x^2 in the expansion of $(1 + 3x)^6 (1 - 3x - 5x^2)$. [3]

3 Find the set of values of k for which the equation $x^2 + (k - 2)x + (2k - 4) = 0$ has real roots. [5]

4 **(a)**



(i) Copy the Venn diagram above and shade the region that represents $(A \cap B) \cup C$. [1]

(ii) Copy the Venn diagram above and shade the region that represents $A' \cap B'$. [1]

(iii) Copy the Venn diagram above and shade the region that represents $(A \cup B) \cap C$. [1]

(b) It is given that the universal set $\mathscr{E} = \{x : 2 \leqslant x \leqslant 20, x \text{ is an integer}\}$,
$X = \{x : 4 < x < 15, x \text{ is an integer}\}$,
$Y = \{x : x \geqslant 9, x \text{ is an integer}\}$,
$Z = \{x : x \text{ is a multiple of } 5\}$.

(i) List the elements of $X \cap Y$. [1]

(ii) List the elements of $X \cup Y$. [1]

(iii) Find $(X \cup Y)' \cap Z$. [1]

5 Solve the equation $3x(x^2 + 6) = 8 - 17x^2$. [6]

6 Given that $\log_8 p = x$ and $\log_8 q = y$, express in terms of x and/or y

(i) $\log_8 \sqrt{p} + \log_8 q^2$,

(ii) $\log_8 \left(\frac{q}{8}\right)$, [2]

(iii) $\log_2 (64p)$. [3]

7 The function f is defined by

$$f(x) = (2x + 1)^2 - 3 \quad \text{for } x \geqslant -\frac{1}{2}.$$

Find

(i) the range of f, [1]

(ii) an expression for $f^{-1}(x)$. [3]

The function g is defined by

$$g(x) = \frac{3}{1 + x} \quad \text{for } x > -1.$$

(iii) Find the value of x for which $fg(x) = 13$. [4]

8 **(a)** Solve the equation $(2^{3-4x})(4^{x+4}) = 2$. [3]

(b) **(i)** Simplify $\sqrt{108} - \frac{12}{\sqrt{3}}$, giving your answer in the form $k\sqrt{3}$, where k is an integer. [2]

(ii) Simplify $\frac{\sqrt{5} + 3}{\sqrt{5} - 2}$, giving your answer in the form $a\sqrt{5} + b$, where a and b are integers. [3]

9 **(a)** Variables x and y are related by the equation $y = 5x + 2 - 4e^{-x}$.

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

(ii) Hence find the approximate change in y when x increases from 0 to p, where p is small. [2]

(b) A square of area $A\,\text{cm}^2$ has a side of length x cm. Given that the area is increasing at a constant rate of $0.5\,\text{cm}^2\,\text{s}^{-1}$, find the rate of increase of x when $A = 9$. [4]

10 Solve

(i) $4\sin x = \cos x$ for $0° < x < 360°$,

(ii) $3 + \sin y = 3\cos^2 y$ for $0° < y < 360°$, [

(iii) $\sec\left(\frac{z}{3}\right) = 4$ for $0 < z < 5$ radians. [3]

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

EITHER

A curve has equation $y = \frac{\ln x}{x^2}$, where $x > 0$.

(i) Find the exact coordinates of the stationary point of the curve. [6]

(ii) Show that $\frac{d^2y}{dx^2}$ can be written in the form $\frac{a\ln x + b}{x^4}$, where a and b are integers. [3]

(iii) Hence, or otherwise, determine the nature of the stationary point of the curve. [2]

OR

A curve is such that $\frac{dy}{dx} = 6\cos\left(2x + \frac{\pi}{2}\right)$ for $-\frac{\pi}{4} \leqslant x \leqslant \frac{5\pi}{4}$. The curve passes through the point $\left(\frac{\pi}{4}, 5\right)$.

Find

(i) the equation of the curve, [4]

(ii) the x-coordinates of the stationary points of the curve, [3]

(iii) the equation of the normal to the curve at the point on the curve where $x = \frac{3\pi}{4}$. [4]

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